CLINICAL GUIDELINES

Physical and Occupational Therapy Services

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Clinical guidelines for medical necessity review of physical and occupational therapy services.

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Dear Provider,

This document provides detailed descriptions of eviCore's basic criteria for musculoskeletal management services. They have been carefully researched and are continually updated in order to be consistent with the most current evidence-based guidelines and recommendations for the provision of musculoskeletal management services from national and international medical societies and evidence-based medicine research centers. In addition, the criteria are supplemented by information published in peer reviewed literature.

Our health plan clients review the development and application of these criteria. Every eviCore health plan client develops a unique list of CPT codes or diagnoses that are part of their musculoskeletal management program. Health Plan medical policy supersedes the eviCore criteria when there is conflict with the eviCore criteria and the health plan medical policy. If you are unsure of whether or not a specific health plan has made modifications to these basic criteria in their medical policy for musculoskeletal management services, please contact the plan or access the plan's website for additional information.

eviCore healthcare works hard to make your clinical review experience a pleasant one. For that reason, we have peer reviewers available to assist you should you have specific questions about a procedure.

For your convenience, eviCore Customer Service support is available from 7 a.m. to 7 p.m. Our toll free number is (800) 918-8924.

Gregg P Allen, M.D. FAAFP
EVP and Chief Medical Officer

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Utilization Management Policy
Physical Therapy and Occupational Therapy

Purpose:

This policy outlines the process for determining medically necessary, appropriate and reasonable physical therapy and occupational therapy services.

Definitions:

Utilization Management

The Institute of Medicine (IOM) Committee on Utilization Management by Third Parties recognizes UM as "a set of techniques used by or on behalf of purchasers of health care benefits to manage health care costs by influencing patient care decision-making through case-by-case assessments of the appropriateness of care prior to its provision."
There are 3 types of Utilization Management:
Precertification/prior authorization is conducted before a service or treatment and is rendered in order to eliminate or reduce unnecessary services.

*Concurrent review*s performed during the episode of care. Periodic review occurs at varied intervals and may encompass case management activities such as care coordination, discharge planning, and care transitioning.

Retrospective review is conducted after the service has been completed and assesses the appropriateness of care provided.

Physical Therapy

Physical therapy (PT) is a dynamic profession with an established theoretical and scientific base and widespread clinical applications in the restoration, maintenance, and promotion of optimal physical function. Physical therapists are health care professionals who help individuals maintain, restore, and improve movement, activity, and functioning, thereby enabling optimal performance and enhancing health, well-being, and quality of life. Their services prevent, minimize, or eliminate impairments of body functions and structures, activity limitations, and participation restrictions. Physical therapy is provided for individuals of all ages who have or may develop impairments, activity limitations, and participation restrictions related to (1) conditions of the musculoskeletal, neuromuscular, cardiovascular, pulmonary, and/or integumentary systems or (2) the negative effects attributable to unique personal and environmental factors as they relate to human performance. (APTA)

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Occupational Therapy

The practice of Occupational Therapy means the therapeutic use of occupations, including everyday life activities with individuals, groups, populations, or organizations to support participation, performance, and function in roles and situations in home, school, workplace, community, and other settings. Occupational therapy services are provided for habilitation, rehabilitation, and the promotion of health and wellness to those who have or are at risk for developing an illness, injury, disease, disorder, condition, impairment, disability, activity limitation, or participation restriction. Occupational therapy addresses the physical, cognitive, psychosocial, sensory-perceptual, and other aspects of performance in a variety of contexts and environments to support engagement in occupations that affect physical and mental health, well-being, and quality of life. (AOTA Model Practice Act)

Medically Necessary Services

To be considered reasonable and necessary the following conditions must each be met:

- The services shall be considered under accepted standards of medical practice to be a specific and effective treatment for the patient's condition.
- The services shall be of such a level of complexity and sophistication or the condition of the patient shall be such that the services required can be safely and effectively performed only by a therapist, or in the case of physical therapy and occupational therapy by or under the supervision of a therapist.
- Services that do not require the performance or supervision of a therapist are not skilled and are not considered reasonable or necessary therapy services, even if they are performed or supervised by a qualified professional.
- There must be an expectation that the patient's condition will improve significantly in a reasonable (and generally predictable) period of time. Medicare coverage does not turn on the presence or absence of a beneficiary's potential for improvement from the therapy, but rather on the beneficiary's need for skilled care.
- The amount, frequency, and duration of the services must be reasonable under accepted standards of practice.

For these purposes, "generally acceptable standards of practice" means standards that are based on credible scientific evidence published in the peer-reviewed literature generally recognized by the relevant healthcare community, specialty society evidence-based guidelines or recommendation, or expert clinical consensus in the relevant clinical areas.

Rehabilitative Therapy

Therapeutic care is care provided to relieve the functional loss associated with an injury or condition and is necessary to return the patient to the functioning level required to perform their activities of daily living, instrumental activities of daily living and work activities. Therapeutic care generally occurs within a reasonable period of time and is guided by evidence based practice of physical therapy.

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Acute Phase

Acute care is care of an injury or condition characterized by short and relatively severe symptom complex, generally up to the first month following onset of injury. The condition may be induced by either traumatic or non-traumatic factors and may consist of a new condition or an exacerbation of an existing one. Need for care is proportional to the severity of the signs and symptoms of the particular case, modified by the status of healing tissues. The therapeutic goals of acute care are patient education in the recovery/healing process, reduction of symptoms and minimization of functional loss, in preparation for resolution of the injury or condition. Means and methods include a combination of direct care and a home management program to progress towards recovery of function.

Subacute Phase

Subacute care is care of an injury or condition characterized by a less severe symptom complex and intermediate course. Typically, it follows an acute injury or exacerbation, and can extend up to three months from onset. Subacute care is characterized by a combination of direct care and home management consisting of exercise, symptom management, patient education, and an emphasis on compliance. The therapeutic goal of this phase is to improve functional status by increasing existing range of motion and muscle strength and reducing signs and symptoms associated with the condition or injury. Means and methods include progression of exercise, instruction in self-care, and monitoring patient compliance and motivation. Intensity of care is guided by the condition of healing tissue structures, generally including therapy visits supplemented by a home management program.

Chronic Phase

This phase of care may last up to 6 month from onset. It may also refer to treatment of conditions that are chronic in nature and do not occur in conjunction with an acute or subacute phase. The therapeutic goals of this phase are reduction and management of symptoms with a goal of maximizing function over time. Means and methods include progression of exercise, continued patient education, and transition to self-management. Intensity of care is guided by functional status, focusing on home management, supplemented by therapy visits.

Skilled Maintenance Care

Maintenance care is defined as services required to maintain the member's current condition or to prevent or slow deterioration of the member's condition.

- Skilled maintenance care for Medicare and Medicaid enrollees is covered if the specialized skill, knowledge and judgment of a qualified therapist are required:
  - To establish or design a maintenance program appropriate to the capacity and tolerance of the member
  - To educate/instruct the member or appropriate caregiver regarding the maintenance program
  - For periodic re-evaluations of the maintenance program
  - For delivery of maintenance programs

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- Skilled care is necessary for the performance of a safe and effective maintenance program only when:
  - (a) the therapy procedures required to maintain the patient's current function or to prevent or slow further deterioration are of such complexity and sophistication that the skills of a qualified therapist are required to furnish the therapy procedure or
  - (b) the particular patient's special medical complications require the skills of a qualified therapist to furnish a therapy service required to maintain the patient's current function or to prevent or slow further deterioration, even if the skills of a therapist are not ordinarily needed to perform such therapy procedures.

The need for maintenance care is not determined by the presence or absence of a member's potential for improvement but by the need for skilled care.

Skilled Maintenance Programs in an Outpatient and Home Health setting will not be covered if furnished by a Physical Therapist Assistant. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)

eviCore will authorize maintenance care when the member's plan of care establishes that the member requires the specialized skill, knowledge and judgment of a qualified therapist to maintain the member's current condition or to prevent or slow deterioration of the member's condition.

Habilitation:

Health care services that help you keep, learn, or improve skills and functioning for daily living. Examples include therapy for a child who isn't walking or talking at the expected age. These services may include physical and occupational therapy, speech-language pathology, and other services for people with disabilities in a variety of inpatient and/or outpatient settings. (National Association of Insurance Commissioners (NAIC). Most states have their own definition, but they have adopted some version of the NAIC definition.

Palliative Care

Palliative care is typically given to alleviate symptoms and does not provide corrective benefit to the condition treated. A patient receiving palliative care, in most instances, demonstrates varying lapses between treatments. If an exacerbation of a condition occurs, care becomes therapeutic rather than palliative, and documentation of the necessity for care (e.g., etiology of exacerbation, objective findings, and desired outcomes) must be obtained. Palliative care is non-covered because the skills of a therapist are not required but may be approved at the direction of a health plan based on the plans benefit language.

Preventive Care Examinations

Preventive care includes management of the asymptomatic patient. Preventive care examinations may include pre-participation athletic examination. Preventative care is non-covered because the skills of a therapist are not required, an exception is children covered by Early and Periodic Screening, Diagnostic and Treatment guidelines.

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Criteria/Guidelines for Provision of Physical Therapy (PT) and Occupational Therapy (OT)

Indications for Coverage

- Authorization is based on available benefits and certificate of coverage
- The services must be reasonable and necessary
- The services requested must be require the expertise, knowledge, clinical judgment, decision making and abilities of a therapist that a caregiver or member cannot provide independently
  - A qualified provider of Physical/Occupational therapy service is one who is licensed where required and performs within the scope of licensure.
  - Services provided by PT/OT aides or other non-qualified professionals are not covered (coverage is determined by State Law or Health Plan Rules).
- Services are of the appropriate type, frequency, intensity and duration for the individual needs of the member
- Documentation should establish the variables that influence the member's condition and factors that influence the clinician's decision to provide more services than are typical for the member's condition (typical is established using eviCore Guidelines which is based on published professional literature and professional guidelines)
- PT and OT services meet the functional needs of the member who suffers from a physical impairment due to illness, disease, or injury and are appropriate treatment for the condition. The patient must have functional deficits that interfere with Activities of Daily Living, Instrumental Activities of Daily Living or return to work
- PT and OT services achieve a specific diagnosis-related goal for a member, who has a reasonable expectation of achieving measurable improvement, in a reasonable and predictable period of time or documentation supports the need for skilled maintenance care.
  - Significant is defined as a measureable and meaningful increase (as documented in the patient's record) in the patient's level of physical and functional abilities that can be attained with short-term therapy, usually within a 60-90 day period.
- PT/OT services inherently include the introduction and provision of, and education about a home (self) management program, appropriate for the condition(s) under treatment. In keeping with professional standards, this home management program should be introduced into the course of treatment at the earliest appropriate time.
- The need for ongoing care is supported by documentation that shows objective measurements (using a functional outcome tool or standardized test) that the member is progressing towards goals or documentation shows the need for skilled maintenance care.

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Services not considered medically necessary

1. Service(s) that can be self-administered or safely and effectively furnished by an unskilled person without the direct or general supervision of a therapist
2. Training in nonessential self-help, recreational tasks, or sport specific performance.
3. Services related to activities for the general good and welfare of the member e.g., general exercises to promote overall fitness and flexibility and activities to provide diversion or general motivation
4. Passive modalities that extend beyond the acute phase of recovery.
5. Non-skilled routine, repetitive and reinforced procedures that do not require one-to-one intervention such as stationary bike riding, progressive resistive exercise after instruction, and passive range of motion.
6. Services not provided under a therapy plan of care
7. Services provided by staff who are not qualified or appropriately supervised
8. The unavailability of a competent person to provide a non-skilled service, does not make it a skilled service when the therapist furnishes the service

Non-covered Services

Providers should reference Health Plan Policies for non-covered services

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued or transitioned to a skilled maintenance program when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures and the skills of a therapist are not needed to continue on a maintenance program.
- If the member has been non-compliant with therapy, as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are to restore or maintain function, motor ability, and range of motion with skilled interventions.

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Disciplines that may use the PT/OT Benefit

The Patient Protection and Affordable Care Act of 2012 allows provider specialties such as Chiropractors, Massage Therapist, Acupuncturists, Naturopathic practitioners and physicians who utilize various approaches and adjunct modalities to achieve therapeutic benefit in the treatment of neuro-musculoskeletal conditions, to utilize the Physical therapy and Occupational Therapy benefit to bill for adjunct therapeutic modalities. Physical therapy and Occupational Therapy services are provided according to the members' benefit certificates and the health plan's medical policies. Services billed "incident to" by MDs/DOs/DPMs must meet the Centers for Medicare & Medicaid Services (CMS) "incident to" guidelines for physical therapy and occupational therapy and must be rendered by "qualified providers" as defined by CMS.

Authorization of Services

Management Rules

1. Place of Service requiring authorization
   - Outpatient therapy as defined by the Health Plan or CMS
   - Home health care.
2. Time-frame for submission
   - Initial authorization: a request for prior authorization for the first request is typically submitted within 7 days of the initial evaluation (Time-frames may change based on health plan rules).
   - Ongoing care: the request may be submitted within 7 days prior to the expiration date of the last authorization (Time-frames may change based on health plan rules). A request submitted greater than 7 days must have clinical information that supports ongoing care.
   - Some health plans may not require prior-authorization; therefore this suggested time-frame will not apply.
3. Clinical Information
   - Acute and subacute conditions – It is recommended that clinical information may be collected within 14 days of the submission date (unless otherwise dictated by State Medicaid Laws or Health Plan Rules)
   - Chronic Conditions – It is recommended that clinical information may be collected within 20 days of the date of submission (unless otherwise dictated by State Medicaid Laws or Health Plan Rules)
4. Vision benefits
   - Rehabilitation benefits allow treatment for visual deficits that affect ADLs and require skilled therapy. Repetitive vison exercises may be transitioned to a home program. Coverage is dependent upon health plan medical policies and/or available benefits and certificate of coverage.

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5. Authorizations
   - Authorizations of visits and units over a specific period of time are based on a set of clinical data for the condition.
     - Some health plans allow dynamic waivers. A dynamic waiver allows a range of visits from 6-12 visits based on the complexity of the condition (surgical/non-surgical diagnosis, date of surgery, and a functional outcome measurement score)
     - Some health plans allow a set number of visits to be completed before prior authorization are required.
     - Updated clinical information is required for ongoing care.
6. Benefit limit
   - The member's benefit limit and remaining benefits are checked at the time of case build. Authorizations are based on medical necessity. Every effort is made to authorize within the benefit limit, however, it is the responsibility of the member and provider to monitor the use of the member's benefits.
7. Initial evaluations
   - Do not require prior approval. The initial evaluation should be completed before a request for authorization is submitted.
8. State or Federal Mandates
   - eviCore makes every effort to authorize care according to state and federal mandates.
9. Duplicate care (the same or similar treatment plan for the same body part or diagnosis)
   - Request for care for the same body part or diagnosis by more than one provider is considered duplicate care. Duplicate care is not medically necessary, as the member's condition can improve with care provided under one treatment plan and by one provider. eviCore will authorize additional care when specialized care is needed such as lymphedema, vestibular rehabilitation, women's health issues etc.
10. Retrospective review
    - Is conducted after the services are completed
    - In order to determine if services were medically necessary and required the skills of a therapist, documentation must be reviewed. The provider must submit all case notes such as: initial evaluation, progress notes, daily treatment notes, modality/exercise logs and discharge summary
11. Reconsideration
    - The provider may ask for a reconsideration of an authorization decision when the case is denied or when a portion of the visits, units or dates of service is approved (partial approval).
    - Reconsideration can be requested in writing or by requesting a peer to peer call.
    - The provider must follow the specific rules as outlined by Centers for Medicare Medicaid or the Health Plan.

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12. Appeals
    - eviCore is delegated for first level appeals for some health plans.
    - Appeals for Medicare members must be filed through the Health Plan unless delegated to eviCore.
    - To appeal an authorization decision, the provider can submit new information in writing for review or the provider may request a peer to peer call and provide new information for review on behalf of the member.
    - Appeal instructions are outlined in the provider/member denial letters

Applicable Federal and State Mandates

The Federal Government and many state insurance mandates require health insurance companies to pay for medically necessary and evidence-based treatments for certain population groups or conditions. eviCore takes into consideration these applicable federal and state mandates when authorizing care.

Early and Periodic Screening Diagnostic and Treatment (EPSDT) Mandate

In 1967, Congress introduced the Medicaid benefit for children and adolescents, known as Early and Periodic Screening, Diagnostic and Treatment (EPSDT). The goal of this benefit is to ensure that children under the age of 21 who are enrolled in Medicaid receive age-appropriate screening, preventive services, and treatment services that are medically necessary to correct or ameliorate any identified conditions – the right care to the right child at the right time in the right setting. This broad scope supports a comprehensive, high-quality health benefit. States share responsibility for implementing the EPSDT benefit with the Centers for Medicare & Medicaid Services (https://www.medicaid.gov/medicaid/benefits/epsdt/index.html). eviCore will adhere to the applicable federal and state guidelines when authorizing therapy for children covered by the EPSDT mandate.

eviCore's Evidence Based Guidelines

eviCore bases clinical guidelines on published national guidelines and research from evidence-based, peer-reviewed literature. In addition, eviCore's Medical Advisory Committee continually evaluates the clinical guidelines based on new evidence in peer-reviewed literature.

Purpose of the Guideline

- Describe appropriate care based on the best available scientific evidence and broad consensus;
- To reduce inappropriate variation in practice;
- To promote efficient use of resources;
- To act as focus for quality control
- Criteria used by clinical reviewers to make authorization decisions

Process for developing new guidelines and updating current guidelines:

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- New Guidelines are created by a physical or occupational therapist who is a subject matter expert.
- Current guidelines are updated annually
- New guidelines are reviewed by external subject matter experts
- The recommendations from the external subject matter expert may be incorporated into the guideline
- The eviCore Medical Advisory Committee will review the new guidelines and updates to the current guidelines annually
- The guideline is then sent to the Health Plan for review
- Accepted changes will be incorporated into the guideline before publication on the eviCore website.

Intended Audience:

- Utilization Management Clinical Reviewers
- Providers of physical therapy and occupational therapy services
- Health Plans that contract with eviCore

Medicare Coverage Policies

The coverage policies of CMS (Centers for Medicare and Medicaid Services) take precedence over eviCore's guidelines for Medicare and Medicare Advantage enrollees.

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General Medical Rehabilitation

Benign Paroxysmal Positional Vertigo	**19**
Pelvic Pain Syndrome	**28**
Pelvic Floor Dysfunction: Bowel and Bladder	**38**
Rheumatoid Arthritis Hip, Knee, Foot, Ankle, Shoulder & Hand	**50**

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Benign Paroxysmal Positional Vertigo

Synonyms

- Benign Paroxysmal Posititional Vertigo (BPPV)
- Benign Positional Vertigo (BPV)

Definition

Benign paroxysmal positional vertigo (BPPV) is a type of dizziness that is characterized by sudden onset of spinning or lightheadedness following head movement or position change. The vertigo is benign in nature, intermittent and usually is of short duration. It is the most common vestibular disorder in adults.[1] The condition is reported in adults of all ages with the mean age onset of 49.4 years with increasing incidence with increasing age.[7] It is present, but is uncommon in children. Etiology includes post -head trauma, viral labyrinthitis/neuritis, post general or ear surgery, Meniere's Disease, chronic otitis/mastoiditis, ototoxicity, and after ischemia occurs in the distribution of the anterior vestibular artery, but it is largely idiopathic.[8]

Patient History

Patient history may include:

- Onset of problem is characteristic and is crucial in assisting in diagnosis. Patients usually experience a sudden onset of nystagmus and vertigo of short duration that occurs with head or position change in the planes of one of the semi-circular canals. The symptoms stop if they remain still or move out of the provoking position. It usually occurs in bed during the night or in the morning when rolling over or trying to get up, but can occur at any time throughout the day. Other provoking positions can include, but are not limited to looking up into a cupboard, tipping head back in the shower, bending over to look under a bed, lying down in bed, or tipping backward in dentist or beauty shop chair.[4]
- Mechanism of onset – Calcium carbonate crystals in the utricle called otoconia break free from the macula of the utricle. The otoconia float into the semicircular canals, which are attached to the utricle. The crystal thus makes the canals gravity sensitive, causing cupulolithiasis or canalithiasis.
  - Cupulolithiasis is described as an inappropriate deflection of the cupula due to the adherence of the otoconia, which persists as long as the canal is in the provoking position. This form of BPPV is less common.[4]
    - Characteristics include:
      - Immediate onset of vertigo when the patient moves into the provoking position
      - Nystagmus characteristic of BPPV that appears with the onset of vertigo complaints
      - Vertigo and nystagmus persist as long as the provoking position is maintained (not fatigable), lasting longer than 60 seconds.

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- Canalithiasis is described as inappropriate deflection of the cupula due otoconia free floating in the semi-circular canal endolymph. This is the most common form of BPPV.
  - Characteristics include:
    - Delay in onset of vertigo (1 to 40 seconds) after moving into provoking position. The latency is due the amount of time it takes for the disruption of the endolymph to pull on the cupula.
    - Nystagmus characteristic of BPPV that appears with onset of vertigo complaints.
    - Vertigo and nystagmus symptoms build to a crescendo and then lessen usually disappearing within 60 seconds.
- Nature of the symptoms – Patients may experience nausea and vomiting, imbalance and difficulty walking a straight path. Many patients have a fear of falling. The dizziness may be described as lightheadedness, spinning or dysequilibrium. Associated symptoms include sweating, blurred vision, jumping vision and a heavy-headed or difficulty concentrating feeling.[10, 4]
- Frequency of symptoms – Intermittent, dependent on how much the patient moves.

Patient Data

- General demographics
- Living environment including home barriers and social support system
- Functional status and activity level including independence level in self-care activities, driving, working and assistive device use
- Medications with special consideration toward medications causing/relieving dizziness and nausea
- Other tests and measurements (laboratory and diagnostic tests) including vestibular function testing, audiogram, MRI/CT
- Past history including history of prior therapy and response to prior treatment

Specific Considerations

- Rule out red flag diagnoses (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
History of neck surgery	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Recent neck trauma	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Severe Rheumatoid Arthritis	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Atlantoaxial +/or occipitoatlantal instability	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Cervical myelopathy or radiculopathy	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Carotid sinus syncope	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Chiari malformation	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques
Vascular Dissection syndromes	Absolute contra-indication to Dix-Hallpike test and canalith repositioning techniques

- Other red flag signs include pure vertical nystagmus, prolonged, persistent nystagmus, abnormal pursuits and saccades, nystagmus that does not change with fixation, lateropulsion, ocular tilt reaction, positive VOR cancellation, direction changing nystagmus, and spontaneous nystagmus

Subjective Findings

- History should include date of and conditions of onset including symptoms, length of dizziness episode, provoking and remitting circumstances and associated past medical history including but not limited to migraine, psychosocial and past incidences of vestibular disorders, traumas or surgeries.
- Patient may report history of head trauma, labyrinthitis/neuritis, or ischemia in distribution of anterior vestibular artery, recent surgery, and/or associated vestibular problems such as Meniere's Disease or ototoxity.
- Patient may report insidious onset
- Patient reports brief episodes of vertigo when head moved into different positions. Vertigo commonly occurs when lying in bed, rolling over in bed, bending over, and looking up.
- Patient reports resolution of vertigo with position change or immobility.
- Patient reports postural instability which can include difficulty walking, veering to involved side, difficulty turning or walking while head is turning; instability in low lighting or darkness or over uneven ground.

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Objective Findings

Objective findings may include:

- Positive Positional testing, including the Dix-Hallpike (a.k.a. Barany or Nylen-Barany Maneuver) test, Side-Lying test, Roll test and others (see Scope of Examination).
- Fall Risk using Functional Outcome measures including, but not limited to Dynamic Gait Index (DGI), Timed Up and Go (TUG), Functional Gait Assessment (FGA), Functional Reach, Multi-directional Reach, Berg Balance Scale.

Scope of Examination

Oculomotor Exam

- With fixation (room light): ocular ROM, gaze-holding, saccades, pursuits, VOR (vestibular ocular reflex) to slow and fast head (Head Thrust) movements, check for spontaneous and gaze holding nystagmus.
- Without fixation (using infra-red goggles or Frenzel Lenses): spontaneous nystagmus, gaze-holding nystagmus, post-head shaking nystagmus
- Cervical Range of Motion: checking for limitations for positional testing
- Positional Testing -Best performed with fixation blocked with infrared goggles or Frenzel Lenses. May include:
  - Dix-Hallpike: tests the posterior and anterior (superior) canals
  - Roll Test: tests the horizontal canals
  - Sidelying test: alternative to Dix-Hallpike that can be used when positioning for Dix-Hallpike is uncomfortable or contraindicated.
  - Seated Supine Positioning Test (helps to determine involved side if positive Roll Test)[14, 15]
  - Bow and Lean Test (aka Choung's Test, Head Tilt or Pitch Test) [16,17]
  - Null Point Test (helps to determine involved side if positive Roll Test)[19]
  - Dix-Hallpike Test with straight head hanging for anterior canal[18]
- Static and Dynamic Visual Acuity Testing
- Static and Dynamic Balance Assessment in sitting and standing
- Testing measures may include Dynamic Posturography, Clinical Test for Sensory Interaction in Balance (CTSIB), modified CTSIB, Dynamic Gait Index, Berg Balance Scale, Romberg, Sharpened Romberg, Single Leg Stance (SLS)
- Assess balance with visual (eyes closed) and/or proprioceptive (foam) challenges

Gait Assessment

- Use of assistive device, gait deviations such as wide base of support, imbalance with head turns or turning, veering, slow cadence, extra steps or slowing with obstacles.

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- Testing Measures may include Dynamic Gait Index, TUG, gait speed, Functional Gait Assessment

Outcome Assessment

- Motion Sensitivity Quotient (usually used for other vestibular disorders)
- Dizziness Handicap Inventory
- Activities-Specific Balance Confidence Scale (ABC)
- May include previously mentioned Functional Outcome Measures (i.e. DGI, FGA)

Results if Benign Paroxysmal Positional Vertigo

- Diagnosis is based on characteristic findings:
  - Latency of one or more seconds after head is moved into provoking position before vertigo and nystagmus occur together, if canalithiasis. There is no latency with cupulolithiasis.
  - Initial heightening then gradual decrease (crescendo) in reduction of symptoms (less than 60 seconds, if canalithiasis and > 60 seconds if cupulolithiasis)
  - Nystagmus characteristic of BPPV:
    - Posterior Canal- up beating with torsional nystagmus rotating toward involved side (down ear).
    - Anterior/Superior Canal – downbeating with torsional nystagmus rotating toward involved side (down ear).
    - Horizontal canal – geotropic when canalithiasis or ageotropic (apogeotropic) when cupulolithiasis[13]
  - Reversal of nystagmus and recurrence of vertigo when returning to sitting
  - Decreased intensity of vertigo with repeated movements for canalithiasis (fatigability).
  - Atypical BPPV
    - BPPV may be positive without characteristic nystagmus including lack of any nystagmus (Subjective BPPV)[11, 12] provided that the described symptoms and history are characteristic of BPPV
    - Some sources consider horizontal and superior canal involvement to be Atypical BPPV

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Differential Diagnoses

Otological Disorders	Neurological Disorders	Other
➢ Meniere's Disease ➢ Vestibular Neuritis ➢ Labyrinthitis ➢ Superior Canal Dehiscence ➢ Post-traumatic Vertigo ➢ Acoustic neuroma ➢ Perilymphatic Fistula ➢ Hypermobile stapes ➢ Mal de Debarquement	➢ Migraine associated vertigo ➢ Vertebrobasilar Insufficiency (VBI) ➢ Demyelinating diseases ➢ Central Nervous System (CNS) lesions ➢ Cerebrovascular Accident (CVA)/Transient Ischemic Attack (TIA) ➢ Orthostatic Tremor ➢ Convergence Spasm	➢ Anxiety and panic disorders ➢ Cervicogenic ➢ Medication side effects ➢ Postural hypotension

Physical/Occupational Therapy Management

Requirements for Physical/Occupational Therapy Visits

- Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations, i.e. Activities Specific Balance Confidence Scale
  - Neurological signs: vertigo; nystagmus. Positional test should be performed every treatment to determine response to treatment and continued presence of BPPV.
- Treatment frequency and duration must be based on:
  - Severity of clinical findings
  - Presence of complicating factors
  - Natural history of condition
  - Expectation for functional improvement
  - Response to canalith repositioning techniques
  - Number of canals and sides involved
  - Patient level of assistance

Treatment Methods

- Particle Repositioning technique: Will vary dependent on mechanism (canalithiasis vs. cupulolithiasis), which semicircular canal is involved, comorbidities, and patient's ability to adhere to treatment:
  - Canalith Repositioning (a.k.a. Epley Maneuver, Canalith Repositioning Technique (CRT), Canalith Repositioning Maneuver (CRM))
  - Liberatory Maneuver (Semont Maneuver)
  - Brandt-Daroff Habituation Exercises

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- Liberatory Maneuver for Horizontal Canalithiasis (aka Appiani Maneuver)[4]
- Lempert Roll Maneuver for Horizontal Canalithiasis (aka Barb-B-Que Roll)[4]
- Forced Prolonged Positioning for Horizontal Canalithiasis BPPV [4]
- Gufoni treatment for Horizontal Canalithiasis in anterior arm followed by other treatment for HC canalithiasis[20]
- Quick BBQ Roll Treatment for Cupulolithiasis[4]
- Modified Semont Maneuver for Horizontal Canal Cupulolithiasis (aka Casani)[4]
- Modified Brandt-Daroff for Horizontal Canal Cupulolithiasis
- Forward Particle Repositioning Maneuver for Anterior Canalithiasis[21]
- Neck Extension repositioning maneuver for Anterior Canalithiasis

- Neuromuscular re-education for static and dynamic balance and gait
- Patient Education
- Fall Prevention Strategies
  - Risk of recurrence
  - Causes, mechanism and treatment of BPPV for basic understanding of their condition

Skilled Maintenance Care

Maintenance care is defined as services required to maintain the member's current condition or to prevent or slow deterioration of the member's condition. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)

- Skilled maintenance care for Medicare and Medicaid enrollees is covered if the specialized skill, knowledge and judgment of a qualified therapist are required:
  - To establish or design a maintenance program appropriate to the capacity and tolerance of the member
  - To educate/instruct the member or appropriate caregiver regarding the maintenance program
  - For periodic re-evaluations of the maintenance program
  - When skilled services are required in order to provide reasonable and necessary care to prevent or slow further deterioration, coverage will not be denied based on the absence of potential for improvement or restoration as long as skilled care is required.
- Skilled Maintenance Programs in an Outpatient and Home Health setting will not be covered if furnished by a Physical Therapist Assistant. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)

Discharge Criteria

- The patient is discharged when positional testing is negative.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.

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- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.

Referral Guidelines

- Refer patient to their primary care provider, for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines or improvement reaches a plateau;
  - Failure to respond to treatment resulting in the need for further assessment to confirm diagnosis.
  - Increased neurologic signs/symptoms

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence, provided there are no limiting factors for capacity to self-treat. Examples of limiting factors include age, dementia, safety, anxiety, pain, and ability to understand and correctly administer the techniques.

Self-Care Techniques

- Post-procedural instructions. These vary among practitioners
- Self-administered canalith/particle repositioning techniques

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Pelvic Pain Syndrome

Synonyms

- Vulvar Vestibulitis
- Vulvodynia
- Chronic Prostatitis/proctalgia
- Vaginismus/anismus
- Dyspareunia/painful intercourse
- Detrussor/Sphincter Dyssenergia
- Pudendal neuralgia
- Urethral syndrome
- Pelvic floor tension myalgia
- Levator ani syndrome
- Coccygodynia
- Interstitial cystitis
- Paradoxical puborectalis contraction (PPC)

Possible Causes

- Musculoskeletal components, including muscular, joint and/or movement dysfunctions
- Psychogenic factors including lifestyle and stress issues and/or history of sexual abuse
- Visceral or systemic factors: inflammation, infection , or disease
- Iatrogenic factors such as scars or adhesions
- Neurologic factors including diseases or Central Nervous System (CNS) dysfunction

Note: Metabolic, hormonal, and functional neurological disorders such as hypoglycemia, neurally mediated hypotension, reproductive hormone imbalance can be as important pelvic pain as any musculoskeletal diagnosis. If missed, they will prevent complete recovery and return to function.

Definition

Pelvic or perineal pain without evidence of regional infection.

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Patient History and Data Collection

Subjective and Historical Information collected should include:

- Symptom picture
  - Have patient draw a picture
  - Describe the problem, i.e., type of pain, consistency, duration
- Symptom pattern
  - Frequency
  - Daily and nightly patterns
- Symptom intensity
  - Rate using 1-10 scale; assess in daytime and in night time
- Bladder and bowel symptoms, plus regularity
- Associated symptoms
- Sleep/Wake Patterns
- Other Medical Problems
- Reproductive History
- Pregnancy History
- Menopause History
- Family History
- Medications
- Self-Care Coping Strategies
- Occupation and activity level
- Patient Goals

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma related; determine nature and extent of traumatic event.
- Determine OPQRST (Onset, Provocative/Palliative factors, Quality, Radiation/Referral pattern, Site [location], Timing of complaint).

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Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear, fracture
Fever, severe pain	Infection
Palpable mass	Hemangioma; soft tissue tumor; foreign body
Diabetes; paresthesias	Neuropathy; other metabolic causes (e.g., B12 deficiency, hypothyroidism)
Constipation, symptoms worse or better with meals, bloody stools	GI conditions
Pain with urination, hematuria	UTI, renal stone
Immune compromised state	Infection
Altered reflexes/progressive weakness	Cord signs/cauda equina

Presentation

The patient presents with pelvic pain symptoms lasting at least six months and is non-cyclical in nature.

Subjective Findings

- Dull, aching, burning, or sharp pains in pelvis, perineum, and/or lower abdomen
- Pain radiating to the low back and rectum
- Bladder or bowel frequency, urgency, incontinence, hesitancy, or straining
- Chronic constipation
- Painful sitting
- Men may complain of constant burning pain in the penis and post-ejaculatory pain
- Women may complain of pain increased during or following sexual intercourse, menstrual periods and pregnancy

Objective Findings

Objective data collected should include:

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Basic Physiological Tests
  - Blood Pressure
  - Blood Glucose Level
  - Heart Rate
  - Basal Body Temperature
- Postural Assessment
  - Standing – 2 feet, 1 foot standing
  - Sitting
  - Supine

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- Pain assessment
- Specific examination considerations:
  - Skin – include color and exudates, symmetry of structures
  - Palpation – trigger points or tender points Abdominals, lumbopelvic, thigh and pelvic floor musculature
  - Range of motion lumbar spine, hips, sacroiliac joints and coccyx Manual Muscle Test – trunk and lower extremities, pelvic floor
  - Biofeedback EMG Assessment using surface or internal sensors
  - Gait assessment
  - Functional assessment screening of bed mobility, transfers, squatting, lifting strategies, standing, sitting
  - Functional Reporting Measures including Pelvic Floor Impact or Disability or Pelvic Floor DIstree Inventory, Chronic Prostatitis Symptom Index, Oswestry, or Pain Disability Index, and a Health-related quality of life questionnaire

Scope of Examination

Examine the pelvic and trunk region and musculoskeletal system for possible causes, or contributing factors to the complaint.

Findings of Pelvic Pain Syndrome

- Muscles in the pelvic region are generally resistant to stretching and ROM is limited by pain
- Tender nodules or taut bands are noted in involved muscle groups and may lead to referral of pain
- Inefficient breathing patterns
- Abnormal postures, movement and holding patterns

Differential Diagnoses

- Interstitial Cystitis
- Pelvic Inflammatory Disease
- Pelvic Cellulitis
- Cancer
- Hip Pathology
- Lumbar Radiculopathy

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Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Impaired muscle performance
  - Impaired functional mobility (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain with urination, pain with intercourse, pain with sitting for prolonged periods, pain limiting function and at least 3/10
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Treatment Methods

Frequency and duration of treatment requires continuous assessment and modification based on patient progress and response.

This is a chronic condition so therapy should focus on teaching management skills and techniques to be followed through by the client. Therapy focuses on stretching and strengthening of affected muscles and correction of aggravating postural and biomechanical factors. Breathing and relaxation training is often indicated. Modalities such as electrical muscle stimulation can be useful to decrease pain to allow participation in an active exercise program. Various other techniques may also be effective i.e. massage and exercise, stretching, ultrasound, biofeedback and behavior modification.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Neurological deficits appear/progress

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

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Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Decrease pain/spasms	➢ Modalities i.e.interferential current, electrical muscle stimulation, functional electrical stimulation, transcutaneous electrical nerve stimulation ➢ Cryotherapy ➢ Thermotherapy ➢ EMG Biofeedback ➢ Trigger point therapy
Restore flexibility of the affected musculature and vertebral joints	➢ Segmental joint mobilization ➢ Range of motion within pain free range ➢ Sustained stretching exercises ➢ Soft tissue mobilization
Increase strength of the pelvic floor muscles	➢ Isotonic exercises ➢ Resisted exercises using vaginal cones
Increase strength and endurance of the spine and extremities	➢ Resisted Isometric Exercises ➢ Segmental strengthening ➢ Isotonic exercises ➢ Functional training
Improvement in body mechanics and postural stabilization	➢ Body mechanics training ➢ Postural stabilization activities ➢ Postural Control

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

Home Medical Equipment

- Hot pack
- Vaginal Cones
- Theraband for therapeutic exercises
- Gymball for therapeutic exercises
- Home electrical stimulation unit

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Self-Care Techniques

- Pelvic Floor Muscle Exercises
- Stretching and strengthening exercises
- Postural advice, instruction on proper body mechanics
- Heat applications if needed to relieve discomfort
- Deep breathing and relaxation techniques
- Adjunct Therapy
  - Acupuncture
  - Nerve stimulation devices
  - Injection of tender sites
  - Surgical treatment

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Pelvic Floor Dysfunction: Bowel and Bladder

Synonyms

- Functional Incontinence
- Stress Incontinence, female and male
- Urinary or bowel frequency
- Dysuria
- Mixed Incontinence, male and female
- Overflow Incontinence
- Urge Incontinence
- Pelvic Muscle Wasting/Atrophy
- Detrusor Sphincter Dyssynergia
- Neurogenic Bladder
- Enuresis
- Constipation

Definitions

Bowel and bladder dysfunction results in lifestyle alterations, emotional changes and/or feelings of pain or discomfort. They may occur throughout the lifespan. Urinary issues are usually addressed after age 5. Constipation issues may be addressed in physical therapy generally from school age on, once the child is able to be cooperative and follow the basic directions involved in treatment.

- Stress Urinary Incontinence
  - Involuntary leakage of urine with increased intra-abdominal pressure, i.e. physical exertion, physical activity, sneezing or coughing. In the elderly, it may result from rolling over in bed, sitting up from reclining, or getting up from a chair. In a younger population, running, bending over, lifting, and jumping are common activities which lead to stress urinary incontinence. Stress urinary incontinence is more frequent in women than in men. Most often it is associated with an incompetent bladder neck and sphincter, weakened urethral musculature, and following multiple vaginal deliveries or male/female pelvic surgery. Stress urinary incontinence results in smaller amounts of urine loss rather than a total loss of urine in one accident.
- Urge Urinary Incontinence
  - It is involuntary loss of urine preceded by a sudden unexpected feeling of urgency.

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- Mixed Incontinence
  - Involuntary leakage of urine associated with urgency and also with effort, exertion, coughing, or sneezing. Mixed incontinence is a combination of stress and urge incontinence.
- Functional Incontinence
  - It is involuntary leakage of urine when a person cannot get to or use the toilet in a timely fashion due to mobility, dexterity, environmental or psychological factors.
- Overflow Urinary Incontinence
  - Involuntary loss of urine in an oozing or unconscious small constant leaking due to the bladder outlet being blocked or the bladder muscles' inability to contract to push urine out in a consistent fashion. As the bladder fills without effective emptying, there is increased pressure on the outlet which causes constant leaking or oozing of urine.
- Total Urinary Incontinence
  - Involuntary loss of urine without any control and due to neurological or tissue damage.
- Frequency
  - Often defined as urinating more than 8 times per day. Nocturia is waking 2 or more times at night to void if under age 70 or 3 or more times if over age 70 Bowel frequency does not have a clinically accepted definition, however, people often seek treatment when the stool consistency changes or there is frequent interruption in daily activities.
- Dysuria
  - Painful or uncomfortable urination caused by infectious or non-infectious disorders.
- Detrusor Sphincter Dyssynergia (DSD)
  - Disturbance of the normal synergistic coordination between bladder contraction and external urethral sphincter muscle relaxation during voiding. It results in an alteration of normal flow and is most often found in neurologic conditions such as spinal cord injury and multiple sclerosis.
- Neurogenic Bladder
  - A flaccid or spastic bladder caused by neurologic damage. Symptoms include overflow incontinence, urge incontinence, frequency, urgency, and retention.
- Enuresis
  - Bedwetting.
- Constipation
  - Constipation is the infrequent and difficult passage of stool.Rome III criteria states symptoms must have occurred > 3 months, and have at least 2 more of the following symptoms: straining, hard or lumpy stools, less than 3 BM's per week, sensation of incomplete emptying or blockage, manual maneuvers to evacuate, no loose stools without laxative.

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- Fecal Incontinence
  - Loss of bowel control, ranging from small to large amounts, in liquid or solid form. It also may present as a lack of control of gas.
- Encopresis
  - Fecal soiling by children in the absence of disease who have previously learned control over their bowels and are over the age of 4.

Causes of Bowel and Bladder Dysfunction

Stress Incontinence

Caused by inadequate closure of the urethra. There are five urethral closure mechanisms to maintain urine in the bladder during activity:

- Pelvic muscle resting tone
- Sphincter resting tone
- Urethral smooth muscle resting tone
- Urethral coaptation
- Bladder angle with the urethra

One or more of the urethral closure mechanisms can be ineffective due to:

- Pelvic muscle weakness
- Pelvic muscle system imbalance
- Hormonal related tissue composition changes
- Neurologic/innervation changes to pelvic muscles
- Descent of bladder from normal angled position

Conditions that lead to ineffective closure mechanisms include:

- Pregnancy in women
- Childbirth, including episiotomy, in women
- Pelvic surgery
- Menopause and andropause (men)
- Pelvic, spinal injury, or trauma
- Inactivity, especially lack of walking
- Repetitive straining from lifting or coughing
- CNS dysfunction
- PNS dysfunction i.e. post radical prostatectomy in men

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Urge Incontinence

Caused by bladder and/or autonomic nervous system dysfunction. There are bladder (detrusor) muscle and autonomic nervous system mechanisms that maintain normal bladder function:

- 10-12 reflex arcs from the subcortex/spine through the autonomic nervous system (ANS) to the bladder that unconsciously controls filling and emptying.
- Sympathetic division of ANS quiets bladder to allow filling
- Parasympathetic division of ANS activates the bladder to facilitate emptying
- Bladder wall mucosa protects muscle tissue from direct irritation

One or more of these mechanisms can be ineffective due to:

- Imbalance of ANS sympathetic and parasympathetic divisions
- Alteration of bladder control reflex arcs, ie. bladder-sphincter dyssynergia
- Alteration of bladder wall lining

Conditions that lead to irritable bladder muscle activity include:

- Menopause and andropause (men)
- Aging
- CNS dysfunction
- Cancer and radical prostatectomy
- Pelvic surgery
- Stress
- Food and drink (such as spicy foods, coffee, tea, and alcoholic beverages)

Note: This is primarily a bladder muscle and ANS problem and only secondarily a pelvic muscle problem.

Overflow Incontinence

Caused by urine overflowing through a blocked or closed bladder outlet. There are two major mechanisms that facilitate urine flowing through an open bladder/urethral outlet:

Neurological reflex arc–reflex inhibition

When the bladder contracts, the reflex arc causes the bladder to open.

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Neurological reflex arc

When the bladder is stretched from being full, the reflex causes the bladder to contract repetitively and with force to push urine out of the opened urethra.

One or more of these mechanisms can be ineffective due to:

- Spinal reflex, subcortical reaction/reflex alteration
- Mechanical bladder outlet obstruction, ie. stones, muscle hypertrophy, tumor
- Atonic, lazy bladder is unable to respond to filling pressure

Constipation

Associated with sluggish movement of stool through the colon. This may be due to dietary issues, medications, organic conditions, or pelvic floor dysfunction. If emptying is delayed, stool loses water and hardens. The stool retention causes rectal distention. Watery stool behind the hardened stool may leak out resulting in fecal incontinence. Over time there may be a loss of rectal sensation and loss of urge to defecate, perpetuating the cycle. Excessive straining related to constipation contributes to anorectal pathology.

Fecal Incontinence

May occur with either constipation or diarrhea. Related factors include digestive disorders, pelvic floor weakness or trauma, hemorrhoids and other internal or external ano-rectal conditions, and physical inactivity.

- Risk Factors
  - Age
  - Functional impairment
  - Parity, childbirth, and postpartum state
  - Menopause
  - Dietary factors
  - Smoking
  - Obesity
  - Genetic factors
  - Prostate disorders
  - Dementia
  - Psychiatric disorders, specifically depression
  - Diabetes
  - Urinary tract infection
  - Chronic gastrointestinal (GI) conditions such as irritable bowel syndrome (IBS), diarrhea, constipation, and inflammatory bowel diseases (IBD)
  - Cardiovascular and pulmonary conditions
  - Gastrointestinal, gynecologic, rectal, and urological procedures
  - Neurological disorders, such as stroke and spinal cord problems

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History

Medical and social history should include:

- Pregnancies: miscarriages, live births
  - Complications during labor, pregnancy, delivery
  - Surgical procedures during delivery – cesarean, episiotomy
  - Length of labor
  - Position of delivery
  - Episiotomy and/or tearing
- Relevant past gynecologic/urologic/rectal history
- Menopause
  - Related symptoms, hysterectomy, related physical changes
- Urologic history
  - When toilet trained, day and night
  - Childhood toileting patterns – bladder and bowel
- Medications and dates of use
- Medical Conditions – chronic conditions such as allergies, pain conditions, MS, etc.
- Surgical History – Brain, pelvic, urologic, gynecologic, rectal, spine, pelvic, hip
- Physical Activity level – type, frequency, intensity of exercise program
- Present symptoms
  - With urination, bowel movement, menstruation, sexual activity, intercourse, and exercise
- Pain rating
- If available, review bladder/bowel diary, fluid intake/output, and diet

Intake Interview and Data Collection

- Subjective Urinary and Bowel Symptoms
  - Urinary
    - Loss of urine with sudden urgency
    - Loss of urine with physical activity
    - Loss of urine, oozing with little awareness
    - Loss of urine when walking, undressing, etc.
    - Loss of urine during sleep
    - Frequency of daytime and night-time emptying
  - Bowel
    - Type and frequency of bowel movement
    - Loss of bowel movement during the day – solid or diarrhea
    - Relation to urinary dysfunction
  - Pain – related to urinary symptoms
  - Menstruation – related to urinary symptoms

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- Objective Urinary and Bowel Symptoms
  - 3-7 day bladder and bowel diary to be completed prior to the initial visit
  - Includes urinary, bowel, fluid frequency and type, food intake, and pad use (type of pads, number of pads, when are pads used)
- Functional Impact Questionnaire
  - 1. Pelvic Floor Distress Inventory
  - 2. Pelvic Floor Impact Questionnaire
  - 3. Geriatric Self Efficacy Scale for Urinary Incontinence

Specific Aspects of History

- Rule out red flags (require medical management)
- Identify co-morbidities requiring medical management and those which affect therapy management
- Determine if trauma-related; determine nature and extent of traumatic event

Red Flag	Possible Consequence or Cause
Hematuria (reddish or dark brown urine) or blood in stools	◆ Disease of genitourinary tract ◆ Acute glomerulonephritis ◆ GI cancer
Dark urine	◆ Hepatic obstructive disease ◆ Biliary obstructive disease ◆ Acute exertional rhabsomyolysis
Urinary urgency	Infection, inflammation
Dysuria	Infection, Inflammation
Polyuria	Diabetes
Reduced force or caliber of flow	Benign prostatic hyperplasia Pelvic Mass
Painful defecation	AbscessPelvic Mass
Difficulty initiating urine stream	Benign prostatic hyperplasia Pelvic Mass
Recent onset of urinary dysfunction, saddle anesthesia with back pain	Neurologic disease

Subjective Complaints

Complaint of involuntary leakage of urine or stool with or without urgency, day or night. Symptoms may be related to effort, exertion, sneezing, or coughing. Complaint of increased frequency of bladder or bowel emptying, or decreased frequency of bowel emptying. Straining to empty.

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Objective Findings

Specific Aspects of Examination for Bladder and Bowel Dysfunction:

Women

- External exam
  - Observe the perineum for skin condition, color, scars, symmetry of anatomy, swelling, gland enlargement, condition of the introitus, and location of structures at rest.
  - Observe the movement of the perineum from the resting position, contracted position, bearing down position, and with coughing
  - Palpate the perineum externally to assess for tenderness, hypo/hypertonicity and hypersensitivity.
  - Assess light touch, deep pressure, and if possible, pin prick sensation.
  - Perform reflex assessment including anal sphincter reflex, bulbocavernosus reflex, and cough reflex.
- Internal vaginal or rectal exam
  - Assess sensation
  - Assess muscle tone
  - Perform manual muscle test of pelvic floor muscles and ability to isolate
  - Assess for presence (absence) of prolapse
- Additional testing may include
  - Functional Stop Test
  - Jump Test

Men

- External exam
  - Perineal exam
  - Check for redness, rashes, and infection of the penile, perineal, scrotal, and anal areas.
  - Identify any congenital abnormalities
  - Assess strength of pelvic floor muscles and ability to isolate
- Internal exam
  - Digital anal examination to assess strength and tonicity

Scope of Musculoskeletal Examination

- Inspection
- Palpation of bony and soft tissue
- Range of motion of trunk and legs
- Strength of trunk and legs
- Orthopedic and neurologic testing if neurologic signs are present

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Normal Bladder Function (age 5+):
(To be used as a reference to define abnormal function)

- Toileting every 2-4 hours during the day
- Presence of a controllable awareness of the need to toilet on a 2-4 hour basis
- Strong, continuous flow of urine for 10-20 seconds in duration
- Urine is light yellow color and without strong odor
- Automatic initiation and completion of urine flow without hesitancy or dribbling
- Absence of leaking with physical activities, coughing, sneezing, bending, lifting, exercise, getting up from sitting or reclining
- Absence of frequent uncontrollable urge feelings with loss of urine.
- Sleeping 7-8 hours throughout the night without toileting

Exceptions to guidelines include:

- Pregnancy - toileting will increase in frequency
- Aging - after 65 years of age, frequency of toileting in the day and at night increases

Normal Bowel Function (age 4+)
4-9 bowel movements per week, with normal consistency without straining

Differential Diagnosis:

- Cystitis in females
- Multiple Sclerosis
- Prostatitis
- Celiac Disease
- GI motility disorders
- Bile acid malabsorbtion disorders
- Inflammatory Bowel Disease
- Spinal Cord Neoplasms
- Spinal Cord Trauma and Related Diseases
- Spinal Epidural Abscess
- Urinary Obstruction
- Urinary Tract Infection in males
- Uterine Prolapse
- Vaginitis

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Physical/Occupational Therapy Management

- For Bowel and Bladder Dysfunction:
  - Education
    - Review anatomy and function of the urogenital system
    - Review relation to bowel patterns and changes
  - Lifestyle changes
    - Food, drink, sleep, walking, social and recreational activities.
  - Autonomic Nervous System Retraining
    - Biofeedback, EMG resting tone retraining
    - Physiological Quieting techniques
  - Visceral Organ Alignment
    - Wedge inversion, manual techniques
  - Pelvic Muscle Retraining
    - Pelvic muscle exercises including Kegels and Roll for Control exercises
    - Biofeedback – using internal or external sensor
    - Electrical Stimulation
    - Vaginal or rectal cones
  - Postural Correction, seating on toilet
  - Align pelvis to assist with muscle function
  - Functional Activity Retraining: coordinate breathing with abdominal and pelvic musculature. Connect pelvic floor muscle training with timing and efficiency of voiding. Teach lifting techniques that avoid strain on the pelvic floor.
- For Functional Incontinence
  - Treatment of non-urogenital dysfunctions such as cognitive and/or physical impairments
  - Includes gait, balance, activities of daily living, therapeutic activities

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.

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- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

Expected Outcome	Procedures/Modalities Such As
➢ Normalize frequency and timing of bowel and bladder control ➢ Efficient emptying of bowel and bladder	➢ Therapeutic Exercise ➢ Neuromuscular Re-education ➢ Manual therapy ➢ Electrical Stimulation or biofeedback (not needed routinely. Use when patient cannot actively contract the pelvic floor muscles, needs motivation, assistance for adherence or for locating targeted musculature .)
➢ Teach self management techniques	➢ Self care/home management training

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at her or his residence.

- Home Medical Equipment
- Vaginal or rectal weights
- Home electrical stimulation unit

Self-Management Techniques

- Bladder and bowel training
- Bladder and bowel diaries
- Lifestyle interventions
- Home exercise program
- Weight loss

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Rheumatoid Arthritis Hip, Knee, Foot, Ankle, Shoulder & Hand

Synonyms
None

Definition
- Rheumatoid arthritis is an inflammatory disease primarily affecting joint synovial tissue.
- Prevalence is up to 1 percent of the U.S. population.
- Autoimmune disease with genetic factors playing a role in its development.
- Women are more likely to be affected than men.
- Onset usually occurs between 20 and 50 years of age.
- Exacerbations and remissions are common.
- Wrist and proximal finger joints are frequently affected; however, the neck, jaw, and all extremity joints can be involved.
- Chronic inflammation leads to joint destruction with instability and loss of range of motion.
- Eventually systemic involvement can lead to cardiopulmonary complications.

Patient History
Patient history may include:

Patient Data
Stiffness of the joints is a major symptom in any type of arthritis and particularly in RA. Frequently, RA is accompanied by “morning stiffness.” Other inflammatory conditions, such as polymyalgia rheumatica and ankylosing spondylitis, also may be accompanied by morning stiffness. The severity of stiffness may better differentiate a primary inflammatory process from other joint processes. Edema of the synovium and periarticular structures contributes to stiffness in RA by mechanically interfering with the usual biomechanics of the joint. With normal sleep patterns, stiffness is most pronounced in the morning, in part due to redistribution of interstitial fluid while sleeping.

Pain is a significant problem for most patients with RA. Although the assessment is subjective, the patient's relief from pain is the objective for treatment. Swollen joints with an applied load or joints with rapidly evolving effusions may be extremely painful due to high intra-articular pressures that lead to excessive stresses on the extensively innervated periarticular supporting structures.

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Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear
Fever, severe pain	Infection
Diabetes	Neuropathy
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of extremity	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of extremity occurs
  - Neurologic testing worsens
  - Range of motion plateaus or decreases

Presentation

Patients may present with stiffness, and tenderness of affected joints. Pain on joint motion may be due to damage of cartilage and bone. Enlargement of synovial membrane and deformity of the joint may develop over time as articular and supporting structures are damaged by the inflammatory process. The patient may also present with limitation of motion, generalized malaise and fatigue.

Subjective Findings

- Complaints of joint stiffness after sleep or periods of inactivity
- Pain, redness, swollen and warm joints
- Multiple joint complaints, frequently symmetrical
- Fatigue
- Fever
- Possible weight loss

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Objective Findings

Examine the musculoskeletal system for possible causes or contributing factors to the complaint.
All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Inspection
  - Nodules
  - Joint swelling
  - Symmetrical involvement
  - Deformities
- Palpation of bony and soft tissue
  - Joint tenderness
  - Sensory changes
  - Temperature changes
- Range of motion, active and passive
  - Test passive and active range of motion of involved joints
- Manual Muscle Testing
  - Test resisted isometric movements of involved joints
- Orthopedic and neurologic testing if neurologic signs are present
  - Joint Play movements of affected joints
  - Test for joint instability of affected joints
  - Reflexes
  - Dermatomes and myotomes
- Functional Assessment - The following standardized tests may be used to assess functional limitations:
  - Functional Independence Measure scale (FIM) (Granger 1993)
  - Functional Life Scale (FLS) (Sarno 1973)
- Psychosocial assessment

Findings of Rheumatoid Arthritis

- May present with signs of inflammation around the joint
- Limited range of motion
- Joint deformity or instability, and possible derangement or subluxation of related joint structures
- Proliferation of synovial tissue
- Usually more than single joint involvement

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Differential Diagnoses

- Osteoarthritis
- Psoriatic arthritis
- Articular cartilage pathology including neoplastic pathology
- Osteonecrosis
- Crystalline deposition diseases including gout and pseudogout (chondrocalcinosis)

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Treatment Methods

- Minimize pain and inflammation,
- Normalize gait, if affected
- Normalize pain-free range of motion,
- Prevent muscular atrophy and deformity
- Maintain proprioception, and
- Relieve joint pain so that other objectives may be achieved
- Use therapeutic exercises for ROM and strengthening
- Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

The following table lists the procedures for **Acute Phase** presentation.

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

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Expected Outcome	Procedures/Modalities Such As
Decrease pain and stiffness	➢ Use ice-packs, topical sprays for acutely inflamed joints ➢ Soft tissue mobilization
Reduce deformities and correct biomechanical alignment	➢ Use of splints and orthosis: ➢ Metatarsal pad or bar is used to remove weight from painful MTP joints and a rocker-bottom sole can be used to facilitate roll-off. Hind foot pronation is addressed with custom inserts ➢ Knee orthosis to control patellar alignment and hyperextension ➢ Dynamic hand splints are used to increase dexterity. Resting hand splints are used for acutely inflamed joints
Decrease stiffness and improve flexibility	➢ Passive range of motion ➢ Active assisted range of motion ➢ Joint mobilization
Improve strength and endurance	➢ Isometric exercises ➢ Isotonic exercises within pain free range
Joint protection education	➢ Use of adaptive equipment ➢ Avoid overuse during the inflammatory phase ➢ Modification of tasks to decrease joint stress
Teach energy conservation techniques	➢ Teach use of adaptive equipment ➢ Teach modification of activities ➢ Rest periods during the day
Self-management	➢ Teach application of ice and soft tissue mobilization to management inflammation ➢ Teach home exercise program of range of motion and strengthening

The following table lists the procedures for **Subacute and Corrective/Rehabilitative Phase** presentation.

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

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Expected Outcome	Procedures/Modalities Such As
Decrease pain and stiffness	➢ Superficial or deep heat i.e. moist hot packs, electric mittens, ultrasound, diathermy or paraffin ➢ Soft tissue mobilization
Reduce deformities and correct biomechanical alignment	➢ Use of splints and orthosis: ➢ Metatarsal pad or bar is used to remove weight from painful MTP joints and a rocker-bottom sole can be used to facilitate roll-off. Hind foot pronation is addressed with custom inserts. ➢ Knee orthosis to control patellar alignment and hyperextension ➢ Dynamic hand splints are used to increase dexterity
Decrease stiffness and improve flexibility	➢ Active range of motion ➢ Stretching exercises within pain free range ➢ Joint mobilization
Improve strength and endurance	➢ Isotonic exercises within pain free range ➢ Begin progressive resistance exercises when isometric program is well established and patient is pain free. ➢ Closed chain exercises ➢ Postural stabilization exercises
Joint protection education	➢ Use of adaptive equipment ➢ Modification of tasks to decrease joint stress
Improve balance	➢ Retraining in balance and proprioception
Teach energy Conservation techniques	➢ Teach use of adaptive equipment ➢ Teach modification of activities ➢ Rest periods during the day
Improve functional status	➢ ADL training in grooming, transfers, dressing, bathing, toileting ➢ IADL training ➢ Gait training ➢ Stair mobility ➢ Measure function improvement using the FIM scale
Self-management	➢ Teach application of heat before stretching and range of motion exercises ➢ Teach home exercise program of range of motion and strengthening ➢ Encourage daily aerobic conditioning

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Cold packs
- Theraband for therapeutic exercises
- Heating pads
- Splints

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening
- Cold packs, if needed, to relieve discomfort
- Heating pad, if needed, to relieve discomfort
- Patient education in joint protection and splinting

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Surgery
- Medication

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Neurological Rehabilitation

Acquired Brain Injury	**60**
Complex Regional Pain Syndrome (CRPS) or Reflex Sympathetic Dystrophy (RSD)	**76**
Neurologic Impairment	**85**
Parkinson's disease	**95**
Spinal Cord Injury	**106**

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Acquired Brain Injury

Diagnoses Included:

- Stroke
- Cerebrovascular Accident
- Head injury
- Brain injury

Definition

Acquired brain injury refers to any damage to the brain that occurs after birth. There are two types of brain injury traumatic and non-traumatic. A traumatic brain injury can be classified as an open or closed injury. A closed injury is caused when the brain is bounced around in the skull due to a blow to the head or severe shaking such as in a road traffic accident. A closed motion can cause tearing, shearing or stretching of the brain tissue. These types of injury are much more common than open head injuries. An open injury occurs when an object such as a bullet, fractures the skull and enters the brain. These injuries usually damage relatively localized areas of the brain resulting in specific damage. A non-traumatic injury is an injury that does not occur as a result of trauma. This includes stroke, tumors, infectious diseases, lack of oxygen or toxicity.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Trauma	Active hemorrhage, fracture
Fever, severe pain	Possible infection, intracranial pressure
Progression of symptoms	Evolving CVA
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Transient neurological signs	TIA, may need medical management; multiple sclerosis
Exertional symptoms, history of cardiac disease	Syncopal episodes of cardiac origin possible
Abnormal, or sudden changes in blood pressure	Medication management
Diminished level of consciousness	Metabolic abnormalities (e.g., hypernatremia, hyperglycemia, severe hypothyroidism)

Differential Diagnoses

- Seizures
- Migraines
- Tumors
- Toxic Metabolic Disturbances
- Hypoglycemia
- Transient global Amnesia
- Carbon Monoxide Poisoning

(Stroke differential diagnosis and mimics by Kamalin MD et al Applied Rad 2015)

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Stroke Impact Scale(long form) or SIS-16 (short form)
  - Berg Balance Scale score less than 45/56(Doggan et al, 2001; Hemiparetic Stroke)
  - Fugl-Meyer Assessment- FMA full or shortened version.
  - Must demonstrate active engagement in therapeutic activities.
- Treatment frequency and duration must be based on:
  - Severity of objective findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition and (time since injury)
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Stroke Impact Scale. (Strength 9.2, ADL/IADL 5.9, Mobility 4.5 or Hand Function 17.8-Lin et al. 2010) or total change in score of 10 points on short form.
  - Minimum Detectable Change in Berg Balance Scale (5 points) (Hiengkaew V. et al. 2012)
  - Minimally Detectable Change in Fugl-Meyer Assessment-Motor Scores of 10 points has been met. (Page SJ et al. 2012)
  - Patient continues:to demonstrate active engagement in therapeutic activities
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Referral Guidelines

- Recommend that if depression and motor, sensory, cognitive, communication, and swallowing deficits are found or become worse, all patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team.
- Mental changes
- Incontinence
- Low initial ADL scores
- Delay in initiating rehabilitation following onset

Subjective Findings

- Recurrent transient weakness
- Swallowing Dysfunction
- Speech Deficits
- Vertigo or Visual Disturbances
- Memory loss or confusion
- Sensory and motor symptoms can be unilateral or bilateral
- Headaches
- Fatigue
- Anxiety and or Depression
- Agitation
- Incontinence
- Decreased judgment or inhibition

Specific Examination Considerations

- The physical and occupational therapy examination begins with a method to measure the loss of body function or structure. Some are global scales, like the Stroke Impact Scale (Duncan et. al 2003), National Institute of Health Stroke Scale (Adam, HP. Et al 1999) and FIM (Functional Independence Measure) or modality specific scales like the Fugl-Meyer or Barthel Index.
- Balance and Gait testing should be completed using a standardized balance test supported by research. Examples are: Berg Balance Test (LaPorta,F. et.al. 2012), Tinneti, or Timed Up and Go (Lin, M.R et al.(2004)).
- Activities of Daily Living (ADL) and Independent Activities of Daily Living (IADL) deficits should be evaluated using standardized testing supported by research. Examples are: Fugl-Meyer, Functional Independence Measure (FIM) is

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recommended by American Heart Association and National Institute of Health (NIH), as well as the Barthel Index

- Sensory Impairment should be assessed which include touch, vision and hearing. Depending on what aspect of sensation you are testing there are multiple standardized tests to choose from. Many of the prior modality specific tests include portions that test sensory. Visual perceptual testing can be completed with: Clock Drawing Test and Behavioral Inattention Test.
- Tone and spasticity should be measured as it is indicative of an increase in severity of stroke. (Winstein et al 2016). The Modified Ashworth scale or Modified Tardieu Scale can be used to collect information.
- Cognition should be evaluated briefly and proper referrals made. These impairments persist in many individuals for years and are associated with poor long-term survival and higher disability (Patel MD et al. 2002). Outcome tools include Neurobehavioral Cognitive Status Examination (Mysiw WJ, et al.1989) and the Mini Mental State Exam.

Management/Intervention

1. General Activity Advice and Education

High level of evidence:

- Most improvement is noted in the first 3 to 6 months post-brain injury with the greatest progress seen in the first 6 weeks (Jergensen et.al 1995, Duncan P. et al. 1999). Clinicians are encouraged to educate patients/clients early on the importance of regular exercise to improve cardiorespiratory fitness which will prevent further deconditioning, reduced socialization and heightened risk of further vascular events, including a second stroke.(Shephard RJ 2009, and Hartman-Maeir A., et al 2007, Duncan P, et al 2003, Brazzelli M, et al 2011, Pang MYC, et al 2006.).

2. Activity-Specific and functional task practice

High level of evidence:

- Functional tasks should be practiced repeatedly with task specific training and graded to challenge an individual –use of circuit training is well supported (Winstein et al, 2016, English C,et al 2010, Van de Port IGL, et al 2012)
- Activity-specific training is recommended with all therapy interventions: transfers, balance, gait and ADL's and IADL's. (Bayona NA, et al 2005, Hubbard IJ, et al. 2009, Blennerhassett, J et al. 2004 Arya KN, et al. 2012,)
- Task oriented exercises are preferable in acute rehabilitation in comparison to traditional approaches (Neurodevelopmental Theory (NDT), Bobath, Brunnstrum, Neuromuscular Facilitation (PNF)) (Langhammer B. et al. 2011, Chan et al 2006)

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3. Constraint Induced Therapy or Modified version

High level of evidence:

- Constraint induced movement therapy (CIMT) has been demonstrated to improve upper extremity activity, participation and quality of life in individuals with baseline ability to control wrist and finger extension with usual care. (Wolf et al, 2006, Corbetta et al. 2010, Barreca et al. 2003; Bonaiuti et al. 2007; Hakkennes & Keating 2005; Taub & Morris 2001, Suputtitada A. et al 2004)
- Evidence does not support the original constraint induced therapy over the modified version at this time.
- Results from a systematic review indicate that modified constraint-induced movement therapy (CIMT) is more effective than traditional rehabilitation in reducing a patient's disability level *(Shi YX et al, 2011)*. It can improve upper extremity ability and increase movement spontaneity. Further studies are needed on CIMT's effectiveness in kinematic analysis.

4. Gait Training/Mobility Training

High Level of Evidence:

- Intensive, repetitive, mobility-task training is recommended for all individuals with gait limitations after stroke or neurological injury(Salbach NM, et al 2004, English C,et al 2010, Van de Port IGL, et al 2012)
- Lower limb resistance training in community settings or circuit training demonstrates an increase in gait speed, strength and functional outcomes in chronic neurologically involved patients (6 months post injury) (Mehta S, et al 2012, Pak S, et al 2008)
- Neuromuscular Electrical Stimulation (NMES) or the use of an Ankle Foot Orthosis (AFO) with traditional physical therapy will assist in the improvement of gait capacity (Everaert DG et al. 2013, Ottawa Panal 2006, Kottink et al. 2004; Robbins et al. 2006).
- NMES/electrical stimulation when used in conjunction with task training may improve upper limb motor function and range of motion in sub-acute and chronic stroke/neurological conditions. (Alon G, et al 2007, Chan MK, et al 2009, Faghri PD, et al 1994, 1997, Powell J, et al 1999)
- Treadmill training in the absence of partial body weight support in combination with conventional therapy or delivered alone shows good support for increased velocity, stride length, and lower limb functional mobility. However may not improve balance. (Pohl M, et al 2002, Macko RF, et al 2005, Langhammer B, et al 2011)
- Unweighted Gait Training is more effective at walking non-ambulatory stroke patients early after stroke. Treadmill training with body support and traditional gait training are equally effective in patients dependent on walking assistance(LEAPS trial, Duncan P, et al 2011, Ada I, et al. 2010, Hoyer E. et al,2012)

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- Strong evidence supporting the use of robotic assisted devices with upper extremity functional recovery. May not effect general strength.(Mehrholz J, et al 2012, Lo A, et al 2010)
- Strong evidence does not support the use of robotic assisted devices with gait training in stroke.(Morone G, et al 2011, Marone G et al 2012, Mehrholz J, et al 2007, Pohl M, et al 2007, Duncan P et al, 2011, Stein J,et al 2014)

Moderate Level of Evidence:

- Conflicting studies regarding benefit for aquatic therapy in the treatment of gait and balance related activities.(Mehrholz J.et al.,2011, Nohr, et al.2008, Jungseo Park, et al 2011)

Insufficient Level of Evidence:

- Biofeedback and virtual therapy (Moreira MC et al. 2013, Woodford and Price 2007, Moreland et al. (1994, 1998))
- Acupuncture as an adjunct to traditional therapy (Shiflett SC. 2007,Cao et al. 2012, Sze et al. 2002)

5. Hemiplegic Shoulder Treatment

High Level of Evidence:

- Prevention with positioning techniques and avoidance of incorrect movement pattern that results in capsular tightness and lateral rotation of the scapula (Niessen MA, et al 2009, Paci M et al 2007)
- Use of sensorimotor training, motor learning training engaging the client in repetitive tasks can be effective in reducing motor impairment (with adjunct use of electrical stimulation, imagery or biofeedback) (Barecca S, et al. 2001, Kwakkel G, et al 1999, AOTA Evidence Based Practice, Barreca et al. 2003; Feys et al. 1998; Jongbloed et al. 1989; Volpe et al. 2000; Volpe et al. 1999)

Moderate Level of Evidence:

- Botulinium toxin injections in conjunction with traditional skilled therapy.(Yelnik AP et al. (2007), Marco E, et al. (2007))
- NMES (surface or intramuscular)/ Transcutaneus Electrical Stimulation (TENS)/Functional Electrical Stimulation may be considered for pain as well as for shoulder subluxation (Church, C et al.2006, Suriya-amarit D, et al 2014, Koyunou E, et al 2010)

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Insufficient Level of Evidence:

- Taping or strapping may be beneficial for pain reduction however not for function (Pandian JD. et al. 2013, Barecca S, et al 2001)
- Corticosteroids/Scapular nerve blocks and acupuncture may be beneficial for pain control (Lakse E et al. 2009, Yasar El et al. 2011
- Overhead pulleys are NOT recommended (Fang ZP., 2004, Barecca S, et al 2001)

6. Balance Treatment
High Level of Evidence:

- Balance training exercises individually and in group settings are beneficial in mild and moderate strokes (Lubetzky-Vilnai A. Kartin D. 2010.)
- Strong evidence that trunk-specific balance training may improve balance outcomes (Karatas et. al 2004, Winstein et al 1989, Lubetzky-Vilnai and Kartin 2010, Verheyden G, et al 2009, Saeys et al 2012, Karthikbabu S, et al 2011)

Moderate Level of Evidence:

- Aquatic therapy (insufficient evidence) (Mehrholz J. Kugler J., Pohl M., 2011, Tripp F et al 2014)

Insufficient Level of Evidence:

- Task oriented therapy and strategy training may improve motor performance and actual use of ataxic/apraxia limbs (West C. et al. 2008, Dovern A., et al. 2012, Richards L, et al 2008)

7. Spasticity

High Level of Evidence:

- Botox injections can reduce spasticity significantly (Teasell R,. 2012. Brashear A, et al 2002, Foley N, et al 2013, Picelli et al 2014)
- Oral anti- spasticity medications or intrathecal baclofen (Meythaler JM, et al 2004, Ivanhoe CB, et al 2004)
- NMES may not reduce spasticity in the wrist or elbow (Stein et al. 2005, Lin & Yan 2011, Kim & Lee 2014, De Jong et al. 2013)
- Hand splints and Taping are NOT recommended in the prevention of spasticity (Vasarean A., et al. 2012, Basaran, A. et al 2012, Steultjens et al 2003, Langlois et al 1991, Tyson and Kent 2001)

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8. Treatments for Visual Improvement
Moderate level of evidence:

- Eyes exercises for convergence (Barrett BT. 2009)
- Prism glasses for visual field cuts (Barrett BT.2009, Vangkilde S. , et al 2010)
- Cognitive rehabilitation for visual field loss or neglect (Brown A, et al 2008, Yang NY, et al 2012, Luante J. et al 2006,
- Computer based compensatory therapy and virtual reality training may assist in perceptual impairments(Katz N. et al 2005,

Home and Self-Care Techniques

Home Medical Equipment

- Hot packs/cold packs
- Resistance band(s), Swiss ball, for therapeutic exercises
- Assistive gait device
- AFO
- Shoulder sling
- Wheelchair
- Adaptive equipment for ADLs

Self-Care Techniques

- Education prior to discharge from skilled therapy is absolutely necessary. Fitness trials demonstrate that exercise training in the chronic stages (greater than 6 months after stroke onset) of stroke are effective and necessary to avoid a decline in functional ability. (Morris J. ,et al. 2012, Duncan P, et al 2003, Brazzelli M, et al 2011, Pang MYC, et al 2006)
  - Incorporate principles of adult learning: observation, practice, repetition and relevance
  - Incorporate principles of self-managements: problem solving, goal setting, making choices, taking action and using resources
- Family and caregiver training
- Progression to therapeutic exercise and Periodic monitoring may be necessary strengthening exercises/task oriented

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Community resources-Case Manager
- Referral to Primary Care Physician

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- Professional and support groups
- Speech therapy
- Orthotist
- Neuropsychologist/Cognitive Behavioral Therapy
- Community fitness center or other Fitness Center

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Complex Regional Pain Syndrome (CRPS) or Reflex Sympathetic Dystrophy (RSD)

Synonyms

- Causalgia
- Sudeck's Atrophy
- Post Traumatic Dystrophy
- Shoulder Hand Syndrome
- Reflex Neurovascular Dystrophy

Definition

CRPS has both peripheral and central nervous system components, which pathophysiology is not well understood. Widespread disturbance of central autonomic regulation is thought to be due to vasospasm of small arterioles and capillaries of plasma and fibrin. This regional, post-traumatic, neuropathic pain problem most often affects one or more limbs. Most patients with CRPS have an identifiable inciting or initiating injury that maybe trivial or severe.

Patient History

Patient history may include:

- Various insults that may lead to CRPS include the following:
  - Trauma (e.g., sprain, dislocations, fractures, surgery, burns, crash injury)
  - Neurologic disorders (eg, stroke, tumor, syringomyelia)
  - Herpes zoster infection
  - Myocardial infarction
  - Musculoskeletal disorder (shoulder rotator cuff injury)
  - Malignancy
  - Spontaneous/idiopathic
- The common characteristic features of CRPS are spontaneous pain, hyperalgesia, impairment of motor function, swelling, changes in sweating, and vascular abnormalities in a single extremity. An overt nerve injury is not detectable.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear
Fever, severe pain	Infection
Popliteal fossa pain, sudden onset	Popliteal aneurysm
Diabetes	Neuropathy
Multiple joint involvement, large tophus	Rheumatologic diseases, gout
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of foot or leg	Arterial occlusion
Immune-compromised state	Infection

Presentation

Pain is the first and primary complaint. It typically occurs in one or more extremities, and it is described as severe, constant, burning and/or deep aching pain. All tactile stimulation of the skin may be perceived as painful. Skin may appear shiny, dry or scaly. Hair may initially grow coarse and then thin. Nails in the affected extremity may be more brittle, grow faster and then slower. Pitting or hard edema is usually diffuse and localized to the painful and tender region. Patients have difficulty moving, this decreased mobilization leads to muscle wasting. Initially symptoms are generally localized to the site of injury, as time progresses pain and symptoms become more diffuse.

Subjective Findings

- Intense prolonged pain
- Complaints of warmth or cold in limb
- Allodynia and hyperalgesia
- Abnormal vasomotor activity

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

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Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Inspection
  - Skin color
  - Shiny, dry, scaly skin
  - Brittle nails
  - Pitting or hard edema
  - Localized or diffused symptoms
  - Difficulty initiating movement
  - Muscle atrophy
  - Postural assessment
  - Gait Analysis
- Palpation of bony and soft tissue
  - Pain/tenderness
  - Tactile stimulation of the skin
  - Vasomotor changes
  - Muscle spasm/guarding
- Range of motion, active and passive of the affected joints
- Manual muscle testing
  - Resisted isometric movements of the affected joints
- Orthopedic and neurologic testing if neurologic signs are present
  - Coordination
  - Dexterity
  - Sensation
  - Balance (Tinetti test)
  - Accessory Joint movements
  - Reflexes
- Functional assessment - The following standardized tests may be used to assess functional limitation:
  - Multiple joints affected: Functional Independence Measure (FIM)
  - Upper Extremity affected: Disabilities of the Arm, Shoulder and Hand (DASH)
  - Lower Extremity affected: Lower extremity functional scale (LEFS)

Findings of Complex Regional Pain Syndrome (CRPS)

- Swelling
- Pitting edema
- Tenderness
- Bluish skin color with shiny red discoloration
- Restricted movement
- Osteopenic changes on X-ray

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Differential Diagnosis

- Chronic Pain Syndrome
- Compartment Syndrome
- Diabetic Neuropathy
- Ischemic Monomelic Neuropathy
- Mononeuritis Multiplex
- Neoplastic Brachial Plexopathy
- Neoplastic Lumbosacral Plexopathy
- Postpolio Syndrome
- Radiation-Induced Brachial Plexopathy
- Radiation-Induced Lumbosacral Plexopathy
- Traumatic Brachial Plexopathy

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

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Treatment Methods

- Therapy program goals are to
  - control pain,
  - decrease inflammation and swelling,
  - normalize gait,
  - normalize pain-free range of motion,
  - prevent muscular atrophy, and
  - relieve joint pain so the other objectives may be achieved.
- The therapy program will consist of
  - modalities to minimize inflammation,
  - therapeutic exercises for ROM and strengthening, and
  - instruction in a home program; complete rest and immobilization are harmful.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

The following table lists the procedures for ***Acute Phase*** presentation.

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Expected Outcome	Procedures/Modalities Such As
Decrease pain	• Superficial heat • Ultrasound • Transcutaneous Electrical Nerve Stimulation • Myofascial release • Massage • Contrast Baths
Gradual desensitization of increasing sensory stimuli	• Sensory stimuli-tapping, vibration, rubbing, massage
Facilitate normal tissue length and improve functional positioning	• Splinting /bracing
Instruction in home program	• Complete rest and immobilization is harmful • Use of arm for ADLs • Use of TENS, heat, massage to control edema and pain

The following table lists the procedures for ***Subacute Phase*** presentation.

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

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Expected Outcome	Procedures/Modalities Such As
Edema control	➢ Massage ➢ Elevation
Improve flexibility	➢ Gentle gliding exercises
Improve strength	➢ Steady progression from gentle weight-bearing to progressive active weight-bearing
Correction of postural abnormalities	➢ Postural exercises in sitting/standing
Self-management techniques	➢ Teach home exercise program of gliding exercises and isometric strengthening exercises

The following table lists the procedures for ***Corrective/Rehabilitative Phase*** presentation.

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Improve flexibility	➢ Gentle range of motion exercises
Gradual stress loading of the joint	➢ Balance and proprioception exercises
Improve strength and coordination	➢ Progressive resistance training ➢ Coordination exercises ➢ Dexterity exercises
Postural normalization	➢ Postural retraining exercises in functional positions
Improve balance	➢ Balance and proprioception exercises
Education and self-management	➢ Teach stress-loading program as home exercise program training

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot packs
- Theraband for therapeutic exercises
- Heating pad
- Assistive devices
- Home electrical stimulation unit

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening and desensitization
- Cold packs, if needed, to relieve discomfort
- Heating pad

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Surgery
- Medication
- Sympathetic nerve blocks
- Surgical evaluation for sympathetic blocks, intravenous regional blocks, intrathecal infusion, sympathectomy, amputations
- Evaluation by a psychologist or psychotherapist
- Biofeedback and counseling

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Neurologic Impairment

Diagnoses Included:

- Multiple Sclerosis
- Guillain-Barre Syndrome
- Myasthenia Gravis
- Progressive Muscular Atrophy (Amyotrophic Lateral Sclerosis, Primary Lateral Sclerosis, Cerebral Palsy etc.)
- Cognitive Impairments: Dementia, Alzheimer's

Definition

Neurologic impairments encompass a wide variety of diagnoses. The common issues that may be seen are generalized weakness, ataxia which shows awkward and uncoordinated movements with functional mobility and gait, loss of strength, loss of balance and coordination, and episodes of exacerbation (relapse or attack) with increased skilled need.

Patient History

- General Demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Trauma	Active hemorrhage, fracture
Fever, severe pain	Possible infection, intracranial pressure
Progression of symptoms	Evolving CVA
Immune-compromised state	Infection
New unilateral weakness; speech abnormalities	Cerebrovascular accident
Marked extremity asymmetry; redness, point tenderness, swelling	Deep vein thrombosis
Diminished level of consciousness	Intracerebral hemorrhage; hydrocephalus; intracerebral tumor; metabolic abnormalities (e.g., hyponatremia, hyperglycemia, severe hypothyrodism)
Bowel or bladder incontinence	Spinal cord involvement

Differential Diagnosis

- Spinal Cord neoplasms
- Sarcoidosis
- Infarction of the Spinal Cord
- B-12 Deficiency
- Small-Vessel Ischemic Disease
- Infectious Disease (Lyme Disease, HIV)
- Conversion Disorder

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Lower Extremity Functional Scale (LEFS) with a score of 64 or less
  - Timed Up and Go score (A score greater than 14 seconds) (MS EDGE task force, Shumway-Cook, A et al 2000)
  - Box of Blocks Test (Mathiowetz, V et al 1985) or 9 hole peg Test
  - Fatigue Severity Scale (FSS) (Valko PO, et al 2008)
  - Must demonstrate active engagement in therapeutic activities
- Treatment frequency and duration must be based on:
  - Expectation for functional improvement
  - Severity of objective findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition and (time since injury)
  - Expectation for functional improvement with skilled intervention,

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- Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinically Important Difference has been met on the LEFS (9 points)
  - Minimally Detectable Change has been made on the TUG(3.5 with cognitive deficits and 10.6 seconds with neurological deficits)(Huang SL, et al 2011, Learmonth YC, et al 2012)
  - Minimal Detectable Change has been made on the Box of Blocks Test(5.5 blocks or 20% change in 9 hole peg)(Grice KO, et al 2003)
  - Minimal Detectable Change in Fatigue Severity Score (1.9 points) (Learmonth et al 2013).
  - Patient and or caregivers continues to demonstrate active engagement in therapeutic activities
  - The patient is unable to maintain progress independently.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Referral Guidelines

Recommend that if depression and motor, sensory, cognitive, communication, and swallowing deficits are found, all patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team.

Subjective Findings

- Pain on weight-bearing
- Weakness
- Limitation in joint motion
- Muscle Spasms
- Vertigo, visual disturbances, and confusion are common
- Sensory and motor symptoms can be unilateral or bilateral
- Ataxia
- Fatigue Issues
- Memory Loss
- Anxiety and/or
- Depression

Objective Findings

The physical/occupational therapy evaluation can include a broad overview, however it is important to prioritize time spent and focus on the patient's primary issues first.

- Posture, Trunk Control, Balance, Transfers
- Ambulation/Mobility
- Range of Motion-active and passive
- Motor Function-lower and upper extremities
- Neurologic Function
- Respiratory Function
- Wheeled Mobility
- Fatigue Level
- Medical Equipment Issues/needs

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Specific Examination Considerations

- Balance and Gait testing should be completed using a standardized balance test supported by research. Examples are: Berg Balance Test (LaPorta,F. et.al. 2012) , Tinneti, Timed 25-foot walk, or Timed Up and Go (Lin, M.R et al, 2004).
- Fatigue should be assessed using a developed scale as fatigue limits functional independence. Fatigue is one of the most common and debilitating symptoms experienced by Multiple Sclerosis (MS) patients and associated with worsening of condition. (examples: Fatigue Scale of Motor and Cognitive Functions) (Krupp et al. 1989, Pilutti, L et al 2013)
- Tone and spasticity should be measured as it is indicative of an increase in functional limitations (Rizzo, MA, et al 2004). The Modified Ashworth scale or Modified Tardieu Scale can be used to collect information.
- Measure of upper extremity function is beneficial to determine the level of functional impact on disability from progressive neurological diseases like Multiple Sclerosis. The 9-hole peg test or Box of Blocks can be used to test manual dexterity. (Yozbatiran N, et al. 2006, Mathiowetz V, et al. 1985, Heller A, et al. 1987, Sunderland A, et al. 1989)
- Measures of cognitive function should be evaluated when signs/symptoms are present (decreased cognitive processing speed, difficulties with memory and executive function). Cognitive impairment is seen commonly in Multiple Sclerosis patients, as well as Alzheimer's and Dementia patients. SDMT (Symbol Digit Modalities Test) is a brief test that can be used monthly with excellent reliability to monitor cognitive function.(Smith A, et al 1982.) The MACFIMS (Minimal Assessment of Cognitive Function in Multiple Sclerosis)has been shown as a reliable tool used with Multiple Sclerosis patients. (Benedict R., et al 2006)
- Periodic assessment for the need of adaptive equipment and durable medical equipment needs is necessary. Many of the neurologic impairments are progressive and will need episodic/periodic monitoring to assist in maintaining the highest level of functional mobility and safety possible.

Physical/Occupational Therapy Management

Management/Intervention

1. General Activity Advice and Education

High level of evidence:
Clinicians are encouraged to educate patients/clients early on the importance of regular exercise to improve cardiorespiratory fitness, flexibility and strengthening which will prevent further deconditioning, reduced socialization and heightened risk of obesity. There are restrictions that need to be monitored; such as frequency, severity, duration, intensity, precautions, and progression.(Refffin, J et al. 2014, Paganoni, S et al 2015)

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- Exercise is supported with neurological conditions/progressive and non-progressive, where prior thoughts opposed due to exertion or fatigue.(Karpatkin, H 2017, Bello-Haas VD, et al. 2007, Hanna, M. et al. 2016. Refffin, J et al. 2014)
- Research supports moderate aerobic exercise for 30 minutes as least 2 days a week and large muscle strengthening 2 days a week. (Latimer-Cheung AE, et al 2013)
- Resistance exercise as well as task oriented circuit training is beneficial in improving function and quality of life. (Bello-Hass, VD, et al 2008, Straudi, S, et al. 2014, White, IJ et al 2004)
- Treadmill training, aerobic training is strongly recommended for increased gait tolerance, fatigue management and independence. Maintaining a program is important. (Newman, MA et al. 2007, Benedetti, MG et al. 2009, Van den Berg,M et al. 2006, Beer et al., 2012; Motl and Pilutti, 2012, Niwald, M et al 2017)

2. Aquatic Therapy
High level of evidence:

- Aquatic therapy is highly recommended for MS patients and others with neurological impairments showing benefits in physical, mental and social status. (Di Fabio et al 1997, Kirsch et al 2000, Roehrs, TG 2004, Rafeeyan, Z et al 2010)

3. Balance Training with Neurological Impairment
High Level of Evidence:

- Balance training exercises individually and in group settings are beneficial (Lubetzky-Vilnai A. Kartin D. 2010.)

Moderate Level of Evidence:

- Core strengthening programs assist with improved balance and decrease postural sway. (Yoosefinejad, AK et al 2014 (case study) Majmudar S,et al 2014)

4. Fatigue Monitoring and Management:
High Level of Evidence:

- Exercise training can reduce feelings of fatigue. (Pilutti, L et al 2013, Motl RW, et al 2007
- Submaximal fitness testing can predict exercise capacity-using grip test, 6- Minute Walk Test and step test(mCAFT). Patients can monitor exercise programs. (Kuspinar A, et al 2010)
- Pedometers are also recommended to monitor gait/exercise endurance with fitness/maintenance home program. (Busse ME, et al 2003, Busse ME, et al 2004)

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5. Spasticity

High Level of Evidence:

- Botox injections can reduce spasticity significantly (Teasell R,. 2012. Brashear A, et al 2002, Foley N, et al 2013, Picelli et al 2014)
- Oral anti- spasticity medications or intrathecal baclofen (Meythaler JM, et al 2004, Ivanhoe CB, et al 2004)
- Hand splints and Taping are NOT recommended in the prevention of spasticity (Vasarean A., et al. 2012, Basaran, A. et al 2012, Steultjens et al 2003, Langlois et al 1991, Tyson and Kent 2001)

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his/her residence.

Home Medical Equipment

- Hot packs/cold packs
- Resistance band(s), Swiss ball, for therapeutic exercises
- Assistive gait device
- Ankle Foot Orthosis
- Wheelchair
- Adaptive equipment for Activities of Daily Living
- Pulse Oximetry/Heart rate monitor/Pedometer

Self-Care Techniques

- Family and caregiver training
- Home ROM/maintenance exercises
- Progression to therapeutic exercise—strengthening exercises
- Gym/Fitness center (if available)-to maintain aerobic/cardiopulmonary status

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Community resources
- Referral to Primary Care Physician
- Professional and support groups
- Orthotist

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Parkinson's Disease

Diagnoses Included:

- Parkinson's disease
- Parkinson's syndrome
- Parkinson's Gaitanis
- Parkinson's
- Shaking Palsy

Definition

Parkinson's disease: A chronic, slowly progressive neurological disease usually occurring later in life that is characterized by a fixed inexpressive face, tremor of resting muscles of limbs and head, slowing of voluntary movements, stiffness of limbs and trunk, festinating gait with short, shuffling, accelerating steps, instability, muscle weakness, balance/coordination impairments, and slower, quieter, monotone speech. The cause is due to degeneration of the basal ganglia, and by low production of the neurotransmitter dopamine.

Patient Data

Parkinson's is the second most common neurodegenerative disorder after Alzheimer's and the most common movement disorder. The majority of individuals who develop Parkinson's are 60 years or older (adult onset) but early-onset Parkinson's (onset between 21 – 40 years of age) and juvenile-onset (under 21 years of age) also exist. Men are affected 1.5 – 2 times more often than women. Risk factors may include head trauma, illness, or exposure to environmental toxins such pesticides and herbicides. A small number of individuals are at an increased risk due to family history. Parkinson's follows a broad pattern of progression. Changes tend to come on slowly with symptoms worsening over time and new symptoms appearing.

Condition Severity Classifications

There are five stages of Parkinson Disease.

- **Stage 1: Mild.** There may be symptoms, but they are not severe enough to interfere with daily tasks or life style. The symptoms may be so mild they might be missed, but family and friends may notice changes in posture, walking, or facial expressions. A distinct symptom of this stage is that tremors and other difficulties in movement are generally exclusive to one side of the body.
- **Stage 2: Moderate.** Symptoms are much more noticeable than those in stage 1. Stiffness, tremors, and trembling may be more noticeable, and changes in facial expressions can occur. This stage does not impair balance. Task completion may be slower, difficulties walking may develop or increase and posture may change. At this stage, symptoms will be felt on both sides of the body (one side may have stronger symptom), speech difficulties may develop. The majority of people at this stage is

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still able to live alone, but may find tasks and activities they are no longer able to complete.

- Progression from stage 1 to stage 2 is unpredictable and can take months to years.
- **Stage 3: Middle.** This stage is indicates a significant progression in the disease. Many of the same symptoms of stage 2 are present, but reflexes are decreased and balance impairments are likely present. Walking is impaired, but still possible without assistance. Falls are more common in this stage and movements are slower. Daily tasks are affected but may still be able to be completed. (Medication and OT may help with symptom management).
- **Stage 4: Severe / Loss of Independence.** At this stage, movements may require assistance or an assistive device. The majority of people are unable to live alone due to impaired reaction times and loss of movement.
- **Stage 5: Advanced.** At this stage, 24 hour per day care and wheelchairs will be needed for mobility. The majorities are unable to stand or walk due to advanced rigidity and freezing and are at a high risk of falling.
- **Stages 4 and 5:** Dementia is present in 75 percent of those diagnosed with Parkinson's. Thirty percent at these stages may experience confusion, hallucinations, and delusions.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions and co-morbidities
- Prior functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Trauma	Active hemorrhage, fracture
Fever, severe pain	Possible infection, intracranial pressure
Postural hypotension	falls
Immune-compromised state	Infection
Excessive salivation/Swallowing changes	Aspiration pneumonia
Incontinence without awareness	Infections
Constipation	Decreased mobility, Dietary modification, Medication management
Osteoporosis	Fractures
Dementia	falls

Differential Diagnosis

- Cognitive: Alzheimer's, Dementia with Lewy Bodies, Vascular Dementia
- Disorders of the Central Nervous system: Multiple Sclerosis, Amyotrophic Lateral Sclerosis, Progressive Bulbar Palsy, Progressive muscular Atrophy, Primary Lateral Sclerosis, Cerebral Palsy, Huntington Disease
- Stroke
- Essential Tremor
- Normal Pressure Hydrocephalus
- Multiple System Atrophy
- Tumors
- Toxic Metabolic Disturbances

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Timed up and Go Score of greater than 14 sec
  - Berg Balance Score Less than 45/56 or
  - Tinetti score of less than 20(Soyuer et al, 2007)
  - Functional Reach Score less than between 6-10inches is indicative of the need of skilled therapy. (Duncan, P, et al 1990)
  - 9 hole peg test - must be two SD below the norm for patients age (See Table 1 and Table 2)

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Table 1. Average and Standard Deviation of MALE Participants' Scores (314 total)

Age	*N*	*M*-right (seconds)	*M*-left (seconds)	*SD*-right	*SD*-left
21–25	41	16.41	17.53	1.65	1.73
26–30	32	16.88	17.84	1.89	2.22
31–35	31	17.54	18.47	2.70	2.94
36–40	32	17.71	18.62	2.12	2.30
41–45	30	18.54	18.49	2.88	2.42
46–50	30	18.35	19.57	2.47	2.69
51–55	25	18.93	19.84	2.37	3.10
56–60	25	20.90	21.64	4.55	3.39
61–65	24	20.87	21.60	3.50	2.98
66–70	14	21.23	22.29	3.29	3.71
71+	25	25.79	25.95	5.60	4.54
All Male Subjects	314	18.99	19.79	3.91	3.66

Table 2. Average and Standard Deviation of FEMALE Participants' Scores (389 total)

Age	*N*	AVG-right (seconds)	AVG-left (seconds)	STDEV-right	STDEV-left
21–25	43	16.04	17.21	1.82	1.55
26–30	33	15.90	16.97	1.91	1.77
31–35	32	16.69	17.47	1.70	2.13
36–40	35	16.74	18.16	1.95	2.08
41–45	37	16.54	17.64	2.14	2.06
46–50	45	17.36	17.96	2.01	2.30
51–55	42	17.38	18.92	1.88	2.29
56–60	31	17.86	19.48	2.39	3.26
61–65	29	18.99	20.33	2.18	2.76
66–70	31	19.90	21.44	3.15	3.97
71+	31	22.49	24.11	6.02	5.66
All Female Subjects	389	17.67	18.91	3.17	3.44

Average Charts from: Grice, KO, et al 2017.

- Treatment frequency and duration must be based on:
  - Severity of objective findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition and (time since diagnosis)
  - Expectation for functional improvement with skilled intervention
  - Response to treatment provided

- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met: [Shirley Ryan Abilitylab-rehabilitation tests and measures]
  - Minimal Detectable Change in Timed Up and Go (TUG) (4.85 seconds) (Shirley Ryan Abilitylab.org.
  - Minimum Detectable Change in Berg (4 to 5 points)

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- Minimum Detectable Change Tinetti Score. (6 points)
- Minimally Detected change in Functional Reach. (Forward functional reach: 9 cm; Backward reach: 5cm)
- Minimum Detectable Change 9 Hole Peg Test (dominant hand: 2.6 sec; non-dominant hand: 0.82 sec)
- The patient is unable to maintain progress independently

Referral Guidelines

- Recommend that if depression and motor, sensory, cognitive, communication, and swallowing deficits are found or become worse, all patients should be formally assessed by the appropriate clinician from the coordinated rehabilitation team.
- Mental changes
- Incontinence
- Low initial ADL scores
- Delay in initiating rehabilitation following onset

Subjective Findings

- Pain
- Shaking / Tremors
- Limitation in joint motion / Stiffness
- Muscle Spasms
- Progressive weakness
- Swallowing Dysfunction
- Speech Deficits
- Memory loss or confusion
- Sensory and motor symptoms can be unilateral initially and progress to bilateral
- Fatigue
- Anxiety and/or Depression
- Incontinence / constipation

Objective Findings

The physical/occupational therapy evaluation can include a broad overview, however it is important to prioritize time spent and focus on the patient's primary issues first.

- Posture, Trunk Control, Balance, Transfers
- Ambulation/Mobility
- Range of Motion-active and passive
- Motor Function-lower and upper extremities

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- Neurologic Function
- Respiratory Function
- Fatigue Level
- Medical Equipment Issues/needs

Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Balance and Gait testing should be completed using a standardized balance test supported by research. Examples are: Berg Balance Test (LaPorta, F. et.al. 2012), Tinneti, Timed 25-foot walk, or Timed Up and Go (Lin, M.R et al. (2004)).
- Measure of upper extremity function is beneficial to determine the level of functional impact on disability from progressive neurological diseases like Parkinson disease. The 9-hole peg test can be used to test manual dexterity. (Yozbatiran N, et al. 2006, Mathiowetz V, et al. 1985, Heller A, et al. 1987, Sunderland A, et al. 1989)
- Measures of cognitive function should be evaluated when signs/symptoms are present (decreased cognitive processing speed, difficulties with memory and executive function). Cognitive impairment is seen commonly in Parkinson disease patients, as well as Alzheimer's and Dementia patients. SDMT (Symbol Digit Modalities Test) is a brief test that can be used monthly with excellent reliability to monitor cognitive function. (Smith A, et al 1982.)
- Periodic assessment for the need of adaptive equipment and durable medical equipment needs is necessary. Many of the neurologic impairments are progressive and will need episodic/periodic monitoring to assist in maintaining the highest level of functional mobility and safety possible.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.

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- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Management/Intervention

1. General Activity Advice and Education

High Level of Evidence:

- Resistive Exercise is supported for Parkinson's: (Effectiveness of resistance training and physical function in people with Parkinson's disease: a systematic review and meta-analysis. (Chung, CL et al, 2016.)

2. Balance Training with Neurological Impairment

High Level of Evidence:

- Balance and Motor Function are supported for Parkinson's Stages 1, 2, and 3 by Tai Chi and Qigong: The Efficacy of traditional Chinese Medical Exercise for Parkinson's. (Yang, Y, et al. 2015)
- Balance and Gait are supported with Parkinson's BIG/ LSVT program of specific high intensity exercises. (Farley, B et al 2005, Ebersbach, G, et al 2010, Ebersbach G, et al 2014,Millage B, et al 2016, Fox, C et al. 2012)
- Exercises and motor training with balance related activities increase balance in Parkinson's patients. Further research is needed to determine if fall risk is benefited.(Allen NE et al 2011, Shen X et al. 2016))

Moderate Level of Evidence:

- Community exercise class has been shown to increase quality of life for neurological conditions. (Ploughman M, et al 2014, States RA, et al 2011)
- Dexterity and exercise are supported for Parkinson's: Effects of Single Hand-Exercise on Manual Dexterity and Strength in person's with Parkinson's: (Matteos-Toset S et al. 2016)

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3. Use of External Cues

High Level of Evidence:

- Breaking activities down into one step (task –specific training) and using visual, auditory, or proprioceptive external cues assists in maintaining movement in Parkinson's patients. (Morris M. 2000, El-Tamawy, MS. et al. 2012, Rochester L, et al 2010)

Moderate Level of Evidence:

- The use of music has been effective with helping with gait in Parkinson's patients.(De Bruin N, et al. 2010, Paccetti, C et al. 2000, Hackney ME, et al. 2007, Dalla Bella D et al. 2015)

4. Aquatic Therapy

Moderate level of Evidence:

- Water based therapy can increase balance and forward lean in patients with Parkinson's disease. (Volpe D et. al 2016, Volpe D. et al. 2014)

Home and Self-Care Techniques

Home Medical Equipment

- Assistive gait device
- Wheelchair
- Adaptive equipment for ADLs

Self-Care Techniques

Education prior to discharge from skilled therapy is absolutely necessary.

- Incorporate principles of adult learning: observation, practice, repetition and relevance
- Incorporate principles of self-managements: problem solving, goal setting, making choices, taking action and using resources
- Family and caregiver training
- Progression to therapeutic exercise and Periodic monitoring may be necessary—strengthening exercises/task oriented

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Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Community resources-Case Manager
- Referral to Primary Care Physician
- Professional and support groups
- Speech therapy
- Community fitness center or other Fitness Center

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Spinal Cord Injury

Synonyms

- Tetraplegia
- Paraplegia

Definition

Spinal cord injury (SCI) is an insult to the spinal cord resulting in a change, either temporary or permanent, in its normal motor, sensory, or autonomic function. The International Standards for Neurological and Functional Classification of Spinal Cord Injury is a widely accepted system describing the level and extent of injury based on a systematic motor and sensory examination of neurologic function. The following terminology has developed around the classification of SCI:

- Tetraplegia (replaces the term quadriplegia) - Injury to the spinal cord in the cervical region, with associated loss of muscle strength in all 4 extremities
- Paraplegia - Injury in the spinal cord in the thoracic, lumbar, or sacral segments, including the cauda equina and conus medullaris

Patient History

- SCI can be sustained through different mechanisms, with the following 3 common abnormalities leading to tissue damage:
  - Destruction from direct trauma
  - Compression by bone fragments, hematoma, or spinal disk material
  - Ischemia from damage or impingement on the spinal arteries
- The most common causes of SCI since 2010 include the following:
  - Motor vehicle accidents (38%) - These are the major cause of traumatic SCI in the United States.
  - Falls (30%) - These are most common in persons at or above age 45 years. Older females with osteoporosis have a propensity for vertebral fractures from falls with associated spinal cord injury.
  - Violence (14%) - This is the most common cause of SCI in some urban settings in the United States, although a trend toward a slight decrease in violence-related SCI has been found. One study showed that among patients who had suffered an assault, SCI from a penetrating injury tended to be worse than that from a blunt injury.
  - Sports injuries (9%) - Such injuries are responsible for many cases of SCI. The sport that most commonly leads to SCI is diving.
  - Other causes of SCI include the following:
  - Vascular disorders
    - Tumors
    - Infectious conditions
    - Spondylosis
    - Iatrogenic injuries, especially after spinal injections and epidural catheter placement

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- Vertebral fractures secondary to osteoporosis
- Developmental disorders

Injuries by American Spinal Injury Association (ASIA) classification

- Incomplete tetraplegia - 45%
- Complete paraplegia - 20%
- Incomplete paraplegia - 21%
- Complete tetraplegia - 14%
- The most common neurologic level of injury in tetraplegia is C5. In paraplegia, T12 is the most common level.
- The ASIA Impairment Scale classifies the completeness of SCI on a scale from A-E, as follows :
  - A - Complete; no sacral motor or sensory sensation in segments S4-5
  - B - Sensory incomplete; preservation of sensation below the level of injury, extending through sacral segments S4-5
  - C - Motor incomplete; voluntary anal sphincter contraction or sensory sacral sparing, with sparing of motor function distal to 3 levels below the motor level of injury and with the majority of key muscles having a strength grade of less than 3
  - D - Motor incomplete; voluntary anal sphincter contraction or sensory sacral sparing, with sparing of motor function distal to 3 levels below the motor level of injury and with the majority of key muscles having a strength grade of 3 or greater
  - E - Normal; normal motor and sensory recovery (hyper-reflexia may be present)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event

Red flags may include:

- Severe orthostatic hypotension
- Cardiovascular changes
- Respiratory changes
- Autonomic Dysreflexia
- Infected decubiti
- Depression with suicidal ideation

Objective Findings

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Comprehensive and detailed neurologic examinations that are performed early and are repeated often form an important component of patient assessment and of neurologic and functional outcome prediction. Key elements of the examination include motor and sensory testing, which allows for the designation of a neurologic level of injury (NLOI) and of the completeness of injury. In addition, rectal examination is required to assess motor and sensory functions.

Neurologic level of injury

The NLOI is defined as the most caudal (i.e., lowest) level of the spinal cord that has normal motor and sensory function. The motor level, which is a better predictor of the patient's functional abilities, is determined by the manual testing of key muscle groups on both sides of the body. These groups represent neurologic levels, and findings are graded 0-5 (with 0 being absent strength and 5 being normal strength).

Sensory scoring is for light touch and pinprick, graded as follows:

- 0 - Absent
- 1 - Impaired or hyperesthesia
- 2 - Intact

Functional Outcome Measures

Several functional outcome measures are reliable and valid for use in SCI. Outcome measures need to be standardized and validated so that clinicians know how to perform them, are clear on their measuring characteristics, and are capable of providing information about clinically meaningful outcome changes. At least one of the following is needed to provide medical necessity at initial evaluation and reassessments.

Additional functional assessment scales are as follows:

- Spinal Cord Independence Measure (SCIM) - Designed as an alternative to the Functional Independence Measure (FIM) to assess 16 categories of self-care, mobility, and respiratory and sphincteric function. The SCIM III is more sensitive to changes than the FIM. Total SCIM Minimally Clinically Important Difference (MCID) values varied from 12 for patients with complete tetraplegia to 45.3 for those with incomplete thoracic lesions. The MCID of Self Care varied from 3.3 to 8.5 and from 10 to 18 for Respiration and Sphincter Management, depending on the level and severity of the lesion. With regard to Mobility (room and toilet), the MCID varied from 1 to 3 and from 2.5 to 7.26 for Mobility (indoors and outdoors). (Corallo et al., 2017) A total score of less than 67/100 would indicate a possible need for ongoing skilled intervention.
- Timed Up and Go Test (TUG) score- Measures time it takes for patient to get up and walk 3 meters turn around and walk back. Anything greater than 14 seconds could establish skilled therapy need. Smallest real difference (SRD) 10.8 seconds. (T Lam et al., 2007).
- Correlates highly with Six-Minute Walk test. May also use Six-Minute Walk Test (6MWT) - Measures the distance a patient can walk on a flat, hard surface in 6

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minutes. Minimally clinically important difference (MCID) for 6MWT 0.13. (Lam et al, 2007) Limited community ambulation speed can be accomplished at 0.44 m/s and independent community ambulation at 0.80 m/s(Forest et al, 2014)

- Capabilities of Upper Extremity Instrument (CUE) - A 32-item measure for assessing upper extremity function with tetraplegia. Minimal detectable change (MDC) 33.8 (Marino et al. 1998). Overall score less than 96/128 may indicate need for skilled intervention.
- Braden Scale - A quick, 6 item test for assessing risk for pressure ulcers that assesses 6 areas: Sensory perception, moisture, activitiy, mobility, nutrition and friction and shear. Scores of 15-18 indicate mild risk, 13-14 moderate risk, 10-12 high risk and 9 or less severe risk for pressure ulcers. A score of less than 15 would indicate need for further skilled intervention. (https://scireproject.com/outcome-measures/outcome-measure-tool/braden-scale/)

Differential Diagnosis

- Aortic Dissection
- Epidural and Subdural Infections
- Hanging Injuries and Strangulation
- Neck Trauma
- Spinal Cord Infections
- Syphilis
- Transverse myelitis
- Acute intervertebral disk herniation
- Extradural spinal cord compression.

Requirements for Physical/Occupational Therapy Visits

- The patient's condition must indicate a potential for rehabilitation.
- LE strength post SCI is a reliable predictor of ambulation potential. (Dipiro et al. 2015)
- Therapy must show measurable functional progress via at least one of the following:
  - SCIM III- less than 67/100 or progress by at least the MCID at reassessment
  - TUG score or 6 MWT- slower than 14 seconds at initial evaluation and progress by at least the SRD for the TUG or the MCID for 6MWT
  - CUE score- less than 96/128 or progress by at least the MDC at reassessment
  - Braden Scale- a score less than 15 on the Braden scale. There is no MDC, MCID or SRD established for this test, need to establish skilled need for pressure ulcer prevention/intervention.
- The patient must not have a significant psychological diagnosis that would hinder his ability to benefit from the program.

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- Comorbidities must not affect the patient's ability to participate and benefit from therapy (e.g., pain must be controlled, etc.). and must not put other patients or staff at risk (e.g., infectious disease)
- The patient must exhibit at least two of the following impairments:
  - Mobility Impairment (including inability to transfer safely, inability to operate a wheelchair, etc.).
  - Activities of Daily Living Impairment (may include bathing, grooming, dressing, feeding, and toileting).
  - Spasticity Control Problems
  - Risk of Decubitus ulcer formation associated with sensory deficit.
  - Perceptual impairment sufficient to limit safety or reasonable function.
- Patient continues to demonstrate active engagement in therapeutic activities as well as caregivers.
- The patient is unable to maintain progress independently.

Treatment Methods

The objectives of rehabilitation after an individual has sustained an acute spinal cord injury (SCI) include maximizing the patient's medical, functional, and psychosocial outcomes, with functional outcomes being tied to the level of the individual's SCI. The majority of recovery occurs in the first 6 months. Providing education to the patient and his/her family is also essential. Rehabilitation should begin as soon as possible after injury in order to optimize outcomes and reduce complications.

Functional outcomes may vary by individual, depending on such factors as the level and completeness of the injury, neurologic recovery (or loss), associated medical complications (pain, spasticity, contractures, cardiac disease, musculoskeletal injury), the amount of rehabilitation training that the patient receives, and the rehabilitation team's level of expertise, as well as the patient's motivation, age, and family and financial resources.

The use of orthotics and assistive devices (some of which are mentioned below) can sometimes facilitate the patient's functional abilities. Advances in surgical reconstruction and functional electrical stimulation (FES) also may enhance the patients' functional abilities.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.

Referral Guidelines

- Refer patient to their primary care provider to explore alternative treatment options when you find:
  - Severe depression
  - Skin breakdown
  - Severe orthostatic hypotension
  - Signs of infection

Appropriate Procedures/Modalities

A spinal cord injury (SCI) at the cervical level results in tetraplegia, the loss of hand and upper limb function with impairment or loss of motor and/or sensory function. In incomplete spinal cord injuries, some neural transmissions can still pass through the spinal cord but it is often fragmentary or distorted which leads to additional neurological complications such as chronic pain or spasticity. Tetraplegia results in impairment of function in the arms as well as in the trunk, legs and pelvic organs. Individuals with tetraplegia rely on the use of their hands and upper limbs in order to complete basic activities of daily living such as self-feeding, dressing, bathing and toileting. Mobility needs such as transfers from surface to surface, transitional movements such as rolling, bridging and sit to lying down, crutch walking and wheeled mobility is also completed by using their arms (Snoek et al. 2004). The level at which the injury or lesion occurs and the completeness of the lesion (incomplete or complete) indicate the level of independence of the person (Ditunno1999).

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The main focus in rehabilitation of the spinal cord injured person is compensation of functional loss and using those parts of the sensorimotor system, which are still intact (van Truijl et al, 2002). Research findings regarding neuroplasticity and neurological recovery of the spinal cord also include current rehabilitation practices that should focus on strategies to restore functional lost after SCI. D. Zbogar, et al 2017, noted that the amount of movement practice that happens in inpatient SCI therapy is low and does not progress with time and higher repetitions may help to improve outcomes further.

Ginis, Scheer and Goosey-Tolfrey, 2017, established updated guidelines for aerobic and strengthening exercise in individuals with SCI. Guidelines state to improve cardiorespiratory fitness and muscle strength, adults with SCI should engage in at least 20 min of moderate to vigorous intensity aerobic exercise 2 times per week, and three sets of strength exercises for each major functioning muscle group, at a moderate-vigorous intensity, 2 times per week. (Ginis, Scheer and Goosey-Tolfrey, 2017) These guidelines can help with establishing home exercise programs and educating patients and caregivers on appropriate exercise levels after discharge.

Upper Extremity Rehabilitation

- There is level 1 evidence based on one retrospective clinical trial that physical capacity continues to improve after 1- year post discharge.
- There is level 2 evidence based on one pre/post study that neuromuscular stimulation-assisted ergometer alone and in conjunction with voluntary arm crank exercise was an effective strengthening intervention for chronically injured individuals.
- There is level 2 evidence based on one study that muscle strength continues to improve up to 15 months post hospital discharge for both tetraplegic and paraplegic individuals.
- There is level 4 evidence based on one study that neuromuscular stimulation-assisted exercise improves muscle strength over conventional therapy.
- There is level 1 evidence (from 2 RCTs) that augmented feedback is not effective in improving upper limb function in tetraplegia.
- The use of neuroprostheses appears to have a positive impact on pinch and grip strength and ADL functions in C5-C6 complete tetraplegia, however, access to the devices are limited and continue to be expensive in use.
- There is level 1 evidence from one RCT that showed that massed practice (repetitive activity) and somatosensory stimulation (median nerve stimulation) demonstrated significant improvement in grip and pinch strength required for functional activity use.
- There is level 2 evidence from one RCT that showed that the use of concomitant auricular and electrical acupuncture therapy may improve the neurological and functional recovery of acutely injured spinal cord individuals.

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- There is level 2 evidence based on one RCT that wearing a thumb opponens splint will improve pinch strength and functional use of the hand.
- There is level 1 evidence based on two RCTs that a shoulder exercise and stretching protocol reduces the intensity of shoulder pain post SCI.
- There is level 2 evidence that general acupuncture is no more effective than Trager therapy in reducing post-SCI upper limb pain.
- There is level 4 evidence from multiple studies that support the use of reconstructive surgery for the tetraplegic upper limb for the improvement of ADL and quality of life.
- There is level 4 evidence from multiple studies that support the use of neuroprostheses for persons with C5-C6 complete tetraplegia in the improvement of pinch and grip strength and ADL functioning. However, many devices are only available in clinical trials in specialized rehabilitation centers and the overall cost of the device continues to be expensive.
- Robot-assisted upper extremity training can improve movement without impacting pain or spasticity in chronic SCI patients. It can also sensitively measure changes after therapy interventions. (Cortes, et al. 2013) (moderate level of evidence)
- Assist-as-needed robotic therapy has potential after incomplete SCI injury but has not yet shown gains in arm function, further research is still needed. (Frullo et al, 2017) (low level of evidence)

Lower Extremity Rehabilitation

High Level of Evidence:

- Patterned Electrical Stimulation (PES) programs are beneficial in preventing and restoring lower limb muscle atrophy as well as improving lower limb muscle strength and endurance.
- Functional Electrical Stimulation (FES)-assisted exercise programs are beneficial in preventing and restoring lower limb muscle atrophy as well as improving lower limb muscle strength and endurance.
- For patients less than 6 months post-SCI, body weight supported treadmill training has equivalent effects on gait outcomes to conventional rehabilitation consisting of over-ground mobility practice. .Body weight-support gait training strategies can improve gait outcomes in chronic, incomplete SCI, but no body weight-support strategy (over-ground, treadmill, with FES) is more effective.
- FES-assisted walking can enable walking or enhance walking speed in incomplete SCI or complete (T4-T11) SCI. Regular use of FES in gait training or activities of daily living can lead to improvement in walking even when the stimulator is not in use.

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- Contracture management should be simple and not require a large amount of time, allowing for sustainability from people with SCI with priority placed on positioning programs for joints most likely to impacted. (Harvey, 2016)
- Partial body weight supported treadmill training performed in a controlled aquatic environment led to significant improvements of moderate to large magnitude in physical function and walking ability. (including speed and endurance) There is the potential for smaller in home portable use and community use of underwater treadmills for SCI and other physical disabilities and diseases. (Stevens, et al., 2015)

Moderate Level of Evidence:

- The most sensible approach to strength training in individuals with SCI injuries may be a combined approach of resistance training and repetitive practice of functional tasks with low loads and high repetitions. There is little evidence that using electrical stimulation alone will increase voluntary strength. (Harvey, 2016)
- Activity-based therapies (ABT) may promote neuromuscular recovery and increased function post-SCI; however, not everyone will benefit. Clinicians need to advise individuals with SCI of the time and effort needed for ABT. (Jones, et al. 2014)
- There is limited evidence that bracing alone does not enable significant gains in functional ambulation for people with complete SCI. The advantages of bracing appear largely restricted to the general health and well-being benefits related to practice of standing and the ability to ambulate short-distances in the home or indoor settings. The benefits of bracing-alone on functional ambulation are primarily with people with incomplete spinal lesions.
- There is limited evidence that a combined approach of bracing and FES results in additional benefit to functional ambulation in paraplegic patients with complete SCI. Locomotor training programs are beneficial in improving lower limb muscle strength although in acute SCI similar strength benefits can be obtained with conventional rehabilitation. The real benefit of locomotor training on muscle strength may be realized when it is combined with conventional therapy. This should be further explored in acute, incomplete SCI where better functional outcomes may be realized with the combination of therapies.

Insufficient Level Evidence:

- Robot-assisted gait training has shown mixed results. Acute SCI patients have shown improvement with walking distance, strength and independence. Chronic SCI patients have shown improvement in speed and balance but no improvement in distance/strength or independent mobility. Also, there are aerobic and cardiovascular benefits to robot-assisted gait training. More research is needed on types of devices. (Nam, et al., 2017)
- Benefits of robot-assisted gait training also include ability to initiate gait training early in dependent patients, less effort for therapists, longer duration and higher intensity of gait and more consistency with gait patterns. (Nam, et al. 2017)

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- There is no data to compare locomotion assistance with exoskeleton versus conventional Knee Ankle Foot Orthotics (KAFOs). There is no consistent benefit from rehabilitation using an exoskeleton versus a variety of conventional methods in chronic SCI patients. (Fisahn et al, 2016)
- The Hybrid Assistive Limb (HAL) exoskeleton did result in increased functional improvements in the 10 Minute Walk Test (10 MWT), 6MWT and Walking Index for Spinal Cord Injury II (WISCII) score when not wearing the exoskeleton in incomplete SCI and complete SCI patients. It is currently a training device not an everyday walking aid. (Grasmucke, et al., 2017)

Home and Self-Care Techniques

The patient/caregiver can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Manual/power wheelchairs
- Orthotics
- Assistive gait device
- Hospital bed and shower chair/drop arm commode
- Hoyer lift
- Standers

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening
- Cold packs, if needed, to relieve discomfort
- Heat packs

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Psychologist
- Social Worker
- Case Manager
- Physician
- Medication

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Orthopedic – Cervical Disc- Radicular

Cervical Radicular Conditions	**118**
Cervical, Post-Surgical Conditions	**135**
Stenosis – Cervical / Thoracic Spine	**148**

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Cervical Radicular Conditions

Synonyms

- Lateral recess entrapment of cervical nerve root
- Cervical radiculopathy
- Pain in upper limb
- Radiating pain in a dermatome
- Disc herniation
- Bulging disc
- Cervical disc herniation
- Herniated nucleus pulposus in cervical spine
- Brachial Neuritis
- Cervical Radiculitis

Definition

Neurogenic pain following the distribution of one, or less commonly, more than one cervical nerve root(s). Pain may be accompanied by upper extremity numbness, weakness, or hyporeflexia, and may be due to cervical disc herniation (younger patients), or foraminal encroachment (older patients).

- Neck pain with radiating pain (radicular)

Patient History

- Patient history may include:
  - General demographics
  - Occupation/employment
  - Hand dominance
  - Living environment
  - History of current condition
  - Functional status and activity level (prior level of function)
  - Medications
  - Other tests and measurements (laboratory and diagnostic tests)
  - Past history (including history of prior therapy and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

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- Adhesive capsulitis of shoulder with referred cervical pain (restricted active and passive shoulder motion)
- Demyelinating conditions (symptoms, intensity and location vary)
- Multiple sclerosis
- Metastatic Ca
- Myelopathy (trunk or leg dysfunction, gait disturbance, bowel or bladder dysfunction, signs of upper motor neuron involvement)
- Myocardial ischemia (refer for evaluation if suspected)
- Peripheral nerve entrapment (Phalen's test, Tinel's test at elbow and wrist)
- Rotator cuff disorder with referred cervical pain (significant pain with shoulder circumduction motions)
- Thoracic outlet syndrome (positive TOS orthopedic test)
- TIA/CVA
- Signs of upper motor neuron involvement (clonus, hyperreflexia, Babinski reflex) may suggest compression of spinal cord, which should be evaluated medically

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Direct trauma to the head with loss of consciousness LOC)	Subdural hematoma; epidural hematoma; fracture
Nuchal rigidity, and/or positive Brudzinskis, or Kernigs sign	Subarachnoid hemorrhage; meningitis
Bladder dysfunction associated with onset of neck pain	Myelopathy; spinal cord injury
Associated dysphasia	Cerebrovascular Accident
Associated cranial nerve, or central nervous system (CNS) signs/symptoms	Tumor; intracranial hematoma
Onset of a new headache	Tumor; infection; vascular cause (older patients, also consider temporal arteritis; glaucoma)
Co-morbidities of rheumatoid arthritis, seronegative arthritides, Down syndrome	Atlantoaxial instability due to associated transverse ligament laxity
Cancer	Cause of symptoms (metastatic or primary)
Alcoholism, drug abuse	Side effect or withdrawal phenomenon
Immune-compromised state	Infection

Note: Diseases that may refer pain to the cervical spine include: brain lesions, CAD, dental disease, esophageal disease, upper airway disease, lymphadenopathy.

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR The Neck Disability Index (ODI) with a score of 16% or higher (Minimum Clinically important difference 10% (Young, et al, 2009))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Positive neurological testing
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider, for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines or improvement reaches a plateau;
  - Atrophy of upper extremity occurs;
  - Signs of fracture or dislocation occurs;
  - Increased neurologic signs/symptoms: increased UE numbness/tingling, increased UE weakness, increased UE pain, decreased UE reflexes.

Patient Presentation

- Patient may report trauma or insidious onset. Incidence of disc herniation in patients over age 40 decreases due to dehydration of the nucleus pulposus.
- Cervical ROM restrictions may be present, may be a loss of cervical lordosis
- Muscle spasms in corresponding myotomes or paravertebral muscles
- Nerve root tension signs (shoulder depression) are typically positive but may be absent in cases involving a free fragment of disc tissue
- Foraminal compression may cause radiating upper extremity pain
- Extension with rotation of cervical spine may cause shoulder or arm pain
- Dejerine's triad may be positive
- Dural tension signs
- Extremities symptoms and findings, if present, follow nerve root pattern
- Sensory abnormalities in dermatome
- Loss of reflex

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- Motor power weakness of upper extremity (particularly the hand)
- Decreased upper extremity girth may be present (Muscle atrophy)

Subjective Findings

- Pain, numbness, tingling, paresthesias in upper extremity following cervical nerve root distribution, particularly with hyperextension and rotation.
- Weakness in upper extremity, such as with grip strength.
- Lack of upper extremity coordination and difficulty with fine manipulation tasks, including handwriting, may be reported.
- Midline disc protrusions may involve both extremities.
- Better with rest.
- Relief from placing hand on top of head, which decreases tension on the irritated cervical nerve.
- Headaches and neck pain, which accompany upper extremity pain

Specific Examination Considerations

The medical literature would indicate that the cause of a patient/client's neck pain is often not clearly known (Borgouts, Koes, & Bouter, 1998) therefore, the physical therapist should assess for impaired muscular, neural, connective tissue, and articular joint function. The patient history is to also clarify any concerns or questions that may arise from the self-report questionnaires (Cleland, Childs, Fritz, & Whitman, 2006). Factors in the patient/client history that have importance include age greater than 40 years of age, co-existing lower back pain, greater than 3 months duration, loss of hand strength/function, and psychological factors such as anxiety, and poor quality of life, and medical "red flags" (Cook, 2008). In performing subjective and objective examination of the patient/client, clinicians should take into consideration those diagnostic classifications associated with serious pathological conditions and/or psychosocial factors when the patient's reported activity limitations or impairments of body function and structure are not consistent with conditions improvable with physical therapy interventions.

- Evaluation
  - Cervical active range of motion
  - Measurement of bodily impairment. Cervical active range of motion is measured ordinarily in the seated, upright position and flexion, extension, lateral side flexionand bilaterally rotation directions are measured (Cleland, Childs, Fritz, & Whitman, 2006). Use of a validated measurement instrument is necessary (Youdas, Carey, &Garret, 1991).
  - Cervical and upper thoracic segmental mobility

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- Measurement of bodily impairment. The purpose of this assessment is to determine the amount of accessory movement available at each spinal segment in relation to motion segments proximal and distal to the segment being assessed (Maitland, 2001). The patient is placed either in a supine or prone position and examination of the inter-segmental movement is palpated and assessed. The therapist is assessing for normal, hypomobile, or hypermobile movement correlated with pain associated with movement impairment (Bovim, Schrader, & Sand, 1994; Sandmark & Nisell, 1995).
- Upper cervical ligamentous stability tests
  - Distraction test
  - Measurement of nervous system structural impairment. The purpose of the test is to maximize the diameter of the neuroforamina and correlate diminishment of the patient's primary symptom complaint (Cook & Hegedus, 2008; Wainner, Fritz Irrang, Boninger, Delitto, & Allison, 2003). A positive test is indicated if the client/patient has a reduction or elimination of primary symptoms.
  - Alar and transverse ligament tests
    - Sharp-Purser Test

      Measurement of nervous system structural impairment. The patient is sitting with support and one palm of the examiner's hand is place on thepatient forehead and while the craniovertebral junction is in a slight flexed position the head is glided backwards on the neck. The patient's primary symptoms are reproduced. This is a test for spinal cord compression syndromes of the upper cervical spine (Sharp & Purser, 1961; Uitvlugt & Idenbaum, 1988).
    - Alar Ligament Test

      Measurement of bodily impairment. This test tests for ligamentous insufficiency of the alar ligaments which provide stability to the atlanto-occipital junction of the upper cervical spine (Cook & Hegedus, 2008; Magee, 2002). This test is first performed with the patient in a sitting position, and the therapist stabilizes the spinous process of C2 by use of a pinch grip with one hand while slightly sidebend the patient's head with the other hand. A delay in movement of the C2 spinous process would indicate a positive test (Hoffman, Mower, Wolfson, Todd, & Zucker, 2000).
- Cervical Flexion Rotation Test
- Measurement of bodily impairment. This test assesses the presence of cervicogenic headaches (Cook & Hegedus, 2008). The patient is supine and the therapist maximally flexes the cervical spine and while maintaining this position the therapist carefully rotates the head bilaterally. Limited movement to less than 45 degrees of rotation to either side would indicate a positive test (Hall & Robinson, 2004).
- Cranio-cervical flexion test

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- Measurement of bodily impairment. The patient is supine and the test is performed by the patient by flexing the cranio-cervical junction against a graded resistance and thereby flattening the cervical lordosis. A normal response is a 26-30 mm Hg pressure increase held for >10 seconds (Fernandez-De-Las-Penas, Perez-De-Heredia, Molero-Sanchez, & Mianogolarra, 2007; Jull, Barrett, Magee & Ho, 1999).
- Neck Flexion Muscle Endurance Test
- Measurement of bodily impairment. The patient is supine and the test is carried out by the patient's ability to lift the head and neck against resistance with the chin maximally retracted for an extended period of time (Harris, Heer, Roy, Santos Whitman & Wainner, 2005; Olsen, Millar, Dunker, Hicks & Glanz, 2006).
- Neurological testing
  - Upper limb adverse neural tension tests
  - Measurement of nervous system structural impairment. The purpose of the upper Limb tension test is to assess the degree of mobility of the upper limb neural elements correlating with client/patient primary symptom reproduction. A test is considered positive if reproduction of the primary complaint, and/or side-to-side differences in ROM greater than 10 degrees is present (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003). The patient is tested in a non-weight bearing supine position and upper limb peripheral nerve biased tension tests are carried out for symptom reproduction and impairment correlation (Butler, 2000).
  - Spurling's test
  - Measurement of nervous system structural impairment. Assessment of the patient's ability to combine sidebending with axial compression to diminish the diameter of the neuroforamina of the cervical spine. A positive test is considered when the patient's primary peripheralising symptoms are reproduced (Cook & Hegedus, 2008; Wainner, Fritz, Irrang, Boninger, Delitto & Allison, 2003).
  - Valsalva Test
  - Measurement of nervous system structural impairment. The patient inhales and bears down without exhaling in order to increase intrathecal pressure and reproduce the patient's primary complaint (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003).
  - Hoffman's Sign
  - Positive test suggests upper motor neuron compromise. Differentially diagnose for Cervical Myelopathy (Harrop, et al 2007).
  - Lhermitte's Sign
  - Positive test suggests upper motor neuron compromise. Differentially diagnose for Cervical Myelopathy (Harrop, et al 2007).

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- Functional outcome measures (Level I, Strong evidence base)
  Clinicians should consider use of scientifically validated self-report patient/client functional outcome measures such as:
  - Neck Disability Index [NDI] (Pietrobon, Coeytaux, Carey, Richardson, & DeVellis, 2002),
  - Pain diagrams using the Numeric Pain Rating Scale (NPRS) (Aprill, Dwyer, & Bogduk, 1990; Chan, Goldman, Ilstrup, Kunselman, & O'Niell, 1993)
  - Patient-Specific Functional Scale (Stratford, Gill, Westaway, & Binkley, 1995; Westaway, Stratford, & Binkley, 1998).

These outcome scoring methods are useful in identifying baseline, interval progress, and discharge status.

Physical/Occupational Therapy Management

Neck pain has a good natural course with 80-90% of cases diminishing within 4-6 weeks (Douglass, & Bope, 2004; Alentado et al., 2014). Head, neck and upper back pain can be described as having a normal expected course and an abnormal one. In a normal course of head, neck and upper back pain, symptoms should diminish over time and can be improved with appropriate intervention. An abnormal episode occurs when a patient's symptoms and/or disabilities do not decrease over time and either stay the same or increase. The role of the therapist is to provide appropriate therapeutic interventions and education of the patient/client in appropriate preventive measures in cases where the patient/client symptoms and/or disabilities exhibit an abnormal course.

- Clinical Interventions (Recommended)
  - Cervical passive mobilization/manipulation techniques (Level I, Strong evidence)
  - Cervical mobilization and manipulative passive motion procedures are recommended, especially in conjunction with appropriate cervical exercises (Bronfort, Evans, Nelson, Aker, Goldsmith & Vernon, 2001; Cleland, Glynn, et al., 2007; Evans, Bronfort, Nelson & Goldsmith, 2002; Gross, Hoving, Haines, Goldsmith, Kay, Aker,…Cochrane Group, 2004; Hoving, Koes, de Vet, et al., 2002; Nilsson, Christensen & Hartvigsen, 1997; Walker, Boyles, Young, et al., 2008). Manual Therapy combined with exercise has good evidence to support it (Boyles, R., et al, 2011)
  - Cervical Coordination, Strengthening and Endurance Exercises (Level I, Strong evidence)
  - Clinicians should consider active exercise interventions that emphasize coordinated movement, endurance development and strength training of the cervical spine (Chiu, Lam, & Hedley, 2005; Falla, Jull, Russell, Vicenzino, & Hodges, 2007; Jull, Falla, Treleaven, Hodges & Vicenzino, 2007; Jull, Trott, Potter, et al., 2002; Taimela, Takala, Asklof, Seppala, & Parviainen, 2000; Ylinen, Nikander, Nykänen, Kautiainen, & Häkkinen, 2010). Strength training, stretching, and aerobic exercise can reduce pain and disability (Systematic Review Level 1 and 2 evidence) (Cheng, Chih-Hsiu, 2015).
  - Upper Quarter Neural Mobilization Procedures (Level I, Level II, moderate evidence)

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- Neural element upper quarter mobilization procedures are recommended to be used in conjunction with diagnostic procedures that indicate the anatomical source of the client/patient symptoms in order to specifically reduce peripheral nerve entrapment (Allison, Nagy, & Hall, 2002; Coppieters, Stappaerts, Wouters, & Jansens, 2003).
- Manual or Mechanical Traction (Level I, Level II, moderate evidence)
- Traction procedures apply longitudinal/axial distraction forces on the cervical spine in order to maximize the neuroforamina of the spine and or distract the discal elements of the spine. Traction is best recommended when the following factors are present: 1) patient reported symptom peripheralization with lower cervical (C4-7) segmental mobility testing, 2) positive shoulder abduction sign, 3) Age greater than or equal to 55 years, 4) positive upper limb neural tension test and 5) relief of symptoms with cervical manual distraction test (Graham, Gross, & Goldsmith, 2006; Raney, Petersen, Smith, et al., 2009). Adding mechanical traction to exercise for patients with cervical radiculopathy resulted in lower disability and pain, particularly at long-term follow-ups. Level 2b evidence (Fritz, JM, et al 2014).
- Patient/Client Education and Counseling (Level I, strong evidence)
- Educating the patient/client regarding favorable outcomes, early movement interventions and self-care is recommended. The patient/client is educated that early return to normal, non-provocative movement is important and that return to function and full recovery are the most common outcomes over the long term (Schnabel, Ferrari, Vassiliou, & Kaluza, 2004; Vassiliou, Kaluza, Putzke, Wulf, & Schnabel, 2006).

- Clinical interventions with neutral recommendation (Level II evidence or based on weak evidence
  - Thoracic mobilization/manipulation techniques (Weak evidence)
  - Thoracic mobilization and manipulative passive motion procedures are proposed with neutral recommendations (Cleland, Childs, McRae, Palmer, & Stowell, 2005; Cleland, Glynn, Whitman, Eberhart, MacDonald & Childs, 2007; Fernandez, Fernandez, Plaza, Lomas, Miangolarra, 2004).
  - Cervical or upper thoracic muscle or soft tissue stretching techniques (Weak evidence)
  - Manual muscle stretching or other soft tissue mobilization/manipulation techniques have been found to be helpful in treatment of non-specific neck pain. Treatment typically places an emphasis on assessment and treatment of impaired flexibility in the suboccipital, anterior/medial/posterior scalene, upper trapezius, levator scapulae, pectoralis minor and pectoralis major muscle groups (Brousseau, et al., 2012; Ylinen, Kautianen, Wiren & Hakkinen, 2007).
  - Centralization Procedures and Exercise (Weak evidence)
  - These procedures include those that require specific, directional repeated movements intended to centralize the patient's symptoms (Kjellman & Oberg, 2002; Murphy, Hurwitz, Gregory, & Clary, 2006). Similar (though not as well researched) to LBP, directional preference and centralization may be associated with improved outcomes (Edmond, Susan L. et al 2014).

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- Clinical interventions not recommended (Poor evidence or expert opinion)
  - Activity Limitation/Participation Measures
  - Evidence supporting the long term benefit of patient education procedures, use of soft cervical collars, and activity limiting interventions in isolation of other more active interventions is generally lacking, therefore it is not recommended that physical therapy clinicians utilize activity limiting interventions and use education methods that are easily reproduced by the patient (Crawford, Khan & Varley, 2004; Jull, Trott, Potter, et al., 2002; Rosenfeld, Seferiadis, A, Carlsson & Gunnarsson, 2003; Schnabel, Ferrari, Vassiliou, & Kaluza, 2004)
  - Therapeutic Modalities and Acupuncture (Poor or insufficient evidence)
  - Therapeutic modalities including pulsed electromagnetic therapy, electrical stimulation, therapeutic ultrasound, transcutaneous electrical nerve stimulation are not recommended due to poor or insufficient evidence of treatment efficacy(TENS) (Gross, Aker, Goldsmith, & Pelosso, 2002; Kjellman, Skargren, & Oberg, 1999; Verhagen, Peeters, de Bie, & Oostendorp, 2002).

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and

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psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Use of a cervical pillow while sleeping may be helpful
- Theraband for therapeutic exercises
- Cervical traction unit
- Hot packs/cold packs
- Home electrical stimulation unit
- Gymball

Self-Care Techniques

- Postural advice, postural exercises
- Flexibility exercises
- Cervical stabilization exercises, isometrics
- Aerobic conditioning, such as walking or swimming
- Heat applications, cold packs, if needed, to relieve discomfort/stiffness

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Physiatry
- Medication
- Acupuncture

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Cervical, Post-Surgical Conditions

- Post Open Reduction Internal Fixation (ORIF) Syndrome
- Post Fusion Syndrome
- Post Discectomy Syndrome
- Post Laminectomy Syndrome

Synonym
Failed Spinal Surgery Syndrome

Definition
Post-surgical course, in which patient continues to show abnormal findings for strength, ROM, and pain with referral to upper back, shoulder, arm, and/or hand. Patient may also have altered reflexes and sensation. Because multiple factors can contribute to this syndrome, patients are considered to be suffering from a chronic pain syndrome. It is recommended that patients be treated by a multidisciplinary team including at least an MD/anesthesiologist, physical therapist, occupational therapist and psychologist to help manage the rehabilitation.

Patient History
- Patient history may include:
  - General demographics
  - Occupation/employment
  - Hand dominance
  - Living environment
  - History of current condition
  - Functional status and activity level (prior level of function)
  - Medications
  - Other tests and measurements (laboratory and diagnostic tests)
  - Past history (including history of prior therapy and response to prior treatment)

In addition to the standard information gathered, a complete understanding of the surgical procedure performed should be obtained from the surgeon.

Specific Considerations
- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, focal redness	Infection
Direct trauma to the head with loss of consciousness (LOC)	Subdural hematoma; epidural hematoma; fracture
Nuchal rigidity, and/or positive Brudzinskis, or Kernigs sign	Subarachnoid hemorrhage; meningitis
Bladder dysfunction associated with onset of neck pain	Myelopathy; spinal cord injury
Associated dysphasia; unilateral weakness	Cerebrovascular accident
Associated cranial nerve or central nervous system (CNS) signs/symptoms	Tumor; intracranial hematoma
Onset of a new headache	Tumor; infection; vascular cause (older patients, also consider temporal arteritis; glaucoma)
Co-morbidities of rheumatoid arthritis, seronegative arthritides, Down syndrome	Atlantoaxial instability due to associated transverse ligament laxity
Cancer	Cause of symptoms (metastatic or primary)
Alcoholism, drug abuse	Side effect or withdrawal phenomenon
Immune-compromised state	Infection

Note: Diseases that may refer pain to the cervical spine include: brain lesions, CAD, dental or oral diseases, esophageal disease, upper airway disease, lymphadenopathy.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the **Patient Specific Functional Scale (PSFS)**– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR **The Neck Disability Index (NDI)** with a score of 16% or higher (Minimum Clinically Important Difference 10% (Young, et al, 2009))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of upper extremity occurs
  - Signs of demyelinating condition, tumor or infection
  - Increased neurologic signs/symptoms: increased Upper Extremity (UE) numbness/tingling, increasing UE weakness, increasing UE pain, decreasing UE reflexes

Presentation

Patient presents with continued signs and symptoms post operatively. There may be surgery specific precautions that vary by surgeon and procedure.

Subjective Findings

- Pain, numbness, tingling, paresthesias in upper extremity following cervical nerve root distribution
- May complain of weakness in upper extremity, such as with grip strength
- May complain of difficulty with fine manipulation tasks, including handwriting, may be reported
- Headaches and neck pain may accompany upper extremity pain

Findings of Cervical Examination

- Cervical ROM restrictions may be present
- Muscle spasms in corresponding myotomes
- Nerve root tension signs (shoulder depression) are typically positive but may be absent in cases involving a free fragment of disc tissue
- Foraminal compression may cause radiating upper extremity pain
- Extension with rotation of cervical spine may cause shoulder or arm pain
- Dejerine's triad may be positive
- Dural tension signs
- Extremities symptoms and findings, if present, follow nerve root pattern
- Sensory abnormalities in dermatome
- Loss of reflex
- Motor power weakness of upper extremity
- Decreased upper extremity girth may be present

General Examination Considerations

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All of the following objective tests may not be appropriate on admission to therapy post-surgically, but should be assessed as appropriate during the course of care.

- Evaluation
  - Cervical active range of motion
  - Measurement of bodily impairment. Cervical active range of motion is measured ordinarily in the seated, upright position and flexion, extension, lateral side flexion and bilaterally rotation directions are measured (Cleland, Childs, Fritz, & Whitman, 2006). Use of a validated measurement instrument is necessary (Youdas, Carey, &Garret, 1991).
  - Cervical and upper thoracic segmental mobility
  - Measurement of bodily impairment. The purpose of this assessment is to determine the amount of accessory movement available at each spinal segment in relation to motion segments proximal and distal to the segment being assessed (Maitland, 2001). The patient is placed either in a supine or prone position and examination of the inter-segmental movement is palpated and assessed. The therapist is assessing for normal, hypomobile, or hypermobile movement correlated with pain associated with movement impairment (Bovim, Schrader, & Sand, 1994; Sandmark & Nisell, 1995).
  - Upper cervical ligamentous stability tests
    - Distraction test
    - Measurement of nervous system structural impairment. The purpose of the test is to maximize the diameter of the neuroforamina and correlate diminishment of the patient's primary symptom complaint (Cook & Hegedus, 2008; Wainner, Fritz Irrang, Boninger, Delitto, & Allison, 2003). A positive test is indicated if the client/patient has a reduction or elimination of primary symptoms.
    - Alar and transverse ligament tests
      - **Sharp-Purser Test**
        Measurement of nervous system structural impairment. The patient is sitting with support and one palm of the examiner's hand is place on thepatient forehead and while the craniovertebral junction is in a slight flexed position the head is glided backwards on the neck. The patient's primary symptoms are reproduced. This is a test for spinal cord compression syndromes of the upper cervical spine (Sharp & Purser, 1961; Uitvlugt & Idenbaum, 1988).
      - **Alar Ligament Test**
        Measurement of bodily impairment. This test tests for ligamentous insufficiency of the alar ligaments which provide stability to the atlanto-occipital junction of the upper cervical spine (Cook & Hegedus, 2008; Magee, 2002). This test is first performed with the patient in a sitting position, and the therapist stabilizes the spinous process of C2 by use of a pinch grip with one hand while slightly sidebend the patient's head with the other hand. A delay in movement of the C2 spinous process would indicate a positive test (Hoffman, Mower, Wolfson, Todd, & Zucker, 2000).

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- C1/2 Rotation Assessment
- Measurement of bodily impairment. This test assesses the presence of cervicogenic headaches (Cook & Hegedus, 2008). The patient is supine and the therapist maximally flexes the cervical spine and while maintaining this position the therapist carefully rotates the head bilaterally. Limited movement to less than 45 degrees of rotation to either side would indicate a positive test (Hall & Robinson, 2004).
- Cranio-cervical flexion test
- Measurement of bodily impairment. The patient is supine and the test is performed by the patient by flexing the cranio-cervical junction against a graded resistance and thereby flattening the cervical lordosis. A normal response is a 26-30 mm Hg pressure increase held for >10 seconds (Fernandez-De-Las-Penas, Perez-De-Heredia, Molero-Sanchez, & Mianogolarra, 2007; Jull, Barrett, Magee & Ho, 1999).
- Neck Flexion Muscle Endurance Test
- Measurement of bodily impairment. The patient is supine and the test is carried out by the patient's ability to lift the head and neck against resistance with the chin maximally retracted for an extended period of time (Harris, Heer, Roy, Santos Whitman & Wainner, 2005; Olsen, Millar, Dunker, Hicks & Glanz, 2006).
- Neurological testing
  - Upper limb adverse neural tension tests
  - Measurement of nervous system structural impairment. The purpose of the upper Limb tension test is to assess the degree of mobility of the upper limb neural elements correlating with client/patient primary symptom reproduction. A test is considered positive if reproduction of the primary complaint, and/or side-to-side differences in ROM greater than 10 degrees is present (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003). The patient is tested in a non-weight bearing supine position and upper limb peripheral nerve biased tension tests are carried out for symptom reproduction and impairment correlation (Butler, 2000).
  - Spurling's test
  - Measurement of nervous system structural impairment. Assessment of the patient's ability to combine sidebending with axial compression to diminish the diameter of the neuroforamina of the cervical spine. A positive test is considered when the patient's primary peripheralising symptoms are reproduced (Cook & Hegedus, 2008; Wainner, Fritz, Irrang, Boninger, Delitto & Allison, 2003).
  - Valsalva Test
    Measurement of nervous system structural impairment. The patient inhales and bears down without exhaling in order to increase intrathecal pressure and reproduce the patient's primary complaint (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003).

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- Functional outcome measures (Level I, Strong evidence base.)
  Clinicians should consider use of scientifically validated self-report patient/client functional outcome measures such as:
  - Neck Disability Index [NDI] (Pietrobon, Coeytaux, Carey, Richardson, & DeVellis, 2002),
  - Pain diagrams using the Numeric Pain Rating Scale (NPRS) (Aprill, Dwyer, & Bogduk, 1990; Chan, Goldman, Ilstrup, Kunselman, & O'Niell, 1993)
  - Patient-Specific Functional Scale (Stratford, Gill, Westaway, & Binkley, 1995; Westaway, Stratford, & Binkley, 1998).

These outcome scoring methods are useful in identifying baseline, interval progress, and discharge status.

Differential Diagnoses

- Myocardial ischemia (refer for evaluation if suspected)
- Demyelinating conditions (symptoms, intensity and location vary)
- Myelopathy (trunk or leg dysfunction, gait disturbance, bowel or bladder dysfunction, signs of upper motor neuron involvement)
- Thoracic outlet syndrome (positive TOS orthopedic test)
- Peripheral nerve entrapment (Phalen's test, Tinel's test at elbow and wrist)
- Adhesive capsulitis of shoulder with referred cervical pain (restricted active and passive shoulder motion)
- Rotator cuff disorder with referred cervical pain (significant pain with shoulder circumduction motions)
- Signs of upper motor neuron involvement (clonus, hyperreflexia, Babinski reflex) may suggest compression of spinal cord, which should be evaluated medically.

Physical/Occupational Therapy Management

- Therapy must show measurable functional progress.The type of physical therapy intervention for post-operative patient of the cervical spine depends on the diagnosis and the type of surgical approach. The start of care typically is 3-6 weeks post operatively. Therapists should take into consideration:
  - Anterior vs. Posterior approach
  - Wound healing
  - Signs of infection
  - Physical and Psychological condition of the patient
  - Patient motivation
  - Specific goals

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Initial Rehabilitation Phase 0-6 weeks (3-6 weeks post-operative)

- Goals:
  - Perform transfers and gait safely and independently.
  - Ensure understanding of good posture.
  - Achieve full shoulder ROM.
  - Advise patient regarding pacing and discuss expectations.
  - Return to driving at 4-6 weeks (as per precautions below)
  - Proprioception: upper limbs and lower limbs.
  - Deep neck flexor activation.
  - Return to work at 4- 6 weeks.
  - Ensure understanding of use of collar and length of time to be worn (depends on procedure and surgeon).
- Precautions
  - During the first 4-6 weeks it is important to gradually increase activities and also pace activities throughout the day dependent on pain. Current evidence supports a steady paced up increase in activity whilst respecting post operative soreness, healing times, nerve recovery times, neural sensitivity and patient's previous level of fitness.
  - Avoid driving; until approximately 4-6 weeks post-operatively or longer if required. It is important that the patient can sit comfortably in the car, turn their neck as required for driving and be able to carry out an emergency stop without hesitation.
  - For the first 4- 6 weeks lifting may be limited to less than 10 pounds
  - Walking; no restrictions, should be increased gradually each day.
  - Sitting; should be in a supportive chair.
  - Sleeping; Advice on neutral cervical spine position
- Treatment
  - Evidence supporting specific treatment interventions with respect to specific post operative cervical conditions is scarce. The following recommendations are based on healing phases and their milestones. Continuation of care must be based on patient presentation with adequate progress as measured through objective findings.
- Pain relief:
  - Ensure adequate analgesia and positioning
  - Use of modalities as appropriate
- Patient education:
  - Advise patient on pacing and activities.
  - Advise patient on posture and movement and ergonomic correction.
  - Reinforce importance of lifting no load heavier than 10 pounds (per surgeon).
  - Expectations of treatment and recovery time.
  - Scar management.

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- Exercises
  - Core stability activation; lumbar and cervical
  - Encourage normal functional movement.
  - Proprioception and balance – UL & LL
  - Kinetic chain
- Mobility
  - Ensure patient can manage transfers and gait independently taking into account pre operative mobility.
- Multidisciplinary Care
  - Referral onwards as necessary to appropriate service i.e.; OT, psychology, orthotics
- Milestones to progress to next rehab phase:
  - Adequate pain relief.
  - Achieving goals as above
  - Managing normal activities and gradually increasing.
  - Basic core stability.
  - Attain functional cervical spine AROM (60 degrees or more of cervical rotation)

Recovery/rehabilitation phase: 6 weeks to 6 months

- Goals:
  - Increase normal ADLs
  - Return to work at 4-6 weeks (unless heavy manual work-aim to return at 3 months with a phased return)
  - Graded return to fitness
  - Increase lifting
  - Regain functional cervical spine movement
  - Regain normal glenohumeral and scapular ROM and dynamics
- Precautions/Restrictions
  - Return to work approximately 4-6 weeks.
    - Phased as appropriate for job role (ie driving, travelling or computer based).
    - Heavy manual work should be phased in after 3 months check providing surgical team are in agreement and will be based on the demands of the job. Further information from occupational health services may be needed.
  - Avoid lifting anything heavier than 10kg until 3 months post-operatively or until the surgeon advises.
  - Light upper limb resistance exercises
  - Rowing and increasing upper body weights from 3-6 months as control allows
  - No breast stroke or front crawl swimming until 6 months
  - Running not usually allowed until fusion confirmed at about 3-6 months. Discussion with surgical team may be necessary.
  - No Contact sports until 9 months: to be discussed at 6 month review with surgical team.

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- Treatment
  - Treatment frequency should be tapered at this phase to ensure adequate transition to self-management of symptoms. Slow progress does not in and of itself constitute medical necessity.
- Pain relief
  - Ensure adequate pain relief coincides with appropriate level of exercise and activity.
- Patient education
  - Ensure patient is pacing at appropriate level and is not over or under exercising. Ensure good knowledge of importance of posture in all positions.
  - Encourage normal movement patterns.
  - Advise patient on healing times
  - Ergonomic advice.
- Exercises
  - Progress core stability and kinetic chain
  - Ensure good muscle endurance
  - Ensure adequate cervical ROM.
  - Scapular and glenohumeral posture dynamics and ROM
  - Assist to increase general fitness and functional retraining following restrictions. Swimming-backstroke to start and then front crawl after 6 months if technique good
  - Can attend gym but no rowing or upper body weights until 3 months post op
  - Proprioception: upper limb, lower limb and cervical spine
  - Increase walking
- Manual therapy
  - Soft tissue, scar tissue and joint mobilisations as appropriate
  - Aggressive manipulative (grade v) techniques to the cervical spine should be avoided
  - Neural dynamics assessment and treatment as indicated
- Milestones to achieve by 6 months:
  - Return to normal activities
  - Achieving above goals
  - Continuing independence with exercise program
  - Recovery can take up to 18 months.
- Failure to meet milestones:
  - Refer back to surgical team. Outpatient physical therapy can continue only if the patient is still making progress in pain levels and functional outcome measures. Slow progress does not in and of itself constitute medical necessity.

-adapted from Royal National Orthopedic Hospital, 2014

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Additional Proposed Cervical Interventions

- ROM (as per specific protocols in regards to limitations) progressive to tolerance
- Stabilization with neuromuscular re-education for deep neck flexors
- Flexibility: posterior paraspinals, upper traps, levator scapula, scalenes
- Strengthening of upper quarter muscles
- Mobility–manual therapy to cervico-thoracic joints (where appropriate)
- Aerobic conditioning program
- Cognitive behavioral therapy
- Patient education
- Activity modification
- Postural awareness
- Body mechanics for work or ADLs
- HEP

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity.

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband
- Gymball
- Home electrical stimulation unit

Self-Care Techniques

- Postural advice, postural exercises
- Cervical isometric exercises, cervical stabilization exercises, flexibility exercises (when precautions are lifted)
- Aerobic conditioning
- Cold/heat applications, if needed, to relieve discomfort/stiffness
- Brief use of cervical collar, if necessary, in acute stages, to limit motion
- Instruct patient in any surgery specific precautions

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Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Physiatry
- Medication
- Acupuncture
- Anesthesia/pain management

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Stenosis – Cervical / Thoracic Spine

Synonyms

- Spondylosis
- Spinal canal narrowing
- Cervical Stenosis
- Foraminal Stenosis

Definition

Condition caused by a narrowing of the spinal canal, usually present with pain or weakness in extremities on walking. Condition may be mistaken for intermittent claudication due to vascular disease. Size of canal may be small since birth due to some congenital or developmental factors in certain individuals. Later in life when degenerative changes occur, canal is further narrowed by osteophytes from facet joints and vertebral body, thickening of posterior longitudinal ligament or ligamentum flavum, or retrolisthesis of vertebral body secondary to narrowing of disc space.

Patient History

Patient history may include:

- Patient Data
  - General demographics
  - Occupation/employment
  - Hand dominance
  - Living environment
  - History of current condition
  - Functional status and activity level (prior level of function)
  - Medications
  - Other tests and measurements (laboratory and diagnostic tests)
  - Past history (including history of prior therapy, and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- The following table presents common red flags for this diagnosis and their possible causes.

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Direct trauma to the head with loss of consciousness (LOC)	Subdural hematoma; epidural hematoma; fracture
Nuchal rigidity, and/or positive Brudzinskis, or Kernigs sign	Subarachnoid hemorrhage; meningitis
Bladder dysfunction associated with onset of neck pain	Myelopathy; spinal cord injury
Associated dysphasia	Cerebrovascular accident
Associated cranial nerve, or central nervous system (CNS) signs/symptoms	Tumor; intracranial hematoma
Onset of a new headache	Tumor; infection; vascular cause (older patients, also consider temporal arteritis; glaucoma)
Co-morbidities of rheumatoid arthritis, seronegative arthritides, Down syndrome	Atlantoaxial instability due to associated transverse ligament laxity
Exertional pain, history of CAD	CAD
Pleuritic pain, chronic cough, dyspnea	Pulmonary diseases
Cancer	Cause of symptoms (metastatic or primary)
Alcoholism, drug abuse	Side effect, or withdrawal phenomenon
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR The Neck Disability Index (ODI) with a score of 16% or higher (Minimum Clinically important difference 10% (Young, et al, 2009))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold

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- The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
- Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of upper extremity occurs
  - Signs of demyelinating condition, tumor or infection
  - Increased neurologic signs/symptoms: increased UE numbness/tingling, increasing UE weakness, increasing UE pain, decreasing UE reflexes

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Presentation

- Lateral cervical stenosis (radiculopathy) is typical of lower motor neuron disorders.
  - Signs typically include hyperreflexia of affected upper extremity accompanied by motor weakness and sensory disturbances consistent with level of compression of nerve root.
  - Cervical ROM is typically limited, and extension and ipsilateral side-bending may exacerbate upper extremity symptoms.
  - Spurling's test is usually positive. Upper extremity symptoms may be reduced or relieved with manual cervical traction.
  - Neck pain is not always present.
  - Unsteadiness in gait or clumsiness often is an early symptom.
  - Central cervical stenosis (myelopathy) involves upper motor neuron or long-tract disorders.
  - Weakness with spasticity may be present, along with clonus and a positive Babinski sign.
  - Vibratory sensation typically, is diminished in lower extremities, and both upper and lower extremity reflexes may become hyperactive.
  - Cervical ROM is typically restricted in all planes.
  - Lhermittes sign may be present.
  - Spurling's test is expected to be negative, and manual cervical traction has no effect on symptoms.
  - Possible loss of bowel and bladder control.
  - Wide-based gait pattern-ataxia.
  - Proprioception affected.

Subjective Findings

- Neck Pain
- Upper Extremity numbness and weakness
- Lower Extremity numbness and weakness
- Loss of dexterity in hands

Objective Findings

Objective findings may include:

- Not all evaluation items may be appropriate for each condition. Therapists should use their own clinical judgement based on the clinical presentation and diagnosis.
- Postural Observation
- Palpation
- Cervical active range of motion

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- Measurement of bodily impairment. Cervical active range of motion is measured ordinarily in the seated, upright position and flexion, extension, lateral side flexion and bilateral rotation directions are measured (Cleland, Childs, Fritz, & Whitman, 2006). Use of a validated measurement instrument is necessary (Youdas, Carey, &Garret, 1991).
- Cervical and upper thoracic segmental mobility
- Measurement of bodily impairment. The purpose of this assessment is to determine the amount of accessory movement available at each spinal segment in relation to motion segments proximal and distal to the segment being assessed (Maitland, 2001). The patient is placed either in a supine or prone position and examination of the inter-segmental movement is palpated and assessed. The therapist is assessing for normal, hypomobile, or hypermobile movement correlated with pain associated with movement impairment (Bovim, Schrader, & Sand, 1994; Sandmark & Nisell, 1995).
- Upper cervical ligamentous stability tests
  - Distraction test
    - Measurement of nervous system structural impairment. The purpose of the test is to maximize the diameter of the neuroforamina and correlate diminishment of the patient's primary symptom complaint (Cook & Hegedus, 2008; Wainner, Fritz Irrang, Boninger, Delitto, & Allison, 2003). A positive test is indicated if the client/patient has a reduction or elimination of primary symptoms.
  - Alar and transverse ligament tests
    - Sharp-Purser Test

      Measurement of nervous system structural impairment. The patient is sitting with support and one palm of the examiner's hand is place on thepatient forehead and while the craniovertebral junction is in a slight flexed position the head is glided backwards on the neck. The patient's primary symptoms are reproduced. This is a test for spinal cord compression syndromes of the upper cervical spine (Sharp & Purser, 1961; Uitvlugt & Idenbaum, 1988).
  - Alar Ligament Test
    - Measurement of bodily impairment. This test tests for ligamentous insufficiency of the alar ligaments which provide stability to the atlanto-occipital junction of the upper cervical spine (Cook & Hegedus, 2008; Magee, 2002). This test is first performed with the patient in a sitting position, and the therapist stabilizes the spinous process of C2 by use of a pinch grip with one hand while slightly sidebend the patient's head with the other hand. A delay in movement of the C2 spinous process would indicate a positive test (Hoffman, Mower, Wolfson, Todd, & Zucker, 2000).

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- Cervical Flexion Rotation Test
  Measurement of bodily impairment. This test assesses the presence of cervicogenic headaches (Ogince, M., 2007; Cook & Hegedus, 2008). The patient is supine and the therapist maximally flexes the cervical spine and while maintaining this position the therapist carefully rotates the head bilaterally. Limited movement to less than 45 degrees of rotation to either side would indicate a positive test (Hall & Robinson, 2004; Hall, T. M.,2008).
- Cranio-cervical flexion test
  Measurement of bodily impairment. The patient is supine and the test is performed by the patient by flexing the cranio-cervical junction against a graded resistance and thereby flattening the cervical lordosis. A normal response is a 26-30 mm Hg pressure increase held for >10 seconds (Fernandez-De-Las-Penas, Perez-De-Heredia, Molero-Sanchez, & Mianogolarra, 2007; Jull, Barrett, Magee & Ho, 1999).
- Neck Flexion Muscle Endurance Test
  Measurement of bodily impairment. The patient is supine and the test is carried out by the patient's ability to lift the head and neck against resistance with the chin maximally retracted for an extended period of time (Harris, Heer, Roy, Santos Whitman & Wainner, 2005; Olsen, Millar, Dunker, Hicks & Glanz, 2006).
- Vertebral Artery Insufficiency Test
- Neurological testing
  - Upper limb adverse neural tension tests
    - Measurement of nervous system structural impairment. The purpose of the upper Limb tension test is to assess the degree of mobility of the upper limb neural elements correlating with client/patient primary symptom reproduction. A test is considered positive if reproduction of the primary complaint, and/or side-to-side differences in ROM greater than 10 degrees is present (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003). The patient is tested in a non-weight bearing supine position and upper limb peripheral nerve biased tension tests are carried out for symptom reproduction and impairment correlation (Butler, 2000).
  - Spurling's test
    - Measurement of nervous system structural impairment. Assessment of the patient's ability to combine sidebending with axial compression to diminish the diameter of the neuroforamina of the cervical spine. A positive test is considered when the patient's primary peripheralising symptoms are reproduced (Cook & Hegedus, 2008; Wainner, Fritz, Irrang, Boninger, Delitto & Allison, 2003).

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- Valsalva Test
  - Measurement of nervous system structural impairment. The patient inhales and bears down without exhaling in order to increase intrathecal pressure and reproduce the patient's primary complaint (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003).
    - Upper Extremity Manual Muscle Tests
    - Dermatomal Testing
    - Upper Extremity Reflex Tests

- Functional outcome measures (Level I, Strong evidence base.)
  Clinicians should consider use of scientifically validated self-report patient/client functional outcome measures such as:
- Neck Disability Index [NDI] (Pietrobon, Coeytaux, Carey, Richardson, & DeVellis, 2002),
- Pain diagrams using the Numeric Pain Rating Scale (NPRS) (Aprill, Dwyer, & Bogduk, 1990; Chan, Goldman, Ilstrup, Kunselman, & O'Niell, 1993)
- Patient-Specific Functional Scale (Stratford, Gill, Westaway, & Binkley, 1995; Westaway, Stratford, & Binkley, 1998).

These outcome scoring methods are useful in identifying baseline, interval progress, and discharge status.

Findings of Stenosis

- Foraminal compression may cause radiating upper extremity pain
- Extremities symptoms and findings, may follow nerve root pattern
- Sensory abnormalities may follow a dermatomal distribution
- Signs of upper motor neuron involvement (clonus, hyperreflexia, Babinski reflex) may suggest compression of spinal cord, which should be evaluated medically

Differential Diagnoses

- Cervical nerve root compression
- Other myelopathies
- Multiple sclerosis
- Metastatic Ca
- TIA/CVA

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Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Management/Intervention

- Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.
- Therapy intervention is frequently aimed at providing symptomatic relief in acute exacerbations of a pain complaint.
- Short term modality intervention is appropriate if significant relief is provided.
- If successful in reducing pain complaint, strengthening of weak musculature, restoration of function and instruction in self-management techniques to stabilize condition is also appropriate.
- Activities and exercises should have a flexion bias, as extension is thought to be aggravating.
- Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

A. Clinical Interventions (Recommended)

1. Cervical passive mobilization/manipulation techniques (Level I, Strong evidence)

Cervical mobilization and manipulative passive motion procedures are recommended, especially in conjunction with appropriate cervical exercises (Bronfort, Evans, Nelson, Aker, Goldsmith & Vernon, 2001; Cleland, Glynn, et al., 2007; Evans, Bronfort, Nelson & Goldsmith, 2002; Gross, Hoving, Haines, Goldsmith, Kay, Aker,…Cochrane Group, 2004; Hoving, Koes, de Vet, et al., 2002; Nilsson, Christensen & Hartvigsen, 1997; Walker, Boyles, Young, et al., 2008). Manual Therapy combined with exercise has good evidence to support it (Boyles, R., et al, 2011)

2. Cervical Coordination, Strengthening and Endurance Exercises (Level I, Strong evidence)

Clinicians should consider active exercise interventions that emphasize coordinated movement, endurance development and strength training of the cervical spine (Chiu, Lam, & Hedley, 2005; Falla, Jull, Russell, Vicenzino, & Hodges, 2007; Jull, Falla, Treleaven, Hodges & Vicenzino, 2007; Jull, Trott, Potter, et al., 2002; Taimela, Takala, Asklof, Seppala, & Parviainen, 2000; Ylinen, Nikander, Nykänen, Kautiainen, & Häkkinen, 2010). Strength training, stretching, and aerobic exercise can reduce pain and disability (Systematic Review Level 1 and 2 evidence) (Cheng, Chih-Hsiu, 2015).

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3. **Upper Quarter Neural Mobilization Procedures (Level I, Level II, moderate evidence)**
   Neural element upper quarter mobilization procedures are recommended to be used in conjunction with diagnostic procedures that indicate the anatomical source of the client/patient symptoms in order to specifically reduce peripheral nerve entrapment (Allison, Nagy, & Hall, 2002; Coppieters, Stappaerts, Wouters, & Jansens, 2003).
4. **Manual or Mechanical Traction (Level I, Level II, moderate evidence)**
   Traction procedures apply longitudinal/axial distraction forces on the cervical spine in order to maximize the neuroforamina of the spine and or distract the discal elements of the spine. Traction is best recommended when the following factors are present: 1) patient reported symptom peripheralization with lower cervical (C4-7) segmental mobility testing, 2) positive shoulder abduction sign, 3) Age greater than or equal to 55 years, 4) positive upper limb neural tension test and 5) relief of symptoms with cervical manual distraction test (Graham, Gross, & Goldsmith, 2006; Raney, Petersen, Smith, et al., 2009). Adding mechanical traction to exercise for patients with cervical radiculopathy resulted in lower disability and pain, particularly at long-term follow-ups. Level 2b evidence (Fritz, JM, et al 2014).
5. **Patient/Client Education and Counseling (Level I, strong evidence)**
   Educating the patient/client regarding favorable outcomes, early movement interventions and self-care is recommended. The patient/client is educated that early return to normal, non-provocative movement is important and that return to function and full recovery are the most common outcomes over the long term (Schnabel, Ferrari, Vassiliou, & Kaluza, 2004; Vassiliou, Kaluza, Putzke, Wulf, & Schnabel, 2006).

B. Clinical interventions with neutral recommendation (Level II evidence or based on weak evidence

1. **Thoracic mobilization/manipulation techniques (Weak evidence)**
   Thoracic mobilization and manipulative passive motion procedures are proposed with neutral recommendations (Cleland, Childs, McRae, Palmer, & Stowell, 2005; Cleland, Glynn, Whitman, Eberhart, MacDonald & Childs, 2007; Fernandez, Fernandez, Plaza, Lomas, Miangolarra, 2004).
2. **Cervical or upper thoracic muscle or soft tissue stretching techniques (Weak evidence)**
   Manual muscle stretching or other soft tissue mobilization/manipulation techniques have been found to be helpful in treatment of non-specific neck pain. Treatment typically places an emphasis on assessment and treatment of impaired flexibility in the suboccipital, anterior/medial/posterior scalene, upper trapezius, levator scapulae, pectoralis minor and pectoralis major muscle groups (Brousseau, et al., 2012; Ylinen, Kautianen, Wiren & Hakkinen, 2007).

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3. **Centralization Procedures and Exercise (Weak evidence)**
   These procedures include those that require specific, directional repeated movements intended to centralize the patient's symptoms (Kjellman & Oberg, 2002; Murphy, Hurwitz, Gregory, & Clary, 2006). Similar (though not as well researched) to LBP, directional preference and centralization may be associated with improved outcomes (Edmond, Susan L. et al 2014).

C. Clinical interventions not recommended (Poor evidence or expert opinion)

1. **Activity Limitation/Participation Measures**
   Evidence supporting the long term benefit of patient education procedures, use of soft cervical collars, and activity limiting interventions in isolation of other more active interventions is generally lacking, therefore it is not recommended that physical therapy clinicians utilize activity limiting interventions and use education methods that are easily reproduced by the patient (Crawford, Khan & Varley, 2004; Jull, Trott, Potter, et al., 2002; Rosenfeld, Seferiadis, A, Carlsson & Gunnarsson, 2003; Schnabel, Ferrari, Vassiliou, & Kaluza, 2004)
2. **Therapeutic Modalities and Acupuncture (Poor or insufficient evidence)**

Therapeutic modalities including pulsed electromagnetic therapy, electrical stimulation, therapeutic ultrasound, transcutaneous electrical nerve stimulation are not recommended due to poor or insufficient evidence of treatment efficacy(TENS) (Gross, Aker, Goldsmith, & Pelosso, 2002; Kjellman, Skargren, & Oberg, 1999; Verhagen, Peeters, de Bie, & Oostendorp, 2002).

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises
- Home traction unit

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises, stretching
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Anesthesia/pain management
- Acupuncture

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Orthopedic – Cervical Non Specific

Cervicalgia with or without Headache 163

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Cervicalgia with or without Headache

Diagnoses included

- Cervicalgia
- Mechanical neck pain
- Neck pain
- Cervical Spondylosis
- Whiplash Associated Disorders (WAD)
- Cervicogenic Headache
- Tension Type Headache
- Stress Headache

Definition

Head, neck, and upper back pain is defined as pain that consists of soreness, tension, pain, and/or stiffness in the neck and upper back region without a radicular component. This includes neck and upper back pain that is typically increased with movement or prolonged positioning, decreased with rest, and is of mechanical and/or chemical origin. Head, neck and upper back pain can be categorized according to the International Classification of Functioning, Disability and Health (ICF) impairment-based category of low back pain (World Health Organization [WHO], 2005) in the following ways:

- Neck pain with mobility deficits (b7101 Mobility of several joints)
- Neck pain with headaches (b28010 Pain in head and neck)
- Neck pain with movement coordination impairments (b7601 Control of complex voluntary movements)

Patient History

Patient Data

- general demographics
- living environment
- functional status and activity level
- medications
- other tests and measurements (laboratory and diagnostic tests)
- past history (including history of prior therapy and response to prior treatment)

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Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Direct trauma to the head with loss of consciousness (LOC)	Subdural hematoma; epidural hematoma; fracture
Nuchal rigidity, and/or positive Brudzinskis, or Kernigs sign	Subarachnoid hemorrhage; meningitis
Bladder dysfunction associated with onset of neck pain	Myelopathy; spinal cord injury
Associated dysphasia	Cerebrovascular accident
Associated cranial nerve or central nervous system (CNS) signs/symptoms	Tumor; intracranial hematoma
Onset of new headache	Tumor; infection; vascular cause (older patients, also consider temporal arteritis, glaucoma)
Co-morbidities of rheumatoid arthritis, seronegative arthritides, Downs syndrome	Atlantoaxial instability due to associated transverse ligament laxity
Cancer	Malignancy, or primary site
Alcoholism, drug abuse	Side effect, or withdrawal phenomenon
Immune-compromised state	Infection

Differential Diagnoses

- Cervical nerve root compression
- Other myelopathies
- Multiple sclerosis
- Metastatic Ca
- TIA/CVA
- Cervical disc herniation (neurologic abnormality and radicular pain typically)
- Dislocation of the cervical spine (significant trauma, greater than 3 mm loss of contact between contiguous segments)
- Fracture of cervical spine (history, abnormal radiograph)
- Inflammatory arthritides, such as rheumatoid arthritis (history, radiographic findings)
- Cervical spine tumor, or infection (night pain, weight loss, history of cancer, fever)

Note: Diseases that may refer pain to the cervical spine include: brain lesions, CAD, dental disease, esophageal disease, upper airway disease, lymphadenopathy, TMJ dysfunction, ankylosing spondylitis.

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR The Neck Disability Index (ODI) with a score of 16% or higher (Minimum Clinically important difference 10 points (Young, et al, 2009))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or

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periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.

- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Presentation

- Pain is usually of insidious onset
- May report prior history of episodic neck pain
- May begin between the 3rd and 6th decades of life and persist for years
- Limited active cervical range of motion
- Neck pain
- Tenderness to palpation
- Normal neurological findings

Subjective Findings

- Pain and stiffness in neck—pain typically worse with motion
- Headaches may accompany neck pain
- Essentially constant awareness of some level of neck discomfort, or limitations in motion
- Pain may radiate to superior shoulders or to mid scapular areas without numbness or tingling

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Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

The medical literature would indicate that the cause of a patient/client's neck pain is often not clearly known (Borgouts, Koes, & Bouter, 1998) therefore, the physical therapist should assess for impaired muscular, neural, connective tissue, and articular joint function. The patient history is to also clarify any concerns or questions that may arise from the self-report questionnaires (Cleland, Childs, Fritz, & Whitman, 2006). Factors in the patient/client history that have importance include age greater than 40 years of age, co-existing lower back pain, greater than 3 months duration, loss of hand strength/function, and psychological factors such as anxiety, and poor quality of life, and medical "red flags (Cook, 2008). Use of the Canadian Cervical Spine Rule should be considered especially in a direct access environment (Bandiera, G., Stiell, I.G., Wells, G.A., Clement, C., De Maio, V., Vandemheen, K.L., Greenberg, G.H., Lesiuk, H., Brison, R., Cass, D. and Dreyer, J., 2003).

In performing subjective and objective examination of the patient/client, clinicians should take into consideration those diagnostic classifications associated with serious pathological conditions and/or psychosocial factors. The patient's reported activity limitations or impairments of body function and structure should be consistent with conditions improvable with physical therapy interventions.

WAD (whiplash associated disorders) conditions

WAD conditions can be classified 5 types- 93% of are WAD II (neck pain and a musculoskeletal symptom such as loss of ROM or point tenderness) and are often treated by physical therapy (Sterling M., et al, 2004)

According to a systematic review and meta- analysis done in 2015, there is very little Level 1 or Level 2 evidence supporting conservative management of **acute** WAD. The evidence that does exist is favorable but does not meet minimally clinically significant differences for pain or ROM. (Wiangkham T, et al, 2015)

A systematic literature review in suggests that although different central mechanisms seem to be involved in sustaining the pain complaints in whiplash patients, hypersensitivity of the central nervous system plays a significant role. (Van Oosterwijck, J., et al 2013)

Clinicians should incorporate a WAD Clinical Prediction Rule to help guide their patient care (Ritchie C, et al, 2015).

The results of a systematic review suggest that both patients with idiopathic neck pain and patients with WAD have poorer balance than healthy controls. (Silva, A.G. et al, 2013).

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Headache conditions

Diagnosis of cervicogenic headaches cannot be made without use of an anesthetic blockade. However, tension type headaches are classified by the presence of myofascial trigger points. (Becker, W. J., 2010).

Differential diagnosis of cervicogenic headache may include pain with active range of motion, pain with passive intervertebral mobility, and a positive Cervical Flexion Rotation Test (Rubio-Ochoa J, 2016)

Evaluation

- Postural Observation
- Palpation
- Cervical active range of motion
- Measurement of bodily impairment. Cervical active range of motion is measured ordinarily in the seated, upright position and flexion, extension, lateral side flexion and bilateral rotation directions are measured (Cleland, Childs, Fritz, & Whitman, 2006). Use of a validated measurement instrument is necessary (Youdas, Carey, &Garret, 1991).
- Cervical and upper thoracic segmental mobility
- Measurement of bodily impairment. The purpose of this assessment is to determine the amount of accessory movement available at each spinal segment in relation to motion segments proximal and distal to the segment being assessed (Maitland, 2001). The patient is placed either in a supine or prone position and examination of the inter-segmental movement is palpated and assessed. The therapist is assessing for normal, hypomobile, or hypermobile movement correlated with pain associated with movement impairment (Bovim, Schrader, & Sand, 1994; Sandmark & Nisell, 1995).
- Upper cervical ligamentous stability tests
  - Distraction test
    - Measurement of nervous system structural impairment. The purpose of the test is to maximize the diameter of the neuroforamina and correlate diminishment of the patient's primary symptom complaint (Cook & Hegedus, 2008; Wainner, Fritz Irrang, Boninger, Delitto, & Allison, 2003). A positive test is indicated if the client/patient has a reduction or elimination of primary symptoms.
  - Alar and transverse ligament tests
    - Sharp-Purser Test
    - Measurement of nervous system structural impairment. The patient is sitting with support and one palm of the examiner's hand is place on thepatient forehead and while the craniovertebral junction is in a slight flexed position the head is glided backwards on the neck. The patient's primary symptoms are reproduced. This is a test for spinal cord compression syndromes of the upper cervical spine (Sharp & Purser, 1961; Uitvlugt & Idenbaum, 1988).

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- Alar Ligament Test
- Measurement of bodily impairment. This test tests for ligamentous insufficiency of the alar ligaments which provide stability to the atlanto-occipital junction of the upper cervical spine (Cook & Hegedus, 2008; Magee, 2002). This test is first performed with the patient in a sitting position, and the therapist stabilizes the spinous process of C2 by use of a pinch grip with one hand while slightly sidebend the patient's head with the other hand. A delay in movement of the C2 spinous process would indicate a positive test (Hoffman, Mower, Wolfson, Todd, & Zucker, 2000).

- Cervical Flexion Rotation Test
  - Measurement of bodily impairment. This test assesses the presence of cervicogenic headaches (Ogince, M., 2007; Cook & Hegedus, 2008). The patient is supine and the therapist maximally flexes the cervical spine and while maintaining this position the therapist carefully rotates the head bilaterally. Limited movement to less than 45 degrees of rotation to either side would indicate a positive test (Hall & Robinson, 2004; Hall, T. M.,2008).
- Cranio-cervical flexion test
  - Measurement of bodily impairment. The patient is supine and the test is performed by the patient by flexing the cranio-cervical junction against a graded resistance and thereby flattening the cervical lordosis. A normal response is a 26-30 mm Hg pressure increase held for >10 seconds (Fernandez-De-Las-Penas, Perez-De-Heredia, Molero-Sanchez, & Mianogolarra, 2007; Jull, Barrett, Magee & Ho, 1999).
- Neck Flexion Muscle Endurance Test
  - Measurement of bodily impairment. The patient is supine and the test is carried out by the patient's ability to lift the head and neck against resistance with the chin maximally retracted for an extended period of time (Harris, Heer, Roy, Santos Whitman & Wainner, 2005; Olsen, Millar, Dunker, Hicks & Glanz, 2006).
- Vertebral Artery Insufficiency Test
- Neurological testing
  - Upper limb adverse neural tension tests
  - Measurement of nervous system structural impairment. The purpose of the upper Limb tension test is to assess the degree of mobility of the upper limb neural elements correlating with client/patient primary symptom reproduction. A test is considered positive if reproduction of the primary complaint, and/or side-to-side differences in ROM greater than 10 degrees is present (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003). The patient is tested in a non-weight bearing supine position and upper limb peripheral nerve biased tension tests are carried out for symptom reproduction and impairment correlation (Butler, 2000).
  - Spurling's test
  - Measurement of nervous system structural impairment. Assessment of the patient's ability to combine sidebending with axial compression to diminish the diameter of the neuroforamina of the cervical spine. A positive test is considered when the patient's primary peripheralising symptoms are

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reproduced (Cook & Hegedus, 2008; Wainner, Fritz, Irrang, Boninger, Delitto & Allison, 2003).
    - Valsalva Test
    - Measurement of nervous system structural impairment. The patient inhales and bears down without exhaling in order to increase intrathecal pressure and reproduce the patient's primary complaint (Wainner, Fritz, Irrang, Boninger, Delitto, & Allison, 2003).
    - Upper Extremity Manual Muscle Tests
    - Dermatomal Testing
    - Upper Extremity Reflex Tests
    - Hyperreflexia may indicate upper motor neuron lesion (Harrop, et al 2007)
    - Balance and Gait may need assessment
    - The results of a systematic review suggest that both patients with idiopathic neck pain and patients with WAD have poorer balance than healthy controls. (Silva AG and Cruz AL, 2013)
- Functional outcome measures (Level I, Strong evidence base.)
  Clinicians should consider use of scientifically validated self-report patient/client functional outcome measures such as:
    - Neck Disability Index [NDI] (Pietrobon, Coeytaux, Carey, Richardson, & DeVellis, 2002),
    - Pain diagrams using the Numeric Pain Rating Scale (NPRS) (Aprill, Dwyer, & Bogduk, 1990; Chan, Goldman, Ilstrup, Kunselman, & O'Niell, 1993)
    - Patient-Specific Functional Scale (Stratford, Gill, Westaway, & Binkley, 1995; Westaway, Stratford, & Binkley, 1998).

These outcome scoring methods are useful in identifying baseline, interval progress, and discharge status.

Referral Guidelines

- Refer patient to their primary care provider, for evaluation of alternative treatment options if:
    - Improvement does not meet above guidelines or improvement reaches a plateau;
    - Atrophy of upper extremity occurs;
    - Signs of fracture or dislocation occurs;
    - Increased neurologic signs/symptoms: increased UE numbness/tingling, increased UE weakness, increased UE pain, decreased UE reflexes.
    - No objective clinical improvement after 6 weeks of direct care

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Management/Intervention

Neck pain has a good natural course with 80-90% of cases diminishing within 4-6 weeks (Douglass, & Bope, 2004). Head, neck and upper back pain can be described as having a normal expected course and an abnormal one. In a normal course of head, neck and upper back pain, symptoms should diminish over time and can be improved with appropriate intervention. An abnormal episode occurs when a patient's symptoms and/or disabilities do not decrease over time and either stay the same or increase. The role of the therapist is to provide appropriate therapeutic interventions and education of the patient/client in appropriate preventive measures in cases where the patient/client symptoms and/or disabilities exhibit an abnormal course.

- Clinical Interventions (Recommended)
  Cervical passive vertebral mobilization/manipulation techniques (Level I, Strong evidence)
  Cervical mobilization and manipulative passive motion procedures are recommended, especially in conjunction with appropriate cervical exercises (Bronfort, Evans, Nelson, Aker, Goldsmith & Vernon, 2001; Cleland, Glynn, et al., 2007; Evans, Bronfort, Nelson & Goldsmith, 2002; Gross, Hoving, Haines, Goldsmith, Kay, Aker,…Cochrane Group, 2004; Hoving, Koes, de Vet, et al., 2002; Nilsson, Christensen & Hartvigsen, 1997; Walker, Boyles, Young, et al., 2008; Gross A, Langevin P, Burnie SJ, Bédard-Brochu MS, Empey B, Dugas E, Faber-Dobrescu M, Andres C, Graham N, Goldsmith CH, Brønfort G, Hoving JL, LeBlanc F. 2015).
- Cervical Coordination, Strengthening and Endurance Exercises (Level I, Strong evidence)
  Clinicians should consider active exercise interventions that emphasize coordinated movement, endurance development and strength training of the cervical spine and scapulothoracic musculature. (Chiu, Lam, & Hedley, 2005; Falla, Jull, Russell, Vicenzino, & Hodges, 2007; Jull, Falla, Treleaven, Hodges & Vicenzino, 2007; Jull, Trott, Potter, et al., 2002; Taimela, Takala, Asklof, Seppala, & Parviainen, 2000; Ylinen, Nikander, Nykänen, Kautiainen, & Häkkinen, 2010; Gross A, Kay TM, Paquin JP, Blanchette S, Lalonde P, Christie T, Dupont G, Graham N, Burnie SJ, Gelley G, Goldsmith CH, Forget M, Hoving JL, Brønfort G, Santaguida PL 2015).
  - WAD Considerations
    - A RCT study indicates that supervised neck-specific exercise with, or without a behavioral approach, may have greater clinical benefits than general physical activity for patients with chronic WAD. (Maria L., et al 2015)
  - Patient/Client Education and Counseling (Level I, strong evidence)
    - Educating the patient/client regarding favorable outcomes, early movement interventions and self-care is recommended. The patient/client is educated that early return to normal, non-provocative movement is important and that return to function and full recovery are the most common outcomes over the long term (Schnabel, Ferrari, Vassiliou, & Kaluza, 2004; Vassiliou, Kaluza, Putzke, Wulf, & Schnabel, 2006).
- WAD Considerations
  A RCT from 2014 found no benefit from an exercise program versus education for chronic whiplash (Zoe A, et al, 2014)

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- Clinical interventions with neutral recommendation (Level II evidence or based on weak evidence
  - Thoracic mobilization/manipulation techniques (Weak evidence)
  - Thoracic mobilization and manipulative passive motion procedures are proposed with neutral recommendations (Cleland, Childs, McRae, Palmer, & Stowell, 2005; Cleland, Glynn, Whitman, Eberhart, MacDonald & Childs, 2007; Fernandez, Fernandez, Plaza, Lomas, Miangolarra, 2004).
  - Joint mobilization may be more effective than massage therapy for cervicogenic headaches (weak evidence) (Youssef, E. F., & Shanb, A. S. A. 2013).
  - Cervical or upper thoracic muscle soft tissue stretching techniques (Weak evidence)
  - Manual muscle stretching or other soft tissue mobilization/manipulation techniques have been found to be helpful in treatment of non-specific neck pain. Treatment typically places an emphasis on assessment and treatment of impaired flexibility in the suboccipital, anterior/medial/posterior scalene, upper trapezius, levator scapulae, pectoralis minor and pectoralis major muscle groups (Brousseau, et al., 2012; Ylinen, Kautianen, Wiren & Hakkinen, 2007). However stretching alone has not been shown to have any benefit. (Gross A, Kay TM, Paquin JP, Blanchette S, Lalonde P, Christie T, Dupont G, Graham N, Burnie SJ, Gelley G, Goldsmith CH, Forget M, Hoving JL, Brønfort G, Santaguida PL 2015)
  - Low level laser therapy (Weak evidence)
  - Weak evidence supports LLLT for cervical osteoarthritis. There is moderate evidence supporting LLT for chronic neck pain. (Gross, A.R., Dziengo, S., Boers, O., Goldsmith, C.H., Graham, N., Lilge, L., Burnie, S. and White, R., 2013.)
  - Dry Needling (Moderate evidence)
  - Trigger Point Dry Needling may decrease neck pain intensity and widespread pressure pain sensitivity, and also increase active cervical range of motion, in patients with acute mechanical neck pain. (Mejuto-Vázquez, M.J., Salom-Moreno, J., Ortega-Santiago, R., Truyols-Domínguez, S. and Fernández-de-las-Peñas, C., 2014; Liu, L., Huang, Q.M., Liu, Q.G., Ye, G., Bo, C.Z., Chen, M.J. and Li, P., 2015; Llamas-Ramos, R., Pecos-Martín, D., Gallego-Izquierdo, T., Llamas-Ramos, I., Plaza-Manzano, G., Ortega-Santiago, R., Cleland, J. and Fernandez-De-Las-Penas, C., 2014)
  - Trigger point dry needling may be useful in conjunction with other modalities to reduce cervicogenic and tension type headaches (France, S., et al 2014)
  - Transcutaneus Electrical Nerve Stimulation (TENS) (Weak evidence)
  - Moderate to weak evidence supports TENS for acute neck pain (Johnson MI, Paley CA, Howe TE, Sluka KA. 2015)
- Clinical interventions not recommended (Poor evidence or expert opinion)
  - Activity Limitation/Participation Measures
    Evidence supporting the long term benefit of patient education procedures, use of soft cervical collars, and activity limiting interventions in isolation of other more active interventions is generally lacking, therefore it is not recommended that physical therapy clinicians utilize activity limiting interventions and use education methods that are easily reproduced by the patient (Crawford, Khan & Varley,

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2004; Jull, Trott, Potter, et al., 2002; Rosenfeld, Seferiadis, A, Carlsson & Gunnarsson, 2003; Schnabel, Ferrari, Vassiliou, & Kaluza, 2004)

- Therapeutic Modalities (Poor or insufficient evidence)
  Therapeutic modalities including pulsed electromagnetic therapy, electrical stimulation, therapeutic ultrasound, transcutaneous electrical nerve stimulation are not recommended due to poor or insufficient evidence of treatment efficacy(TENS) (Gross, Aker, Goldsmith, & Pelosso, 2002; Kjellman, Skargren, & Oberg, 1999; Verhagen, Peeters, de Bie, & Oostendorp, 2002). Galvanic current, iontophoresis, EMS, and a static magnetic field are not recommended**.** (Kroeling P, Gross A, Graham N, Burnie SJ, Szeto G, Goldsmith CH, Haines T, Forget M. 2013)
- Mechanical Traction
  - No strong evidence supports continuous nor intermittent traction for non-specific neck pain nor chronic neck pain. There may be some short-term pain relief but the evidence is insufficient. (Graham N, Gross A, Goldsmith CH, Klaber Moffett J, Haines T, Burnie SJ, Peloso PMJ. 2008; Borman, P., Keskin, D., Ekici, B. et al. 2008; Yang JD, Tam KW, Huang TW, Huang SW, Liou TH, Chen HC 2016; Chiu TTW, Ng JK-F, Walther-Zhang B, Lin RJH, Ortelli L, Chua SK 2011)
- WAD Specific Considerations
  - Acupuncture and/or dry needling have no effect on WAD (Tae-Woong Moon et al, 2014)
  - Vestibular rehabilitation can have positive effects on balance and postural control (Hansson E E, 2006).

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

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Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

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Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Use of a cervical pillow while sleeping may be helpful
- Theraband for therapeutic exercises
- Hot packs/cold packs
- Home electrical stimulation unit
- Gym ball

Self-Care Techniques

- Postural advice, postural exercises
- Flexibility exercises
- Cervical stabilization exercises, isometrics
- Aerobic conditioning, such as walking or swimming
- Heat applications, cold packs, if needed, to relieve discomfort/stiffness

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Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Physiatry
- Medication
- Acupuncture

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Orthopedic – General Conditions

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Compartment Syndrome

Synonyms

- Volkmann ischemia
- Chronic exertional compartment syndrome

Definition

Compartment syndrome occurs when increased pressure in a muscle compartment compresses the nerves and blood vessels in the area. Compartment syndrome may be related to acute trauma such as fractures or muscle injury. It may also be associated with exertion, repetitive stresses and microtrauma, in which case it can be chronic or acute.

Patient History

Patient history may include:

Patient Data

Trauma, fractures, bleeding in enclosed space, external compression of the limb, vigorous exercise, small thrombotic or embolic events, periostitis (shin splints), and intramuscular injection have all been implicated in the pathogenesis of compartment syndrome.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, severe pain	Possible infection
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of foot, toes, exertional foot or calf pain	Vascular occlusion; vascular insufficiency

Presentation

- All of the following conditions have been implicated in the pathogenesis of compartment syndrome:
  - Trauma
  - Fractures
  - Bleeding in enclosed space
  - External compression of the limb by casts or dressings
  - Limb placement during surgery

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- Small thrombotic or embolic events
- Intramuscular injection
- Frostbite
- Snake bite
- Vigorous exercise
- Muscle imbalances
- Extremity malalignment
- Training errors
- Inadequate footwear
- Poor technique

Subjective Findings

Pain, swelling, and a feeling of tightness in the involved region are often the chief complaints.In the acute situation, the level of pain reported by the individual is often disproportionate to the physical findings. In the chronic stage, symptoms are often related to an overuse injury, and pain is often activity related.

Objective Findings

Objective findings may include:

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Inspection
  - Atrophy
  - Color of skin
  - Postural assessment
  - Localized swelling
  - Deformities
- Palpation of bony and soft tissue for:
  - Tightness
  - Swelling
  - Pain
  - Pulselessness
  - Paresthesia
- Range of motion, active and passive
  - Test affected area
  - Test joint above and below

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- Orthopedic/neurological testing
  - Manual muscle testing
  - Reflexes
  - Test dermotomes. myotomes
  - Joint play movements of joints above and below affected area
- Gait Analysis (Test when the is lower extremity involvement)
  - Gait cycle
  - Stance and swing phase
  - Double-leg stance
  - Single-leg stance
  - Normal cadence
  - Pelvic shift
- Functional Assessment - The following standardized tests may be used to assess functional limitations:
  - Functional Independence Measure scale (lower extremity and upper extremity involvement)
  - Disabilities of the Arm, Shoulder and Hand (DASH) (upper extremity involvement)
  - Lower extremity functional scale (LEFS)

Findings of Compartment Syndrome

- Pain
- Skin may be shiny with abnormal tissue feel
- Paresthesia and possible diminished sensation
- Possible motor weakness
- Pulse and capillary refill are typically unaffected
- Most frequently occurs in the arm and leg in acute cases, and in the anterior pretibial compartment of the leg in chronic syndromes

Differential Diagnoses

- Stress fracture
- Radiculopathy
- Shin splints
- Anterior tibialis tendonitis

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Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Treatment Methods

- Chronic or exertional syndromes are the most commonly treated in therapy and may be helped by:
  - Reducing demands on affected limb,
  - Modifying training schedules or programs to slowly improve activity level, and
  - Massaging and stretching of soft tissues.
- Post fasciotomy patients may require:
  - Training in the use of assistive devices to reduce weight bearing,
  - Exercise for improved range of motion, and
  - Progression to strengthening and return to normal activities.
  - Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.

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- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

The following table lists the procedures for ***Conservative Management***.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

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Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Decrease pain and swelling	◆ Modalities i.e. Ice/ heat ◆ Interferential current ◆ Functional electrical stimulation ◆ Transcutaneous electrical nerve stimulation ◆ Soft Tissue massage
Restore flexibility of the affected musculature	◆ Range of motion within pain-free range ◆ Sustained stretching exercises ◆ Soft tissue mobilization
Increase strength and endurance	◆ Start with exercises that decrease load to affected area e.g. aquatics ◆ Gradually add isometric and isotonic exercises ◆ Add to progressive resistive exercises ◆ Add closed chain exercises ◆ Add functional training
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual tolerance of activities and positions ◆ ADL Training ◆ Gait training ◆ Stair mobility ◆ Functional training activities ◆ Teach home exercise program of stretching, strengthening, and massage ◆ Decrease activity/load to affected compartment

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The following table lists the procedures for ***Post Fasciotomy Management***:

Expected Outcome	Procedures/Modalities Such As
Decrease pain and swelling	◆ Modalities i.e. interferential current ◆ Functional electrical stimulation ◆ Transcutaneous electrical nerve stimulation ◆ Soft Tissue massage
Restore flexibility of the affected musculature	◆ Range of motion within pain-free range ◆ Gentle sustained stretching exercises ◆ Soft tissue mobilization ◆ Mobilize adjacent joints
Increase strength and endurance	◆ Begin with isometric and isotonic exercises ◆ Add progressive resistive exercises ◆ Add closed chain exercises ◆ Mobilize adjacent joints
Normalize gait pattern	◆ Gait training ◆ Endurance training ◆ Stair mobility
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual tolerance of activities and positions ◆ ADL Training ◆ Functional training activities ◆ Teach home exercise program of stretching, strengthening, and massage ◆ Decrease activity/load to affected compartment

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises, stretching
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Medication

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Musculoskeletal Disorders

Definition

Musculoskeletal disorders affect the bones, muscles, ligaments, tendons, and nerves. Onset may be acute (having a rapid onset of symptoms) or insidious. Duration of a musculoskeletal condition may be short term (days or weeks) or chronic (long-lasting). Musculoskeletal pain can be localized in one area, or widespread. Musculoskeletal conditions may be caused by an injury to the bones, joints, muscles, tendons, ligaments, and/or nerves. Direct trauma, e.g. motor vehicle accidents, falls, fractures, collisions, or indirect trauma, e.g. poor posture, repetitive strain, prolonged immobilization or loss of mobility, or overuse, generally underlies development of musculoskeletal complaints.

Symptoms and Causes

- Bone pain: This is usually deep, penetrating, or dull. It most commonly results from injury such as contusions. It is important to be sure that the pain is not related to a fracture or tumor.
- Muscle pain: Muscle pain can be caused by an injury, an autoimmune reaction, loss of blood flow to the muscle, infection, or a tumor. The pain can also be caused by muscle spasms and trigger points.
- Tendon and ligament pain: Tendon and ligament injuries are strain injuries that result in damage to the connective tissue fibers of the tendon or ligament. Tendon injuries range from tendinitis (micro trauma) to rupture (macro trauma). Ligamentous injuries occur when ligament tears either partially or completely. This type of musculoskeletal pain often becomes worse when the affected area is stretched or moved.
- Joint pain: Joint injuries and diseases usually produce a stiff, aching, "arthritic" pain. The pain may range from mild to severe and worsens when moving the joint. The joints may also swell. Joint inflammation (arthritis) is a common cause of pain.
- Fibromyalgia: This is a condition that may cause pain in the muscles, tendons, joints, and other soft tissue. The pain is usually in multiple locations and can be difficult to describe. Fibromyalgia is usually accompanied by other symptoms.
- "Tunnel" syndromes: This refers to musculoskeletal disorders that cause pain due to nerve and/or tendon compression/inflammation. The disorders include carpal tunnel syndrome, cubital tunnel syndrome, and tarsal tunnel syndrome. The pain tends to spread along the path supplied by the nerve and may feel like burning. These disorders are often caused by overuse.
- Aching or stiffness of the entire body.
- The feeling that your muscles have been pulled or overworked
- Fatigue
- Sleep disturbances

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- Swelling or effusion
- Decreased range of motion
- Joint instability
- Muscle guarding or weakness
- Loss of strength, power, endurance
- Inability to perform purposeful, functional, intentional movements

Functional Limitations and Impairments

- Inability to ambulate
- Decreased functional work capacity
- Inability to climb stairs
- Inability to perform repetitive tasks
- Inability to perform self-care tasks
- Inability to reach
- Inability to access the community
- Inability to access transportation
- Limited independence in activities of daily living

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, severe pain	Possible infection
Edema, redness, pain	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of the affected area (s)	Vascular occlusion; vascular insufficiency
Homans Sign	Deep vein thrombosis
Axial compression	Compression fracture
Positive vertebral artery test	Vertebrobasilar ischaemia, TIA
Widespread neurological symptoms	Neurological disease
Positive Lhermitte Sign	Spinal cord pathology
Dyspnea	Lung disease/diaphragmatic paralysis

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Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Assistive devices
    - Assess assistive and adaptive devices and equipment used during functional activities
  - Protective and supportive devices
    - Assess safe use of devices
    - Assess fit and alignment
  - Balance tests (static, dynamic and during functional tasks)
    - Balance scale
    - Dizziness inventories
    - Fall scales
    - Motor impairment scales
  - Gait and Locomotion
    - Foot sprint analysis
    - Gait indexes
    - Mobility skills profiles
    - Functional assessment profiles
  - Motor Function Tests
    - Dexterity
    - Coordination
    - Agility
  - Skin Integrity
    - Skin characteristics (blistering, color, sensation, temperature, texture)
    - Wound (signs of infection, scar tissue characteristics, stage of healing)
  - Palpation of bony and soft tissue
    - Palpate involved muscles for tender nodule, taut band, tight ropiness
    - Observe pattern of referred pain
    - Provocation tests
  - Edema (measure both sides for comparison)
    - Girth measurements
    - Palpation
    - Volume measurements
  - Postural assessment
    - Postural alignment and position
  - Range of motion
    - Active and passive movement of affected area and joint above and below and contralateral joints
    - Functional ROM (e.g. squat tests, toe touch tests)
  - Manual Muscle Testing
    - Test related joints
  - Joint Integrity and mobility
    - Compression and distraction
    - Apprehension
    - Joint play and end feel

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- Glide
- Impingement
- Stress tests
  - Anterior/posterior drawer
  - Varus/valgus, shear

- Neurologic testing
  - Sensory tests (discrimination tests, coarse and light touch, cold and heat, pain, pressure, and vibration.
  - Myotome testing
  - Deep tendon reflexes

Outcome Measures by Condition/Diagnosis

There are several validated functional outcome tools that could be used. The therapist should choose an instrument appropriate for the area(s) being treated. The following standardized tools are recommended for use to assess functional limitations initially and throughout an episode of care. Only tools that are well established, easily accessible and do not require memberships or fees are recommended.

Condition/ Diagnosis	Test	Definition	Author
Elderly > 65 y.o.	Berg Balance Test	Measures both statis and dynamic balance using a 14-item scale	Donoghue and Stokes, 2009
	Gait speed	Measures overall walking performance	Mangione, et al., 2010
	Six Minute Walk test	Tests endurance by measuring the maximum distance that a person can walk in six minutes	Mangione, et al., 2010
	Timed Up and GO (TUG)	Functional mobility test generally used for the geriatric population	Mangione, et al., 2010
	Performance Oriented Mobility Assessment, Tinetti	Evaluates balance and gait	Faber, et. al., 2006 Tinetti, 1986
LE Musculoskeletal Disorder	Lower Extremity Functional Scale (LEFS)	20-itemcondition specific questionnaire designed for use for musculoskeletal conditions of the lower extremity	Binkley, et al, 1999
	Patient Specific Functional Scale (PSFS)	Patient self-report measure used to quantify activity limitation and measure functional outcome	Chatman, et al, 1997

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Low Back Pain, Chronic or Acute	Oswestry Disability Index	Self-report questionnaire that measures the degree to which back or leg pain impacts functional activities	Davidson and Keating, 2002 Maughan and Lewis, 2010
	Patient Specific Functional Scale (PSFS)	Patient self-report measure used to quantify activity limitation and measure functional outcome	Cleland, et al, 2006
	Neck Disability Index (NDI)	10 item questionnaire, 7 items related to ADLs, 2 items related to pain, and 1 item related to concentration	Cleland, et al, 2006 Young, et al, 2009
Neck Pain/Cervical Radiculopathy Pain	Patient Specific Functional Scale (PSFS)	Patient self-report measure used to quantify activity limitation and measure functional outcome	Cleland, et al., 2006
	Numeric Pain Rating Scale (NPRS)	11-pont numerical rating scale for determining pain intensity	Spadoni et al, 2004
UE Dysfunction/Musculoskeletal Disorder	Disabilities of Arm, Shoulder, Hand (DASH)	30 item questionnaire, region specific and allow comparisons across diagnosis of the upper extremity	Schmitt and Di Fabio, 2004
	Shoulder Pain and Disability Index (SPADI)	13-item self-administered questionnaire relating to pain and functional status of the shoulder region	Schmitt and Di Fabio, 2004
	Patient Specific Functional Scale (PSFS)	Patient self-report measure used to quantify activity limitation and measure functional outcome	Hefford, et al, 2012

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment Frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

For post-surgical cases, progression of the rehabilitation program is primarily time based to allow tissue healing; individual surgeons may have their own performance criteria for advancing. Both criteria may vary based on the type of surgery and specific technique used. Consult with referring surgeon.

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Problem/Expected Outcome	Procedures/Modalities Such As
Decrease pain/spasms/inflammation/ Swelling/effusion	◆ Modalities i.e. phonophoresis, ultrasound, interferential current, electrical muscle stimulation, functional electrical stimulation, transcutaneous electrical nerve stimulation ◆ Cryotherapy ◆ Thermotherapy ◆ EMG Biofeedback ◆ Trigger point therapy ◆ Paraffin baths ◆ Compression therapies ◆ Massage ◆ Mobilization/manipulation ◆ Manual traction ◆ Home program
Restore flexibility of the affected musculature and joints	◆ Segmental joint mobilization ◆ Passive exercises ◆ Range of motion within pain-free range ◆ Sustained stretching exercises ◆ Soft tissue mobilization ◆ Home program
Increase strength and endurance of the spine and extremities	◆ Active assisted exercises, active, and resistive exercises (concentric, isotonic, eccentric, isokinetic, isometric, and plyometric ◆ Aquatic programs ◆ Home program
Improvement in body mechanics and postural stabilization	◆ Body mechanics training ◆ Postural stabilization activities ◆ Postural Control ◆ Home program
Increase balance, coordination, and agility	◆ Motor function retraining ◆ Neuromuscular re-education ◆ Perceptual training ◆ Home program
Improvement in gait and locomotion	◆ Gait training ◆ Training in use of assistive devices ◆ Wheelchair training ◆ Home program
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ ADL training ◆ Device and equipment use and training ◆ IADL training ◆ Home program
Preparation for Discharge	◆ Teach a self-management program ◆ Instruction and education of patient and care-givers on current condition and functional limitations

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Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises
- Gymball for therapeutic exercises
- Home electrical stimulation unit
- Home traction
- Soft tissue mobilization devices - tennis balls, knobblers, etc.
- Exercise equipment – bike, treadmill, weights

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Instruction in activity modification
- Stretching exercises
- Aerobic conditioning exercises to increase strength and endurance
- Heat/cold applications, if needed, to relieve discomfort/stiffness
- Self-mobilization, soft tissue mobilization
- Ergonomics
- Strengthening exercises

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Massage therapy
- Physiatry
- Medication
- Chiropractic care
- Homeopathy
- Nutritional intervention
- Acupuncture
- Yoga

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Myofascial Pain Syndrome

Synonyms

- Myalgia
- Fibromyositis

Definition

An inflammation/irritation of myofascial tissue, associated with focal points of tender nodules that may refer pain to other areas of the body when palpated.

Patient History

Patient history may include:

Patient Data

Patients usually report regionalized aching and poorly localized pain in the muscles and joints. They also may report sensory disturbances such as numbness in a characteristic of distribution. The type of pain felt is characteristic of the muscle involved. Onset may be acute after a specific event or trauma (e.g., moving quickly in an awkward position) or chronic from poor posture or overuse. Patients may note disturbed sleep. Those with cervical and periscapular myofascial pain may try to find a comfortable sleeping position. They may or may not be aware of muscle weakness in the affected muscles. They may have a tendency to drop things.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- Determine OPQRST (Onset, Provocative/Palliative factors, Quality, Radiation/Referral pattern, Site [location], Timing of complaint).

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Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear, fracture
Fever, severe pain	Infection
Loss of distal pulse	Arterial occlusion
Progressive weakness	Muscular dystrophies; Guillan-Barre; dermatomyositis, MS, entrapment neuropathies
Palpable mass	Hemangioma; soft tissue tumor; foreign body
Diabetes; paresthesias	Neuropathy; other metabolic causes (e.g., B12 deficiency, hypothyroidism)
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis, infection
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of extremity, exertional extremity pain	Arterial occlusion
Exertional symptoms in chest or upper extremities	CAD
Pleuritic pain, SOB, unrelenting cough	Pulmonary diseases
Constipation, symptoms worse or better with meals, bloody stools	GI conditions
Pain with urination, hematuria	UTI, renal stone
Immune-compromised state	Infection

Presentation

This condition often occurs in areas of muscles that previously experienced cumulative or sudden onset trauma. Typically, subsequent acute manifestations are precipitated by exposure to cold, or by overstretching/overloading the same region of muscle frequently seen in people with poor posture. Symptoms are suggestive of neurologic disorders including: diffuse pain and tenderness, headache, vertigo, visual disturbances, paresthesias, incoordination, and referred pain and are characterized by the presence of myofascial trigger points.

Subjective Findings

- Dull aching pains in muscles rather than joints
- Patient complains of a diffuse area of pain/stiffness covering an area adjacent to the main area of complaint
- May report "knots" or "bumps" in the involved muscles

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

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Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Inspection
    - Postural assessment
    - Localized swelling
    - Deformities
  - Palpation of bony and soft tissue
    - Palpate involved muscles for tender nodule, taut band, tight ropiness
    - Observe pattern of referred pain
    - Temperature changes
    - Motion palpation of spine
    - Test accessory movement
  - Range of motion
    - Test active, passive movement of affected area and joint above and below.
  - Manual Muscle Testing
  - Orthopedic testing
    - Cervical spine: Spurling's test, Distraction test, Nerve tension test, Vertebral artery test
    - Lumbar spine: Straight leg raise test, specific torsion test, slump test, Trendelenberg test, leg length discrepancy test
  - Neurologic testing if complaints radiate to extremities or signs/symptoms of cauda equina syndrome are present
    - Dermatomes
    - Myotomes
    - Deep tendon reflexes
  - Functional assessment - The following standardized tests may be used to assess functional limitations:
    - Cervical spine: Use Neck Disability Index to assess functional disability
    - Lumbar/Thoracic spine: Use the Oswestry Disability Index to track functional disability

Findings of Myofascial Pain Syndrome

- Involved muscle is generally resistant to stretching, limited by pain, taut band is palpable.
- Tender nodules or areas of ropiness are noted in involved muscle group.
- Nodular areas are tender to palpation and may elicit a jump.
- Sensitized areas are generally called trigger points, and if active, palpation may lead to referral of pain.

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Differential Diagnoses

- Fibromyalgia
- Radiculopathy

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Treatment Methods

Therapy focuses on correction of muscle shortening by targeted stretching and strengthening of affected muscles and correction of aggravating postural and biomechanical factors. Modalities such as electrical muscle stimulation can be useful to decrease pain to allow participation in an active exercise program. Corrections of leg-length discrepancies with a heel lift or use of dynamic insoles also may be helpful. Various other techniques may also be effective i.e. massage and exercise, stretching, ultrasound and biofeedback.

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

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Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Decrease pain/spasms	◆ Modalities i.e. Phonophoresis, interferential current, electrical muscle stimulation, functional electrical stimulation, transcutaneous electrical nerve stimulation ◆ Cryotherapy ◆ Thermotherapy ◆ EMG Biofeedback ◆ Trigger point therapy
Restore flexibility of the affected musculature and vertebral joints	◆ Segmental joint mobilization ◆ Range of motion within pain-free range ◆ Sustained stretching exercises ◆ Soft tissue mobilization
Increase strength and endurance of the spine and extremities	◆ Resisted Isometric Exercises ◆ Segmental strengthening ◆ Isotonic exercises ◆ Functional training
Improvement in body mechanics and postural stabilization	◆ Body mechanics training ◆ Postural stabilization activities ◆ Postural Control
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual tolerance of activities and positions ◆ Perform ergonomic work assessment ◆ Avoid prolonged static postures ◆ Teach home exercise program of stretching, strengthening, and application of ice or heat ◆ Assess need for orthotics (i.e. dynamic insoles)

Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises
- Gymball for therapeutic exercises
- Home electrical stimulation unit

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Instruction in energy conservation techniques
- Stretching exercises
- Aerobic conditioning exercises to increase strength and endurance
- Heat applications, if needed, to relieve discomfort/stiffness

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Massage therapy with aggressive deep myofascial therapy
- Physiatry with aggressive deep myofascial therapy
- Medication
- Chiropractic

References

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Myositis Ossificans

Synonyms

- Myo-osteosis
- Traumatic ossifying myositis
- Ossifying hematoma

Definition

Myositis Ossificans is the development of bony deposits in muscle tissue. This occurs as an abnormal healing response after a trauma, or chronic irritation to the muscle.

Patient History

Patient history may include:

Patient Data

Condition most frequently arises when an existing muscle contusion is treated too vigorously, or when patient is returned to activity before complete muscle healing has occurred.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear
Fever, severe pain	Infection, Osteomyelitis
Popliteal fossa pain, sudden onset	Popliteal aneurysm
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer, osteosarcoma	Cause of symptoms (metastatic or primary)
Discoloration of extremity	Arterial occlusion, vascular insufficiency
Immune-compromised state	Infection
Palpable mass	Hemangioma, soft tissue tumor, foreign body

Presentation

Palpable mass in a muscle belly (commonly reported in the quadriceps or biceps brachialis muscles), although definitive diagnosis usually comes via radiography.

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Subjective Findings

- Complaint of stiffness accompanied by loss of range of motion in adjacent joint.
- Pain on palpation.
- History of blunt trauma or recurrent trauma to muscle with hematoma.

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

- Soft-tissue tumors
- Hemangioma
- Foreign body

Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Inspection
    - Contractures
    - Muscle atrophy
    - Antalgic gait
    - Posture/alignment
  - Palpation of bony and soft tissue
    - Effusion/hematoma
    - Mass in muscle belly
    - Warmth
  - Range of motion, active and passive
    - Quadriceps: knee -flex, extension, Lateral-medial rotation, hip-flex, extension, abduction, external rotation, internal rotation
    - Biceps brachialis-Elbow flex, extension, supination, pronation
  - Manual muscle testing
    - Quadriceps: knee -flex, extension, hip-flex, extension, abduction, external rotation, internal rotation
    - Biceps brachialis-Elbow flex, extension, supination, pronation
  - Orthopedic testing
    - Joint play movements
    - Ligamentous instability tests
    - Meniscal tears
    - Patellofemoral joint involvement
    - Leg length discrepancy
    - Balance/proprioception
  - Neurologic testing if neurologic signs are present
    - Test reflexes-Lower extremity: Patellar, Hamstring,
    - Upper extremity: Biceps, Brachialis
    - Test dermatomes:
      - Lower extremity-L4, L5, S1
      - Upper Extremity-C5-T1

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- Functional Assessment - The following standardized tests may be used to assess functional limitations:
  - Lower extremity functional scale (LEFS) (For Lower extremity involvement)
  - Disabilities of the Arm, Shoulder and Hand (DASH)) For upper extremity involvement)

Findings of Myositis Ossificans

- Swelling usually occurs at the time of initial injury.
- Restricted motion caused by pain or swelling.
- Painful limit may be present

Differential Diagnoses

- Neoplastic pathology
- Osteonecrosis

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Treatment Methods

- Therapy program goals are to:
  - minimize hematoma in acute phase,
  - normalize pain-free range of motion,
  - prevent muscular atrophy, and
  - maintain proprioception and cardiovascular fitness.

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Therefore, a therapy program will consist of modalities to minimize the effusion, and therapeutic exercises for ROM and strengthening.

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

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Expected Outcome	Procedures/Modalities Such As
Restore flexibility of affected muscles	➢ Iontophoresis (with acetic acid), ultrasound to affected muscles to soften the bony mass ➢ Gentle pain-free passive range of motion ➢ Active range of motion ➢ Avoid forceful or sustained stretching
Enhance neuromuscular performance during functional activities	➢ Begin with isometric exercises ➢ Begin light resistance exercises as range of motion increases ➢ Add closed chain exercises
Improvement in body mechanics and postural stabilization	➢ Body mechanics training ➢ Postural stabilization activities ➢ Balance and proprioception exercises ➢ Endurance exercises
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	➢ Gradual resumption of activities relating to work, community and leisure ➢ Gait training ➢ Functional Training ➢ Teach application of passive, active range of motion and strengthening program ➢ Use of protective pad to area when sports resumes

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Cold packs
- Theraband for therapeutic exercises

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening
- Cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Medication

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Osteoporosis

Synonyms

In advanced stages, frequently coexists with osteomalacia/osteopenia.

Definition

Osteoporosis is the reduction in the number and size of bony trabeculae resulting in weakened bone, deformity, and, when associated with trauma or other pathology pain. It is more frequent in women, generally beginning after menopause, and often leading to fractures in the spine (occasionally spontaneous), hip and wrist. Long-term corticosteroid use is also associated with osteoporosis.

Risk Factors

- Age > 65 years
- Female
- Positive family history
- Caucasian, Asian, Hispanic
- Low body weight
- Life style characteristics smoker, sedentary, ETOH, high caffeine intake

Patient History

Patient history may include:

Patient Data

- General demographics
- Living environment
- History of current condition
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests),
- Past history (including history of prior therapy and response to prior treatment)
- Menopause
- Body type
- Prior level of function

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Trauma	Fracture
Onset following minor fall or heavy lifting in elderly	Fracture
Direct Blow to the back in young adult	Fracture
Unexplained weight loss	Malignancy
Prior history of cancer	Malignancy
Pain that is worse with recumbency or worse at night	Malignancy
Fever or recent bacterial infection	Infection
Intravenous drug abuse or immunosuppression	Infection
Pain that does not change with change in position	Kidney disease

Presentation

Patient often presents with diffuse pain complaints that can become sharp on flexion or compressive activities. The vertebral body tends to fracture and compress to a wedge shape resulting in thoracic kyphosis and flattening of the lumbar lordosis.

Subjective Findings

- Pain typically worse with flexion of the spine when osteoporosis involves the vertebrae.
- Back motion not greatly restricted.
- Surrounding muscle spasm.
- Frequently, there are no symptoms until a fracture occurs.

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

Note: Extra spinal diseases that may refer pain to the back include: aortic aneurysm, colon Cancer, endometriosis, hip disease, kidney stones, ovarian disease, pancreatitis, pelvic infections, tumors or cysts of the reproductive tract, uterine cancer.

The most serious cause of low back pain is malignant tumor. Most malignant tumors are metastatic and some may cause bony collapse and paralysis. Primary cancers that most commonly metastasize to bone consist of adrenal, breast, kidney, lung, prostate, and thyroid.

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Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Inspection for:
    - Thoracic kyphosis, Dowager's hump (decreased cervical lordosis), decreased lumbar lordosis
    - Use of assistive devices
  - Palpation of bony and soft tissue
    - Muscle spasms
    - Muscular pain
    - Tenderness secondary to fractures (percussion on vertebrae)
  - Range of motion
    - Active and passive range of motion of:
    - Cervical spine, lumbar spine, thoracic spine, hips, wrist
  - Motion palpation of spine
    - Accessory joint movements of thoracic and lumbar spine
  - Orthopedic testing
    - Straight leg raise test
    - Prone knee bending test Femoral nerve traction test
    - Specific Torsion Test
    - Trendelenburg's test and S1 nerve root test
  - Neurologic testing if complaints radiate to lower extremities or signs/symptoms of cauda equina syndrome are present
    - Myotomes: Hip Flex. (L2), Knee ext. (L3), Ankle dorsiflexion. (L4)
    - Dermatomal Sensation Tests (L1-S1)
    - Deep Tendon Reflexes: Patella, Dorsiflexion, and Hamstring
  - Functional Assessment - The following standardized tests may be used to assess functional limitation such as lifting, walking, sitting, standing, sleeping, social life and vocation.
    - Oswestry Low Back Pain Disability Index (Fairbank, 2000)
    - Lower Extremity Scale (LEFS) (Binkley, 1999)

Findings of Osteoporosis

The historical information discussed in the Definition, Risk Factors, and Patient Data sections are good indicators of the presence of osteoporosis; however, the best indicator of osteoporosis is a bone mineral density test. A bone mineral density test measures bone mass and it is considered the most important predictor of fractures caused by osteoporosis.

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Differential Diagnoses

- Extra spinal causes (ovarian cyst, kidney stone, pancreatitis, ulcer)
- Rule out fracture , femoral neck, Colles fracture
- Infection in disc or bone (fever, history of IV drug use, history of severe pain)
- Inflammatory arthritides (family history, patient age/sex, morning stiffness)
- Metastatic disease, myeloma, lymphoma (pathologic fracture, severe night pain)
- Spinal tuberculosis (lower socioeconomic groups, AIDS)
- Depression
- Vitamin D deficiency (rickets)

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

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Treatment Methods

- Depending on level of pain, modalities to address pain may be utilized in the initial therapy visits.
  - Postural exercises should be taught and continued on a home program.
  - Patients with spinal compression fractures should avoid forceful trunk flexion exercises.
  - Gentle weight bearing activity may help prevent or slow loss of bone density.
- The approach to care focuses on long term self-management.
  - Recommend smoking cessation if patient is a smoker and weight reduction if overweight.
  - If patient has significant spine involvement, assistive devices may be needed for ADLs and/or ambulation.
  - Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Referral Guidelines

- Refer patient to their primary care provider to explore alternative treatment options, if:
  - Improvement does not meet the above guidelines or improvement has reached a plateau
  - Fever, chills, unexplained weight loss, significant night time pain
  - Presence of pathological fracture
  - Obvious deformity
  - Saddle anesthesia
  - Loss of major motor function
  - Bowel or bladder dysfunction
  - Abdominal pain
  - Visceral dysfunction
  - Increasing neurologic signs/symptoms: increasing LE weakness, increasing LE pain, increasing LE numbness/tingling, and decreasing LE reflexes

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

The approach to care focuses on long term self-management.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

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Expected Outcome	Procedures/Modalities Such As
Reduce pain and muscle spasm	◆ Modalities i.e. moist heat, Interferential current, TENS ◆ Thoracic orthosis to limit motion of spine
Restore flexibility of lumbar spine	◆ Flexibility exercises (hamstring stretch, Hip flexors stretch, back muscle stretch, Quadriceps stretch, pelvic mobilization)
Enhance neuromuscular performance to reduce risk of falls and fractures	◆ Begin with isometric exercises, avoid flexion exercises ◆ Stabilization exercises ◆ Functional Restoration ◆ Physical Reconditioning program-add low impact weight bearing exercises
Improvement in body mechanics and postural stabilization	◆ Body mechanics training ◆ Postural stabilization activities ◆ Postural Control ◆ Pectoral and intercostal strengthening exercises ◆ Endurance exercises
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual resumption of activities relating to work, community and leisure ◆ Gait training with/without assistive devices ◆ Teach application of heat, stretching and strengthening program ◆ Teach deep breathing exercises
Home modification and prevention of falls and fractures	◆ Use of handrails, grab bars in hallways, stairs and bathrooms ◆ Use of shower chairs, tub bench, adaptive bathing devices ◆ Use of non-skid tape to steps indoors and outdoors ◆ Remove all throw rugs ◆ Cessation of smoking, alcohol and caffeine consumption ◆ Regular program of physical activity

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot pack/cold pack
- Theraband
- Home electrical stimulation unit
- Assistive devices if needed
- Adaptive equipment for ADLs

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Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Postural exercises, to include back extensor exercises
- Aerobic conditioning, such as walking or swimming
- Heat applications, cold packs, if needed, to relieve discomfort/stiffness

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Physiatry
- Medication
- Acupuncture

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Temporomandibular Joint Dysfunction

Synonyms

- Temporomandibular Joint Syndrome
- Myofascial pain dysfunction
- Craniomandibular disorders
- TMJ
- TMD

Definition

TMJ Dysfunction does not have a universally agreed upon definition, or diagnostic criteria, and can have multiple etiologies.

- Syndrome is characterized by TMJ pain and swelling, headache and neck pain occur frequently.
- Typically, patient has difficultly, or an inability to open their mouth.
- Crepitation is common.
- Less frequent symptoms are tinnitus, vertigo, and ear or shoulder pain.
- Underlying cause may be of muscular, articular, or disease process origin.
- Frequently, onset is attributed to trauma, dental procedures, stress or degenerative processes.

Patient History

Patient history may include:

Patient Data

- General demographics
- Medical/dental history
- History of current condition
- Functional status as it relates to eating and speech (prior level of function)
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)
- Prior level of function

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, severe pain	Possible infection
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)

Presentation

Presents with pain associated with chewing, clicking, popping, and snapping sounds in the jaw, limited opening and locking episodes and headaches, other associated symptoms may be neck pain and stiffness, shoulder pain and dizziness.

Subjective Findings

- Patient presents with a complaint of
  - Pain,
  - Clicking or locking of the joint, and
  - Swelling.
- History of
  - Grinding their teeth,
  - Extensive dental procedures,
  - Trauma, and
  - Lifestyle stresses.
- Frequently they also complain of
  - Difficulty chewing,
  - Neck pain, and
  - Feeling of fullness in the ear.

Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Inspection
    - General survey of oral cavity
    - Position of head and shoulders
    - Atrophy/hypertrophy
  - Palpation of bony and soft tissue
    - Tenderness/sites of pain
    - Warmth
    - muscle spasm
    - Click, lock or crepitus
  - Range of motion, active and passive
    - Active movements with overpressure: depression, elevation, lateral deviation, protraction, retraction
    - Passive movements-note end feel, pain , spasms
    - Resisted movements (static tests)-opening, protrusion, lateral excursion
  - Orthopedic and neurologic testing if neurologic signs are present

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    - Passive joint plate movements-Caudal traction, ventral glide, medial-lateral glide, medial glide
    - Dermatome of the face, scalp, neck
    - Upper extremity reflexes
    - Jaw reflexes
    - Cervical-upper extremity scan
    - Test Occipito-Atlantal joint and Atlanto-Axial joint
  - Biomechanical assessment of joint function
    - Dynamic loading of one joint
    - Posterior loading (compression) of both joints
    - Distraction (unloading)
    - Assess stability and mobility of the joint
  - Functional Impairment
    - No standardized functional test for the TMJ
    - Use the Neck Disability Index Scale for the Cervical Spine

Findings of TMJ Syndrome

- Tender to palpation
- Limited joint mobility for opening and protrusion with deviations
- Swelling or asymmetry of the face
- Abnormal cervical posture
- Clicking, locking or crepitation

Differential Diagnoses

- Headache syndromes
- Pharyngeal abscess
- Ear infection
- Infections of the oral cavity
- Herpes zoster
- Temporal Arteritis
- Trigeminal Neuralgia
- Styloid process syndrome
- Paratrigeminal syndrome
- Cervical spine disorders
- Acute pseudogout
- Maxillary sinusitis
- MI/Coronary
- Parotitis

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Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Treatment Methods

- Provide symptomatic relief, and restore normal joint function.
- Modality treatment such as heat/cold, ultrasound, electrical stimulation and biofeedback are frequently used to reduce pain and inflammation.
- Procedures to restore normal joint function include joint mobilization, soft tissue mobilization, and exercises for stretching and strengthening.
- Relaxation exercises may be appropriate.
- Patient education in self-management techniques should be included as well.
- Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Further deterioration such as increasing pain, further limitation of movement and increased joint sounds
  - Dental and otic infections occur
  - Paratrigeminal syndrome occur

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

Acute Phase

Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Subacute Phase

Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

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Corrective/Rehabilitative Phase

Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Decrease pain and muscle spasm	◆ Modalities i.e. Friction massage, ultrasound, Transcutaneous electrical nerve stimulation, biofeedback ◆ Relaxation exercises
Restore flexibility of the affected musculature and restore normal joint mechanics	◆ Active/ passive stretching exercises ◆ Soft tissue mobilization ◆ Joint mobilization techniques
Improve posture awareness and balance of the upper quadrant	◆ Correct body mechanics ◆ Postural control ◆ Correct body positioning of cervical spine and masticatory muscles
Improve swallow sequence	◆ Instruction on normal resting position of tongue and proper swallowing ◆ Maintenance of correct head on neck posture
Patient education and self-management	◆ Avoid large bites, clenching teeth, keep jaw relaxed. ◆ Teach application of moist heat, massage to jaw and temple and sustained stretching exercises ◆ Teach good sleep posture ◆ Use of occlusal repositioning splints ◆ Teach diaphragmatic breathing exercises

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- TENS
- Orthotic appliances

Self-Care Techniques

- Relaxation training
- Home ROM exercises, stretching
- Progression to therapeutic exercise—stretching and strengthening exercises, postural exercises
- Hot packs/cold packs, if needed, to relieve discomfort
- Instruction in use of orthotic appliances

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Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Steroid injection
- Surgery
- Acupuncture
- Psychological counseling; group management

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Orthopedic – Knee

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Anterior Cruciate Ligament (ACL) Reconstruction, Knee

Synonyms

- ACL repair (a misnomer, implying direct primary repair)
- ACL reconstruction (ACLR) with meniscal repair
- ACL reconstruction (ACLR) with additional ligament repair (MCL, LCL or PCL)
- ACL reconstruction (ACLR) with posterior lateral corner (PLC) repair

Definition

- Reconstructive surgery after ACL injury is performed to provide stability and long- term normal function. Procedure usually involves an intra-articular autograft of the middle third of patellar tendon, or tendons of semitendinosus/gracilis. Occasionally an allograft is used from a donor.
- Injury to the ACL is a common type of knee injury. The frequency of this type of injury is approximately 1 in 3000 per year in the U.S. population. This type of injury is more common with females. A majority of individuals that require surgical repair to the ACL are able to return to strenuous activities with proper rehabilitation.
- Based on available literature, there appears to be an improved rate of return to athletic activity after ACLR when compared with non-operative treatment (Fabricant, P. D., et al 2016).
- Patients who had had revision surgery reported inferior function scores, had inferior clinician-reported knee function and more radiographic signs of tibiofemoral osteoarthritis compared with patients with primary ACL reconstruction (Grassi, A., 2016).
- A high pre-injury activity level, the desire of the patient to continue pivoting sports and fear of future give-way episodes are considered the most significant factors affecting the decision to perform anterior cruciate ligament reconstruction (Eitzen, I., et al 2010).

Patient History

- Clinical findings prior to surgery may include (Logerstedt DS, 2017)
  - Symptom onset linked to precipitating trauma
  - Deceleration, cutting, or valgus motion associated with injury
  - “Pop” heard or felt at time of injury
  - Hemarthrosis within 0 to 12 hours following injury
  - Knee effusion present
  - Sense of knee instability reported
  - Excessive tibiofemoral laxity with (cruciate/collateral) ligament integrity tests
  - Pain/symptoms with (cruciate/collateral) ligament integrity tests
  - Lower-limb strength and coordination deficits
  - Impaired single-leg proprioception/balance
  - Abnormal compensatory strategies observed during deceleration or cutting movements

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Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.

Red Flag	Consequence or Cause
Severe trauma, post operatively	Fracture
Fever, severe pain	Infection
Popliteal fossa pain, sudden onset	Popliteal aneurysm
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases, gout
Unilateral edema	Deep Vein Thrombosis (DVT)
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of foot, or leg, exertional leg, or foot pain	Arterial occlusion; vascular insufficiency; Compartment syndrome
Immune-compromised state	Infection

Risk factors of poor outcome

- Higher BMI
- Lower education level
- Smoking
- Revision ACL surgery

Differential Diagnoses

- Not applicable

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Horn, KK, et al 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum clinically important difference 9 points (Binkley et al, 1999; Stratford et al, 2000; Alcock et al, 2012) OR International Knee Documentation Committee (IKDC) Subjective Form with a score of 71 or less (Minimum Clinically Important Difference 11.5 points (Smith, M. V., et al 2012))

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- Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
-)Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Surgery within the past 6 months

- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinically Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care

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- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- The examination begins with an appropriate clinical history that provides the necessary information to guide the clinical exam. It should provide a general overview of the patient's health status, as well as additional data related to current reason for seeking formal physical therapy.
  - date of initial onset of symptoms and /or most recent exacerbation
  - prior and current level of functioning
  - method of injury
  - living situation
  - pain rating using the Numerical Pain Rating Scale (Williamson, A., 2005).
  - Examination of the hip as a contributor to pain and/or dysfunction should be considered (Currier, L. L., 2007)
  - precautions or co-morbidities
  - diagnostic testing that has been performed to date
  - any durable medical equipment that the patient may be using
  - patient's goals
  - Psychosocial factors should be considered- Measures of self-efficacy, self-motivation, and optimism were predictive of rehabilitation compliance, return to sport, and self-rated knee symptoms (Everhart, J. S., et al 2015). Elevated pain-related fear of movement/re-injury, quadriceps weakness, and reduced IKDC score distinguish patients who are unable to return to pre-injury sports participation (Lentz, T. A., et al 2015).

Objective Findings

- Objective findings may include:
  - Range of Motion (ICF category: Measurement of impairment of body function-mobility of a single joint)
    - The amount of active and passive range of motion of knee flexion and extension should be measured using a goniometer (Clapper, 1988; Steultjens, 2000).
  - Muscle Testing (ICF category: Measure of impairment of body function, power of isolated muscles and muscle groups). Manual muscle testing of knee flexion and extension strength may be of benefit in patients functioning at lower levels and having difficulty moving through a full range against gravity. For patients at higher levels of function, maximum voluntary isometric strength using a dynamometer, or isokinetic testing could be performed (Longerstedt, 2010).
  - Visual inspection
  - Assessment of surgical wound integrity

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- Assess for edema
- Assess Gait
- Palpation of bony and soft tissue
- Neurologic testing
- Test proprioception
- Test sensation (L2-L4)
- Test ipsilateral and contralateral hip and ankle for pathology

Specific Examination Considerations

- All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.
  - Outcome Measures (Moderate Evidence) Clinicians should consider the use of scientifically validated self-report patient /client functional outcome measures such as:
    - Medical Outcomes Survey Short Form (SF-36) (Patel, 2007)
    - IKDC 2000 Subjective Knee Form (Wright, 2009)
    - KOS-ADLS (Irrgang, 1998)
    - KOOS (Wright, 2009)
    - IKDC 2000 Subjective Knee Form (Irrgang, 2006)
    - Cincinnati Knee Rating Scale (Wright, 2009)
    - Marx Activity Level Scale (Wright, 2009)
    - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Pua, et al., 2009)
    - Six Minute Walk Test (6MWT) (Naylor, et al 2016; Geiger et al, 2007)
    - Lower Extremity Functional Scale (LEFS) (Binkley, et al, 1999)
    - Patient Specific Functional Scale (PSFS) (Chatman, et al, 1997)

Combined Injuries

- The prevalence of knee osteoarthritis for individuals with isolated anterior cruciate ligament injury is 0%-13% with a higher prevalence of knee osteoarthritis for subjects with combined injuries of 21%-48% (Øiestad, B. E., et al 2009).
- Grade 3 or 4 femoral or tibial articular cartilage injury and meniscus tears/treatment at the time of ACLR were significant predictors of worse functional outcomes (Cox, C. L., et al 2014). Medial meniscus repair predicted worse functional outcomes, whereas lateral meniscal repair is associated with better outcomes (Cox, C. L., et al 2014).
- Concurrent meniscal repair with ACLR is show sustained improvements in patient-oriented outcome scores at 6-year follow-up. Medial mesical repairs had a slightly higher failure rate than lateral meniscal repairs (Westermann, R. W., et al 2014).
- Short term follow up at 2 years revealed lower outcome scores for medial meniscus repairs with ACLR, while Medial, Lateral Meniscectomies and Lateral meniscal repairs showed higher, similar functional outcomes (LaPrade, C. M., et al 2015).

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- Evidence specific to rehabilitation considerations for combined injuries with ACL reconstruction is scarce. Clinicians should consider all factors and modify treatment according to any additional precautions provided by the referring surgeon.

Physical/Occupational Therapy Management

- A number of different programs are used by different physical therapists. The therapy program chosen depends on the activity level of the patient and the type of surgery performed, coexistent injuries (meniscal or other ligamentous injury), and the surgeon.
- There is evidence that rehabilitation protocols should have long term focus on restoring normal sagittal plane gait mechanics, rather than frontal or transverse plane, to reduce the chance for progression of osteoarthritis (Hart, HF et al 2016).
- There is no consensus or strong evidence to support one treatment protocol over another (Makhni, E. C., et al 2016). Generally the rehabilitation process begins immediately following ACL injury, with emphasis on reducing swelling and inflammation, regaining quadriceps control, allowing immediate weight bearing, restoring full passive knee extension, and gradually restoring flexion (Wilk, K., et al 2012).

Pre-operative treatment or Prehabilitation

- There is some evidence that pre-operative physical therapy should be introduced to healthcare management of ACL injury (Alshewaier, S., et al 2017). Twenty one days prior to surgery is considered adequate (Wilk, K., et al 2012). Prehabilitation programs may be performed with the following goals (Risberg, et al 2016):
  - Clarify expectations and goals
  - Shared decision making for treatment
  - Improve adherence to recommendations
  - Include information on risk factors for reinjury: return to high-level pivoting sports and muscle dysfunction
  - Include information on long-term outcome: make sure knee function is normalized and maintain normal body mass index
  - Resolve range of motion and address swelling
  - Improve coordination and proprioception with Neuromuscular exercises
  - Optimize muscle strength and performance

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Recommended Interventions (based on MOON Guidelines by Wright, R. W., et al 2015; Kruse, L. M., et al 2012)

- Early Weight bearing
  - Immediate full weight bearing is recommended.
- Range of Motion
  - Immediate passive and active range of motion activities is recommended.
- Strengthening Exercises
  - Closed chain exercises can be performed immediately.
  - Open chain exercises should be limited in the first 6 weeks post operatively to limit the amount of strain on the graft.
- Neuromuscular Training
  - Exercises including perturbation, balance and proprioception are supported by evidence. Discontinue use once patient is able to perform 20 repetitions of SLR with no lag.
- Home-Based Rehabilitation
  - Home-based rehabilitation programs may be used with motivated patients. There is moderate evidence that structured home programs with periodic contact by a physical therapist, result in the same outcomes as supervised, clinic based rehabilitation (Papalia, R., et al 2013; Beard, D. J., 1998; Grant, J. A., et al 2005; Grant, J. A., et al 2010; Hohmann, E., et al 2011; Ugutmen, E.,et al 2008).

Interventions with Neutral Recommendation

- Neuromuscular Electrical Stimulation (NMES)
  - Evidence is unclear as to the value of NMES.
- Accelerated Rehabilitation
  - There is no clear evidence to fully support rehabilitation aimed at early return to sport or recreational activities. Please see Discharge Considerations for evidence regarding recovery data.

Interventions Not Recommended

- Continuous Passive Motion (CPM)
  - CPM is not supported for ACL surgery.
- Postoperative Bracing
  - Bracing immediately following surgery is not supported by evidence.
- Kinesiotaping
  - No evidence to support the use of kinesiotaping post ACLR (Oliveira, A. K., et al 2016).

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Criteria Oriented Protocol (Wright, R. W., et al 2015)

- Minimum number of visits recommended: 6 visits
- Recommended number of visits 16-24 visits total
- Time frames provided are estimates, and will vary according to the patient and concomitant knee injury such as meniscal repair, chondral repair, and/or secondary ligament repair.

Pre-operative Recommendations

- Normal gait
- AROM from 0 to 120 degrees
- Strength: 20 Straight Leg Raises (SLR) with no lag
- Minimal effusion
- Patient education on post-operative exercises and expectations
- Gait training with crutches
- Wound care instructions
- Phase 1 (0 to 2 weeks)
  - Goals:
    - Full knee extension Range of Motion (ROM)
    - Good quadriceps control (20 repetitions of SLR with no lag)
    - Minimize pain
    - Minimize swelling
    - Normal gait pattern
  - Weight Bearing As Tolerated (WBAT) with crutches until patient demonstrates normal gait pattern and able to ascend/descend stairs safely and pain free.
  - Exercises for ROM and strengthening
  - Aerobic exercise
  - Cryotherapy for pain and swelling
  - Scar massage after incision is healed/closed
- Criteria to move to Phase 2:
  - 20 reps of SLR with no lag
  - Normal gait
  - Crutch use is discharged
  - No greater than 5 degree extension lag
  - 110 degrees of active knee flexion
- Phase 2 (2 to 6 weeks)
  - Goals:
    - Full ROM
    - Increased muscle strength
    - Progress to neuromuscular training

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- Exercises for ROM and strengthening including the hip and ankle
- Neuromuscular training
- Aerobic training

- Criteria to move to Phase 3:
  - Full ROM
  - Minimal pain and swelling
  - Functional strength and control with Activities of Daily Living (ADLs)
  - International Knee Documentation Committee Subjective form (IKDC) question #10 score of 7 or greater
- Phase 3 (7 to 12 weeks)
  - Goals:
    - Maintain full ROM
    - Demonstrate ability to descend 8 inch step without pain or compensation
    - Running without pain or swelling
    - Hopping without pain, swelling, or giving way
    - Strengthening
    - Neuromuscular training
    - Aerobic training
- Criteria to move to Phase 4:
  - Running (straight line) without pain or swelling
  - Hopping without pain or swelling (bilateral and unilateral)
  - No difficulty with neuromuscular or strength exercises
- Phase 4 (13 to 16 weeks)
  - Goals:
    - Running and agility at 75% speed without difficulty
    - Jumping without difficulty
    - Hop tests at 75% contralateral values (Single leg for distance, Triple hop for distance, Cross over hop for distance, 6 meter timed hop)
  - More aggressive strengthening
  - Agility drills
  - Neuromuscular training
  - Aerobic training
- Criteria to move to Phase 5:
  - Maximum vertical jump without pain or instability
  - 75% of contralateral on hop tests
  - Figure 8 run at 75% speed without difficulty
  - IKDC Subjective Form question #10 score of 8 or greater
- Phase 5 (17 to 20 weeks)
  - Goals:
    - 85% contralateral strength
    - 85% contralateral on hop tests
    - Sport specific exercises without pain, swelling or difficulty
  - Aggressive strengthening

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- Sport specific activities

- Suggested Return to Sport evaluation tests:
  - Hop tests (single leg hop, triple hop, crossover hop, 6 meter timed hop)
  - Isokinetic strength test (60 degrees/second; peak torque) (Protocols vary and lack consensus (Undheim, M. B., et al 2015))
  - Vertical jump
  - Deceleration Shuttle test
- Recommended criteria to allow return to sport/activity:
  - No functional complaint
  - Confidence when running, jumping, cutting at full speed
  - 85% contralateral values on hop tests
  - IKDC Subjective Form question #10 score of 9 or greater
- The inability of the patient to develop dynamic muscular joint stabilization through neuromuscular control during walking and activities of daily living (ADL) should exclude the patient from progression into an aggressive return-to-sport rehabilitation phase (Myer, G. et al 2006).

Discharge Considerations

- Return to sport 9 months or later after surgery and more symmetrical quadriceps strength prior to return substantially reduces the reinjury rate (Grindem, H., et al 2016).
- Many patients are most likely are not ready for a safe return to sports, even 8 months post-operatively (Herbst, E., et al 2015).
- Criteria for discharging patients should be based on best available evidence for returning to normal activities. The optimal method to do this remains unclear. It has been suggested that both performance-based measures and patient reported functional outcome measures are needed to fully characterize knee function (Logerstedt, D., et al 2013). Quadriceps strength has been identified as the most telling physical marker for full recovery (Schmitt, L. C.,2015; Palmieri-Smith, R. M., et al 2015). Specific tests may include ((Risberg, et al 2016):
  - Muscle strength tests greater than 90% compared to the strength of the contralateral limb
  - Single-leg hop tests greater than 90% compared to the strength of the contralateral limb
  - Patient-reported outcome within normative values for that specific questionnaire
  - Sport-specific tests if applicable

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Female Considerations

- Women with a history of ACL injury are at greater risk of a second ACL injury with 16-fold greater risk of injury compared to healthy controls and four times greater risk than men with a history of ACLR. Women are also six times more likely to suffer a contralateral injury (Paterno, M et al 2012).
- Altered gait and task specific asymmetries are more prevalent in women than in men post ACLR. The reasons, and thus treatment for, these differences remain unclear and need further examination (Di Stasi, S., et al 2015).
- According to a systematic review, plyometric power, biomechanics and technique, strength, balance, and core stability training can induce neuromuscular changes and potential injury prevention effects in female athletes (Hewett, T. E., et al 2005).

Pediatric and Adolescent Considerations

- ACL Related
  - The majority of young athletes make a return too early to knee strenuous sport after a primary ACL reconstruction, without recovering their muscle function (Beischer, S., et al 2017).
  - For some pediatric patients, significant strength and functional deficits may be present at greater than 1 year after ACLR (Herbst, E., et al 2015).
  - Altered landing mechanics, which may be a predictor for future injury, are tied to asymmetric quadriceps strength in youth populations (Ithurburn, M. P., et al 2015).

Associated injuries in Younger Populations

- *Meniscal repair*- Young patients who undergo ACLR with meniscal repairs show slower healing rates and higher failure rates, but the cause is unknown. Medial meniscal repairs fail at a higher rate than lateral repairs (Fabricant, P. D., et al 2013).
- *Ligamentous tears*- Studies suggest delayed ACLR when Grade II or III Medial Collateral Ligament tears are present (Fabricant, P. D., et al 2013).
- *Chondral lesions*- Articular cartilage lesions related with ACL tears are common. Procedures such as microfracture or osteochondral autograft transfer (OAT) may be performed at the time of ACLR. Surgeon's precautions should be followed regarding weight bearing and exercise progression. However, there is little research regarding the treatment and success of rehabilitation with these combined injuries (Fabricant, P. D., et al 2013).

General Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

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Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

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Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular Home Exercise Program (HEP) performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Referral Guidelines

- Refer patient to their surgeon for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a
  - plateau
  - Atrophy of lower extremity occurs
  - range of motion plateaus or decreases
  - Re-injury occurs
  - Signs of infection

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Home and Self-Care Techniques

- The patient can be taught to use medical equipment and administer self-care at his or her residence.

Home Medical Equipment

- Cold packs
- Resistance band for therapeutic exercises
- Functional Knee bracing for sports
- Assistive gait device
- Home electrical stimulation unit for pain control
- Neuromuscular re-education (NMES) of the quadriceps muscles

Self-Care Techniques

- Instruction in home exercise program for Range Of Motion and strengthening
- Cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Medication

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Knee Pain and Dysfunction

Diagnoses Included:

- Anterior Knee pain
- Patellofemoral pain
- Chondromalacia Patella
- Knee pain
- Knee sprain/strain
- Patellar subluxation or dislocation
- Patellar apophysitis (Singing-Larsen-Johansson lesion)
- Tibial apophysitis (Osgood-Schlatter lesion)
- Patellar tendinitis (Jumper's knee)
- Tibial (Medial) collateral ligament sprain
- Pes anserine bursitis
- Medial plica syndrome
- Fibular (Lateral) collateral ligament sprain
- Iliotibial band syndrome
- Popliteal cyst (Baker's cyst)
- Posterior cruciate ligament injury
- Posterolateral corner injury - Distal hamstrings injury
- Proximal gastrocnemius injury

Definition

Knee pain is defined as pain that consists of soreness, tension, instability, pain, and/or stiffness in the knee region that may extend from the mid-thigh to upper portion of the lower leg. Joints involved may include the tibio-femoral articulation, the articulation of the patella within the trochlear groove of the femur, as well as the proximal articulation of the fibula with the tibia. Pathology may be related to trauma or repetitive strain of the musculotendonous structures or ligaments such as the cruciate or collateral ligaments. Other structures such as the menisci, bursae, or patellar fat pad can also be generators of pain or disability.

Knee pain may be described in terms of how long the individual has been dealing with the condition. Acute knee pain' is defined as pain that has been present for less than 3 months, and 'chronic knee pain' as pain that has persisted for longer than 3 months.

Some subsets of knee pain describe a significant portion of patient's seeking medical care. Patellofemoral pain is more prevalent in younger, more active patient populations, affecting 26% of young athletes (Cosca and Navazio, 2007) and 7% of young active adults (Cosac & Navazio, 2007;W itvrouw, et al., 2000).

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Knee pain and dysfunction can be categorized according to the International Classification of Functioning, Disability and Health (ICF) (World Health Organization [WHO], 2005) in the following ways:

- Knee pain(b28016 pain in joints)
- Knee stiffness, loss of ROM, or locking(b7100 mobility of a single joint)
- Difficulty walking, antalgic gait(b770 gait pattern functions)
- Knee instability (b7150 stability of a single joint)
- Knee pain with movement coordination impairments (b7601 control of complex voluntary movements)

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament/meniscal tear
Fever, severe pain	Infection
Popliteal fossa pain, sudden onset	Popliteal aneurysm
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases
Unilateral edema or positive Homan's sign	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of foot or leg, exertional pain	Arterial occlusion, vascular insufficiency
Immune-compromised state	Infection

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Differential Diagnosis

- Joint effusion from crystal disease (i.e., gout), trauma, infection, rheumatologic diseases
- Diabetic neuropathy
- Fractures
- Neurovascular compromise
- Septic arthritis
- Deep vein thrombosis
- Patellofemoral osteoarthritis
- Tibiofemoral osteoarthritis

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimally Clinically Important Difference 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time

Treatment frequency and duration must be based on:

- Severity of objective clinical findings,
- Presence of and number of complicating factors and comorbidities,
- Natural history and chronicity of condition,
- Expectation for functional improvement with skilled intervention,
- Response to treatment provided

- A request for continued services is considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Scope of Examination

- Examine the musculoskeletal system for possible causes or contributing factors to the complaint.

Patient History

- The examination begins with an appropriate clinical history that provides the necessary information to guide the clinical exam. It should provide a general overview of the patient's health status, as well as additional data related to current reason for seeking formal physical therapy.
  - date of initial onset of symptoms and /or most recent exacerbation
  - prior and current level of functioning
  - method of injury
  - living situation
  - pain rating using the Numerical Pain Rating Scale (Williamson, A., 2005).
  - Focusing on decreasing the baseline pain intensity as a treatment goal might not be relevant in patients with anterior knee pain. (Panken A, 2015)
  - Examination of the hip as a contributor to pain and/or dysfunction should be considered (Currier, L. L., 2007)

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- precautions or co-morbidities
- diagnostic testing that has been performed to date
- any durable medical equipment that the patient may be using
- patient's goals

Objective Findings

- Objective findings may include:
  - Range of Motion (ICF category: Measurement of impairment of body function-mobility of a single joint)
    - The amount of active and passive range of motion of knee flexion and extension should be measured using a goniometer (Clapper, 1988; Steultjens, 2000).
  - Muscle Testing (ICF category: Measure of impairment of body function, power of isolated muscles and muscle groups). Manual muscle testing of knee flexion and extension strength may be of benefit in patients functioning at lower levels and having difficulty moving through a full range against gravity. For patients at higher levels of function, maximum voluntary isometric strength using a dynamometer, or isokinetic testing could be performed (Longerstedt, 2010). Many clinics will not have this equipment available, so the inclined squat strength test could be used as a substitute (Munich, 1997). It is considered more functional and has shown good reliability (Cook, 2007). Measurement of knee flexion angle attained while the patient does a unilateral squat may also be used for side to side comparison.
  - Special Tests: Clinical special tests are a crucial part of the clinical exam and are used to rule in or rule out specific diagnoses. They may be used at the beginning of the exam as a screening tool or at the end to confirm a diagnosis (Woolf, 2003). Note that the results of a systematic review indicate that the accuracy of McMurray's, Apley's, JLT and Thessaly to diagnose meniscal tears remains poor (Smith, B. E., et al, 2015).
    - This represents only a partial list of tests available for the knee. Sound clinical judgment is required on a case by case basis to determine which of these tests are appropriate and if additional procedures are warranted.
- McMurray Test: torn tibial meniscus -moderate level of evidence (Akseki, 2004; Pookarnjanamorakot, et al., 2004)
- Thessaly Test at 20 degrees: torn tibial meniscus - moderate level of evidence
- (Karachalios, et al., 2005; Pookarnjanamorakot, et al., 2004)
- Lachman Test: ACL tear - moderate level of evidence when used in combination with other tests (Cooperman, 1990; Bomberg, 1990; Makhmalbaf, H., 2013)
- Anterior Drawer Test: ACL tear- moderate level of evidence when used in combination with other tests (Makhmalbaf, H., 2013)
- Pivot Shift Test: ACL Tear- moderate level of evidence when used in combination with other tests (Scholten, RJ, 2003; Lopomo, N., 2013)
- Posterior Drawer Test: PCL tear-moderate level of evidence (Fowler & Messieh, 1987; Rubinstein, 1994)

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- Posterior Sag Test: PCL tear - moderate level of evidence(Fowler & Messieh, 1987; Staubli & Jacob, 1990)
- Varus Stress Test at 30 degrees: LCL tear - minimally supported by evidence
- Valgus Stress Test at 30 degrees: MCL tear -moderately supported by evidence (Harilainen, 1986; Sandberg, 1986)
- Varus /Valgus Instability at 0 degrees: MCL/LCL tear -minimally supported by evidence (Rossi, R., 2011)
- Patella Apprehension Test: patella dislocation/ instability -moderate level of evidence (Nijs, et al.,2 006; Niskanen, et al., 2001)
- Medial Patellar Plica test: Plica syndrome- moderately supported (Stubbings, N., & Smith, T., 2014)
- Clarke's Sign: Patellofemoral pain- limited diagnostic usefulness (Nunes, GS, 2013)
- Squatting maneuver: Patellofemoral pain- most accurate diagnostic test (Nunes, GS, 2013, Crossley KM, Stefanik JJ, Selfe J*, et al* 2016)
- Crepitus on palpation: Patellofemoral joint osteoarthritis (Schiphof, D., et al, 2014)
- Joint line tenderness: Meniscal injury- should be used in combination with other tests (Smith, B. E., et al, 2015).
- Apley's test: Meniscal injury- should be used in combination with other tests (Smith, B. E., et al, 2015).

Outcome Measures

- (Moderate Evidence) Clinicians should consider the use of scientifically validated self-report patient /client functional outcome measures such as:
  - Medical Outcomes Survey Short Form (SF-36) (Patel, 2007)
  - IKDC 2000 Subjective Knee Form (Wright, 2009)
  - KOS-ADLS (Irrgang, 1998), KOOS (Wright, 2009)
  - Cincinnati Knee Rating Scale (Wright, 2009)
  - Marx Activity Level Scale (Wright, 2009)
  - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Pua, et al., 2009)
  - Lower Extremity Functional Scale (LEFS) (Binkley, et al, 1999)
  - Patient Specific Functional Scale (PSFS) (Chatman, et al, 1997
- Biomechanical Exam (weak evidence)
  - Weak evidence suggests limited quadriceps and gastrocnemius flexibility, knee extension weakness, and faulty landing mechanics predict development of Patellofemoral Pain Syndrome (Pappas, E., & Wong-Tom, W. M. 2012)

Patellofemoral Pain Syndrome (PFP)

- Hip strength should be examined (Robinson, R. L, 2007)

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- The hip should be examined for limitations in rotation and extension (Currier, L. L., 2007)
- Weaker knee extension strength, expressed by peak torque, appears to be a risk factor for PFPS (Lankhorst, N. E., 2012)
- Examination of hip internal rotation, adduction, and knee external rotation may be considered significant. (Panken A, 2015)
- Evaluation of Q Angle is not supported as significant indicator of dysfunction (Almeida, G. P. L., 2016; Ando T, 1993)
- The core criterion required to define PFPS is pain around or behind the patella, which is aggravated by at least one activity that loads the patellofemoral joint during weight bearing on a flexed knee (eg, squatting, stair ambulation, jogging/running, hopping/jumping). (Crossley KM, Stefanik JJ, Selfe J*, et al* 2016)
- While patellofemoral pain may present in a similar fashion in adolescence and adults, it may not be the same underlying condition or stage, and different treatments may be required. (Antinolfi, P., 2017)
- PFPS of greater than 2 months duration at baseline is the most consistent predictor of poor outcome and early intervention and use of evidence based interventions may enhance prognosis (Collins, N. J., Bierma-Zeinstra, S. M., et al 2012).

Management/Intervention

Clinical Interventions Recommended

- Education and Self-Management: (high level of evidence)
  - Patients should be educated on the diagnosis and prognosis of their condition, healthy lifestyle choices, use of a walking aid if indicated, and the importance of maintaining a healthy weight (Devos-Comby, et al, 2006;H euts, Drietelaar, & Artez 2005;R ichmond,e t al. 2009).
- Strengthening Exercise:(high level of evidence)
  - Quadriceps strengthening in particular has been consistently shown to be beneficial for various types of knee pathology (Bolgla & Boling, 2011;P eeter, et al., 2011; Jamtvedt, et al., 2008;H arvie, O'Leary, & Kumar, 2011; Van der Worp, H., 2011).
  - Hip strengthening, particularly the gluteus medius and maximus, has also been shown to be beneficial for patients dealing with patellofemoral pain (Bolgla & Boling, 2011; Fukuda, et al., 2010; Nagakawa, Muniz, & de Marche Baldon, 2008).
  - Exercise-therapy is recommended to reduce pain in the short, medium and long term, and improve function in the medium and long term. (Crossley, K. M., van Middelkoop, M., et al 2016; Clijsen, R., Fuchs, J., & Taeymans, J. 2014)
  - Combining hip and knee exercises is recommended to reduce pain and improve function in the short, medium and long term, and this combination should be

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used in preference to knee exercises alone. (Crossley, K. M., van Middelkoop, M., et al 2016; Fukuda, T. Y., et al 2012)
- Combined interventions are recommended to reduce pain in adults with patellofemoral pain in the short and medium term. (Crossley, K. M., van Middelkoop, M., et al 2016; Khayambashi, K., et al 2012)
- Adding transverse abdominis, hip abductor, and lateral rotator muscles may improve pain outcomes in PFPS patients. (Frye, J. L., et al 2012)
- Foot Orthoses (moderate level of evidence)
  - Foot orthoses are recommended to reduce pain in the short term. (Crossley, K. M., van Middelkoop, M., et al 2016)

Clinical Interventions with Favorable Recommendation

- Patella Taping:(weak or inconclusive evidence)
  - Some evidence supports the use of taping for the patella when added to strength programs (Bolga & Boling, 2011; Whittingham, Palmer, & Macmillan, 2004; Peeter, et al., 2011; Warden, et al., 2008; Barton, C., et al 2013).
  - The most recent Cochrane review concluded that the currently available evidence from trials reporting clinically relevant outcomes is low quality and insufficient to draw conclusions on the effects of taping. (Callaghan, M. J., & Selfe, J. 2012).
- Stretching/ Flexibility Training:(limited evidence)
  - Although stretching is included in multiple studies reporting positive outcomes, there are few studies that look at stretching alone. There has been some evidence to indicate that improved length of the iliopsoas, quadriceps, and iliotibial band is related to positive outcomes (Tyler, et al., 2006; Peeler & Anderson, 2007)
  - Stretching combined with a strengthening reduces pain associated with PFP (Fukuda, T. Y., et al 2012)
  - Restoring flexibility to quadriceps and hamstrings may lead to better outcomes in patellar tendinopathy (Van der Worp, H., 2011)
- Knee Bracing:(inconclusive evidence)
  - Based on the current evidence available it is not possible to make a recommendation for or against the consistent use of knee bracing. Sound clinical reasoning should be applied by the therapist on a case by case basis, and these interventions may be considered for patients who do not respond to a strengthening and/or manual therapy based program (Bolga & Boling, 2011;R aja & Dewan, 2011)
- Addressing pain catastrophizing and fear avoidance beliefs (moderate to weak evidence)
  - Fear-avoidance beliefs should be targeted during the treatment of patients with patellofemoral pain syndrome (Piva, S. R., et al 2009)
  - Findings suggest that co-interventions to reduce maladaptative beliefs and attitudes about pain may improve the results in anterior knee pain. (Doménech, J., et al 2014)

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Clinical Interventions Not Recommended

- Joint Mobilization for Patellofemoral pain
  - Patellofemoral, knee and lumbar mobilisations are not recommended. (Crossley, K. M., van Middelkoop, M., et al 2016)
- Thermal Modalities- hot packs, cold packs, ice massage:(moderate level of evidence)
  - Based on current evidence, it is not recommended that thermal modalities be routinely used in patients with knee pain (Jamtvedt, et al., 2008). Ice massage may have some potential benefit on ROM, function, and knee strength in patients with kneeO A, but further research is needed (Brosseau, et al., 2003)
- Therapeutic Modalities for the Treatment of Patellofemoral Pain: (moderate level of evidence)
  - Evidence for the use of therapeutic modalities such as ultrasound, estim, laser, iontophoresis, and biofeedback for the treatment of patellofemoral pain is generally lacking and cannot be recommended at this time as a stand-alone treatment. Further studies are needed to confirm a benefit of their addition to a program of conventional physical therapy interventions (Lake & Wofford, 2011;C ollins, Bisset, Crossley & Vicenzino, 2012)
  - Electrophysical agents are not recommended for patellofemoral pain. (Crossley, K. M., van Middelkoop, M., et al 2016)
  - Ultrasound is not recommended for patellar tendinopathy (Larsson, M. E., 2012).
- Kinesio Taping:(limited evidence)
  - Despite the amount of positive anecdotal evidence and case studies available, high quality studies to confirm these findings are still needed.T wo recent reviews found limited quality evidence to support the use of kinesio taping (Williams, Whatman, Hume, & Sheerin 2012;M ostafavifar, Wertz, & Borchers, 2012). In the clinic, kinesiotaping is often used as a complimentary treatment along with therapeutic exercise or manual therapy, or for neuromuscular re-education to facilitate or inhibit certain muscle groups.
  - There currently exists insufficient evidence to support the use of kinesiotaping over other modalities in clinical practice. (Morris, D., et al 2013)
  - Current evidence does not support the use of kinesiotaping (Parreira, P. D. C. S., et al 2014)

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Tendinopathies

- There is insufficient evidence from randomised controlled trials to draw conclusions on the effectiveness of interventions used to prevent hamstring injuries (Goldman, E. F., 2011).
- Strong evidence was found for the use of eccentric training to treat patellar tendinopathy (Larsson, M. E., et al 2012). However there is conflicting evidence as to its superiority to other strengthening approaches (Malliaras, P., et al 2013).
- Ultrasound is not recommended for patellar tendinopathy (Larsson, M. E., 2012).
- Until further evidence is available, current practice and widely published rehabilitation protocols cannot either be supported or refuted (Mason, D. L., et al 2012).
- Limited evidence was found that agility and trunk stabilisation may reduce re-injury rates (Pas, H. I., et al 2015).

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

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There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.

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- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of the extremity occurs
  - Neurological deficits appear/progress

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Theraband for therapeutic exercises
- Knee brace Orthotics as needed
- Home electrical stimulation unit for pain control or muscle re-education

Self-Care Techniques

- Therapeutic exercises, with emphasis on quadriceps (VMO) in terminal knee extension
- Ice massage, if needed, to relieve discomfort
- Use of knee brace or orthotics as needed

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Acupuncture
- Surgical (as a last resort)
- Medication

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Knee Osteoarthritis and Meniscal Pathologies

Diagnoses included:

- Knee osteoarthritis
- Patellofemoral osteoarthritis
- Tibiofemoral osteoarthritis
- Medial Meniscal tear
- Lateral Meniscal tear
- Knee Chondral lesion
- Medial articular cartilage lesion
- Lateral articular cartilage lesion

Definition

Meniscal Injury

- A torn meniscus is the most common cause of mechanical symptoms in the knee. Knee injuries may result in isolated or combined meniscal lesions. They usually occur when a person attempts to turn, twist, or change direction when weight bearing, but can also occur from contact to the lateral or medial aspect of the knee while the lower extremity is planted.
- The meniscus has two types of tears: bucket handle meniscus tear, a longitudinal tear; and the transverse or peripheral tear. Tears are graded from I to III based on the completeness of tears (Grade III is a complete tear of the meniscus).
- Surgical options include partial meniscectomy, meniscal repair depending on grade and location, and allograft transplantation. In general, meniscectomy healing is more rapid than meniscal repair. Long term outcomes vary depending on the type, grade and surgical technique employed.
- Approximately one third of meniscal tears can be treated with conservative intervention that focuses on the resolution of impairments such as swelling, restricted range of motion, and strength using exercises, bracing, and oral medications.

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Knee Osteoarthritis

- Osteoarthritis (OA) is a chronic, degenerative disorder associated with varying degrees of disability and functional limitations.
- Knee OA may be characterized by localized loss of hyaline cartilage and remodeling of subchondral bone accompanied by inflammation.
- Progressive signs and symptoms of pain, swelling, muscle weakness, limited range of motion (stiffness), and decreased functional ability are often present.
- Radiographic imaging may show the presence of osteophytes, joint space narrowing, and subchondral sclerosis.
- The progression of osteoarthritis is thought to be the result of mechanical and molecular changes in the affected joint that may be idiopathic or due to a previous history of trauma to the joint.

Patient History

- Meniscal injuries are commonly preceded by a sudden twist or repeated squatting.
- Individuals often report clicking, catching, locking, or a feeling of giving away in the knee. However, they can be acquired in degenerative conditions.
- Osteoarthritis can be reported as general knee soreness with or without sharp pain felt behind the knee cap, along the medial or lateral joint line, or all of the above.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- Severe trauma Fracture, ligament tear
- Fever, severe pain Infection
- Popliteal fossa pain, sudden onset Popliteal aneurysm
- Diabetes Neuropathy
- Multiple joint involvement Rheumatologic diseases
- Unilateral edema Deep vein thrombosis
- Cancer Cause of symptoms (metastatic or primary)
- Discoloration of foot, or leg Arterial occlusion
- Immune-compromised state Infection

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Differential Diagnoses

- Anterior cruciate ligament injury
- Contusions
- Iliotibial band syndrome
- Knee osteochondritis dissecans
- Lateral collateral knee ligament injury
- Lumbosacral radiculopathy
- Medial collateral knee ligament injury
- Medial synovial plica irritation
- Patellofemoral joint syndromes
- Pes anserine bursitis
- Posterior cruciate ligament injury
- Osteonecrosis of the femur or tibia
- Crystalline deposition diseases including gout and pseudogout (chondrocalcinosis)
- Ipsilateral hip disease

Requirements for Physical/Occupational Therapy Visits

Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:

- Functional Outcome Measurements showing significant functional limitations using the **Patient Specific Functional Scale (PSFS)**– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (MCID) for average score = 1.2 points (Hefford, 2012)) OR **Lower Extremity Functional Scale (LEFS)** with a score of 64 or less (MCID 9 points (Binkley et al, 1999; Stratford et al, 2000; Williams, V. J., 2012)
- Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time

Treatment frequency and duration must be based on:

- Severity of objective clinical findings,
- Presence of and number of complicating factors and comorbidities,
- Natural history and chronicity of condition,
- Expectation for functional improvement with skilled intervention,
- Response to treatment provided
- A request for continued services is considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of lower extremity occurs
  - Range of motion plateaus or decreases
  - Re-injury occurs

Clinical Examination

- The examination begins with an appropriate clinical history that provides the necessary information to guide the clinical exam. It should provide a general overview of the patient's health status, as well as additional data related to current reason for seeking formal physical therapy.
  - date of initial onset of symptoms and /or most recent exacerbation
  - prior and current level of functioning
  - living situation
  - pain rating using the Numerical Pain Rating Scale (Williamson, A., 2005).

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- Focusing on decreasing the baseline pain intensity as a treatment goal might not be relevant in patients with anterior knee pain. (Panken A, 2015)
- Examination of the hip as a contributor to pain and/or dysfunction should be considered (Currier, L. L., 2007)
- precautions or co-morbidities
- diagnostic testing that has been performed to date
- any durable medical equipment that the patient may be using
- patient's goals
- Evaluation of cardiovascular disease, people's expectations and self-efficacy were also discussed as important aspects in a biopsychosocial approach (Fernandes, L., et al 2013).

Subjective Findings

- Pain is localized to the joint line.
- Pain from meniscus injuries is commonly intermittent, and usually the result of synovitis or abnormal motion of the unstable meniscus fragment.
- Includes clicking, catching, locking, pinching, or a sensation of giving way.
- Crepitus may be felt behind the patella and/or along the joint line

Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Visual Inspection
- Gait analysis
- Palpation of bony and soft tissue
- Range of Motion (ICF category: Measurement of impairment of body function-mobility of a single joint)
  The amount of active and passive range of motion of knee flexion and extension should be measured using a goniometer (Clapper, 1988; Steultjens, 2000).
- Muscle Testing (ICF category: Measure of impairment of body function, power of isolated muscles and muscle groups). Manual muscle testing of knee flexion and extension strength may be of benefit in patients functioning at lower levels and having difficulty moving through a full range against gravity. For patients at higher levels of function, maximum voluntary isometric strength using a dynamometer, or isokinetic testing could be performed (Longerstedt, 2010). Many clinics will not have this equipment available, so the inclined squat strength test could be used as a substitute (Munich, 1997). It is considered more functional and has shown good reliability (Cook, 2007). Measurement of knee flexion angle attained while the patient does a unilateral squat may also be used for side to side comparison.
- Special Tests: Clinical special tests are a crucial part of the clinical exam and are used to rule in or rule out specific diagnoses. They may be used at the beginning of

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the exam as a screening tool or at the end to confirm a diagnosis (Woolf, 2003). Note that the results of a systematic review indicate that the accuracy of McMurray's, Apley's, joint line tenderness (JLT) and Thessaly to diagnose meniscal tears remains poor (Smith, B. E., et al, 2015).

This represents only a partial list of tests available for the knee. Sound clinical judgment is required on a case by case basis to determine which of these tests are appropriate and if additional procedures are warranted.

- McMurray Test: torn tibial meniscus -moderate level of evidence (Akseki, 2004; Pookarnjanamorakot, et al., 2004)
- Thessaly Test at 20 degrees: torn tibial meniscus - moderate level of evidence
- (Karachalios, et al., 2005; Pookarnjanamorakot, et al., 2004)
- Lachman Test: Anterior Cruciate Ligament (ACL) tear - moderate level of evidence when used in combination with other tests (Cooperman, 1990; Bomberg, 1990; Makhmalbaf, H., 2013)
- Anterior Drawer Test: Anterior Cruciate Ligament (ACL) tear- moderate level of evidence when used in combination with other tests (Makhmalbaf, H., 2013)
- Pivot Shift Test: Anterior Cruciate Ligament (ACL) Tear- moderate level of evidence when used in combination with other tests (Scholten, RJ, 2003; Lopomo, N., 2013)
- Posterior Drawer Test: Posterior Cruciate Ligament (PCL) tear-moderate level of evidence (Fowler & Messieh, 1987; Rubinstein, 1994)
- Posterior Sag Test: Posterior Cruciate Ligament (PCL) tear - moderate level of evidence(Fowler & Messieh, 1987; Staubli & Jacob, 1990)
- Varus Stress Test at 30 degrees: Lateral Collateral Ligament (LCL) tear - minimally supported by evidence
- Valgus Stress Test at 30 degrees: Medial Collateral Ligament (MCL) tear - moderately supported by evidence (Harilainen, 1986; Sandberg, 1986)
- Varus /Valgus Instability at 0 degrees: Medial Collateral Ligament/ Lateral Collateral Ligament (MCL/LCL) tear -minimally supported by evidence (Rossi, R., 2011)
- Patella Apprehension Test: patella dislocation/ instability -moderate level of evidence (Nijs, et al.,2 006; Niskanen, et al., 2001)
- Medial Patellar Plica test: Plica syndrome- moderately supported (Stubbings, N., & Smith, T., 2014)
- Clarke's Sign: Patellofemoral pain- limited diagnostic usefulness (Nunes, GS, 2013)
- Squatting maneuver: Patellofemoral pain- most accurate diagnostic test (Nunes, GS, 2013, Crossley KM, Stefanik JJ, Selfe J, et al 2016)
- Crepitus on palpation: Patellofemoral joint osteoarthritis (Schiphof, D., et al, 2014)
- Joint line tenderness: Meniscal injury- should be used in combination with other tests (Smith, B. E., et al, 2015).
- Apley's test: Meniscal injury- should be used in combination with other tests (Smith, B. E., et al, 2015).

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Outcome Measures

- (Moderate Evidence) Clinicians should consider the use of scientifically validated self-report patient /client functional outcome measures such as:
  - Medical Outcomes Survey Short Form (SF-36) (Patel, 2007)
  - IKDC 2000 Subjective Knee Form (Wright, 2009)
  - KOS-ADLS (Irrgang, 1998), KOOS (Wright, 2009)
  - Cincinnati Knee Rating Scale (Wright, 2009)
  - Marx Activity Level Scale (Wright, 2009)
  - Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Pua, et al., 2009)
  - Lower Extremity Functional Scale (LEFS) (Binkley, et al, 1999)
  - Patient Specific Functional Scale (PSFS) (Chatman, et al, 1997

Findings related to Meniscus Tear

- The ICD diagnosis of a meniscal tear and the associated ICF diagnosis of joint pain and mobility impairments are made with a fair level of certainty when the patient presents with the following clinical findings (Logerstedt, D., et al 2010):
  - Twisting injury
  - Tearing sensation at time of injury
  - History of delayed effusion (6-24 hours post injury)
  - Pain with forced hyperextension
  - Pain with maximum flexion
  - Pain or audible click with McMurray y impairmen
  - Joint line tenderness
  - Discomfort or a sense of locking or catching in the knee over either the medial or lateral joint line during the Thessaly Test when performed at 5° or 20° of knee flexion

Physical/Occupational Therapy Management

- Therapy must show measurable functional progress. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.
- Treatment should be individualized but does not have to be provided individually to be effective (Fernandes L et al, 2013).

Clinical Interventions Recommended

- Education and Self-Management: (high level of evidence)
  - Patients should be educated on the diagnosis and prognosis of their condition, healthy lifestyle choices, use of a walking aid if indicated, and the importance of maintaining a healthy weight (Devos-Comby, et al, 2006;Heuts, Drietelaar, & Artez 2005; Richmond,e t al. 2009; McAlindon, T. E., et al 2014).
  - Obesity, being overweight, and having a previous knee injury are risk factors for knee OA (Silverwood, V., et al 2015).

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- Strengthening Exercise:(high level of evidence)
  - Quadriceps strengthening in particular has been consistently shown to be beneficial for various types of knee pathology (Jamtvedt, et al., 2008; Azad, A. K., et al 2011).
  - Both weight-bearing and non-weight-bearing interventions, as well as group and individual programs are appropriate (McAlindon, T. E., et al 2014).
  - High-quality evidence shows that among people with knee OA, exercise moderately reduced pain immediately after cessation of treatment and improved quality of life (Fransen, M., et al 2015).
  - Optimal exercise programs for knee OA should have one aim and focus on improving aerobic capacity, quadriceps muscle strength, or lower extremity performance (Juhl, C., 2014).
  - Strengthening, aerobic exercise OR performance exercises for osteoarthritis should be performed on separate days for best effect (Juhl, C., 2014).
- Aerobic Exercise (moderate evidence)
  - Multiple studies support improvement in pain and disability with aerobic exercise for knee OA (Wang, S. Y., 2012).
  - Optimal exercise programs for knee OA should have one aim and focus on improving aerobic capacity, quadriceps muscle strength, or lower extremity performance (Juhl, C., 2014).
- Neuromuscular Electrical Stimulation (NMES):
  - Neuromuscular electrical stimulation can be used with patients following meniscal or chondral injuries to increase quadriceps muscle strength (Logerstedt D, et al 2010).

Clinical Interventions with Favorable Recommendation

Manual Therapy

- Manual therapies including non-thrust joint mobilization and soft tissue manipulation are effective for reducing pain and disability (Abbott, J. H., et al 2013; Jansen, M. J., et al 2011; Deyle, G. D., et al 2000).
- Therapists should consider adding manual therapy to exercise in patients with knee osteoarthritis in cases of pain and reversible limitation in joint mobility- anterior / posterior mobilization of the tibio-femoral joint and patella mobilization (Pollard, Ward, Hoskins, & Hardy, 2008; Deyle, et al., 2005; Jansen, et al., 2011)
- Aerobic Exercise (moderate evidence)
  - Multiple studies support improvement in pain and disability with aerobic exercise for knee OA (Wang, S. Y., 2012).
- Patella Taping:(weak or inconclusive evidence)
  - Some evidence supports the use of taping for the patella when added to strength programs (Peeter, et al., 2011; Warden, et al., 2008).
- Stretching/ Flexibility Training:(limited evidence)

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- Although stretching is included in multiple studies reporting positive outcomes, there are few studies that look at stretching alone. There has been some evidence to indicate that improved length of the iliopsoas, quadriceps, and iliotibial band is related to positive outcomes (Peeler & Anderson, 2007)

- Water-based Strength Programs: (moderate to weak evidence)
  - Water based strengthening programs produce favorable results (McAlindon, T. E., et al 2014)
- Knee Bracing:(inconclusive evidence)
  - Based on the current evidence available it is not possible to make a recommendation for or against the consistent use of knee bracing. Sound clinical reasoning should be applied by the therapist on a case by case basis, and these interventions may be considered for patients who do not respond to a strengthening and/or manual therapy based program (Raja & Dewan, 2011; McAlindon, T. E., et al 2014)
- Foot Orthoses (inconclusive evidence)
  - Foot orthoses may provide benefit to OA conditions (Raja & Dewan, 2011; McAlindon, T. E., et al 2014)
- Addressing pain catastrophizing and fear avoidance beliefs (moderate to weak evidence)
  - Findings suggest that co-interventions to reduce maladaptative beliefs and attitudes about pain may improve the results in anterior knee pain. (Doménech, J., et al 2014)
- Agility and Perturbation training (inconclusive evidence)
  - The addition of agility and perturbation training to exercise training provides no additional benefit (Fitzgerald, G. K., et al 2011).
  - Adding kinesthia and balance exercises to a strengthening program may help with improving function (Diracoglu, D.,et al 2005).

Clinical Interventions Not Recommended

- Thermal Modalities- hot packs, cold packs, ice massage:(moderate level of evidence)
  - Based on current evidence, it is not recommended that thermal modalities be routinely used in patients with knee pain (Jamtvedt, et al., 2008). Ice massage may have some potential benefit on ROM, function, and knee strength in patients with knee OA, but further research is needed (Brosseau, et al., 2003; McAlindon, T. E., et al 2014)
- Therapeutic Modalities:(moderate level of evidence)
  - Electrotherapy/Neuromuscular Electrical Stimulation (NMES) Not recommended (McAlindon, T. E., et al 2014)

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- TENS / Electrical Stimulation: (inconclusive evidence)
  - There is some evidence for the use of TENS/electrical stimulation for the short term relief of knee pain from osteoarthritis (Peter, et al., 2011; Bjordal, et al., 2007) but it is currently not recommended based on current evidence (McAlindon, T. E., et al 2014)
  - TENS may be most appropriate to use for patients with high pain levels in situations where medical management and exercise based intervention were not beneficial (Zang, et al., 2008).
- Ultrasound (inconclusive conflicting evidence)
  - In addition to conventional physical therapy programs seems to have no further significant effect in people with knee OA (Ulus, Y., et al 2012; Cakir, S., et al 2014).
  - Other studies suggest it may be beneficial for reducing knee pain and improving physical functions in patients with knee osteoarthritis and could be a safe treatment (Zhang, C., et al 2016).
- Low level laser therapy (inconclusive evidence)
  - Studies suggest that low level laser therapy when associated with exercises may be effective (Alfredo, P. P., 2012).
- Kinesio Taping:(inconclusive conflicting evidence)
  - Despite the amount of positive anecdotal evidence and case studies available, high quality studies to confirm these findings are still needed.T wo recent reviews found limited quality evidence to support the use of kinesio taping (Williams, Whatman, Hume, & Sheerin 2012;M ostafavifar, Wertz, & Borchers, 2012).
  - In the clinic, kinesiotaping is often used as a complimentary treatment along with therapeutic exercise or manual therapy, or for neuromuscular re-education to facilitate or inhibit certain muscle groups (Castrogiovanni, P., et al 2016).
  - There currently exists insufficient evidence to support the use of KTT over other modalities in clinical practice. (Morris, D., et al 2013)
  - Current evidence does not support the use of kinesiotaping (Parreira, P. D. C. S., et al 2014)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

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Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The patient can be taught a home exercise program and to use medical equipment and administer self- care both at the beginning of treatment and at discharge.

Home Medical Equipment

- Cold packs
- Theraband for therapeutic exercises
- Home electrical stimulation unit for pain control or muscle re-education

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening
- Cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Medication/NSAIDs
- Yoga
- Tai Chi

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Knee Surgery

Surgeries included:

- Knee arthroscopy
- Knee surgery
- Posterior Cruciate Ligament Reconstruction
- Medial Collateral Ligament Repair or Reconstruction
- Lateral Collateral Ligament Repair or Reconstruction
- Lateral Release of patella
- Medial Patellofemoral Ligament Repair or Reconstruction
- Meniscal Repair
- Meniscectomy
- Osteochondral Allograft Transplantation (OAT)
- Autologous Chondrocyte Implantation (ACI)
- Microfracture
- Arthroscopic chondroplasty-lavage and debridement
- Other knee surgery

Definition

Tibial plateau fractures

Tibial plateau fractures are categorized into at least six types, using the Schatzker classification system. Patients referred for therapy post operatively, should have stabilized fractures by use of screws, bone grafting, buttress plates and other forms of fixation. The most common mechanism of injury involves axial loading, such as results from a fall. Other patterns of injury result from laterally directed forces or from a twisting injury. In all cases, force is directed from the femoral condyles onto the medial and lateral portions of the tibial plateau, resulting in fracture. In younger patients, the most common pattern of fracture is splitting, while in older, more osteoporotic patients, depression fractures typically are sustained.

Meniscal and Chondral

Meniscal and Chondral injuries can be the result of degenerative and traumatic forces. The decision on surgery depends on many factors including the nature and severity of the lesion, age of the patient, and activity level of the patient. Meniscal injuries are described on location- medial or lateral compartment- and by type such as bucket handle or horizontal tears.

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Posterior Cruciate Ligament
Posterior Cruciate Ligament tears occur due to anterior blows to the proximal tibia (such as with a dashboard), falls onto the knee with the foot in plantarflexion, or uncontrolled hyperextension of the knee joint. Symptoms consistent with the patient history below may require surgical repair.

Medial Collateral Ligament
Medial Collateral Ligament tears happen when an excessive valgus stress is applied to the knee. Symptoms consistent with the patient history below may require surgical repair.

Lateral Collateral Ligament
Lateral Collateral Ligament tears occur when excessive varus stress is applied to the knee causing tear to the ligament. Symptoms consistent with the patient history below may require surgical repair.

Patella dislocation
Patella dislocation injuries when the patellar either frequently subluxes due to pathoanatomical abnormalities or sustains dislocation from trauma. Surgery intervention may be required when the patella continues to sublux due to hypermobility of the patellofemoral joint.

Patient History
- Clinical findings prior to surgery may include (Logerstedt DS, 2017)
  - Symptom onset linked to precipitating trauma
  - Deceleration, cutting, varus or valgus motion associated with injury
  - Localized tenderness and swelling
  - Knee effusion present
  - Sense of knee instability reported
  - Excessive tibiofemoral laxity with (cruciate/collateral) ligament integrity tests
  - Pain/symptoms with (cruciate/collateral) ligament integrity tests
  - Lower-limb strength and coordination deficits
  - Impaired single-leg proprioception/balance

Abnormal compensatory strategies observed during deceleration or cutting movementsSpecific Considerations
- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Severe trauma post op	Fracture
Fever, severe pain, drainage	Possible infection
Lower extremity angulation or instability	Fracture
Unilateral edema	Lower extremity deep vein thrombosis
Recent invasive procedures post op (dental work, urologic procedures)	Infection
Discoloration of foot or leg, exertional leg or foot pain	Arterial occlusion; vascular insufficiency; compartment syndrome

Differential Diagnosis

Not applicable post-surgery.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Horn, KK, et al 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum clinically important difference 9 points (Binkley et al, 1999; Stratford et al, 2000) OR International Knee Documentation Committee (IKDC) Subjective Form with a score of 71 or less (Minimum Clinically Important Difference 11.5 points (Smith, M. V., et al 2012))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
  - Surgery within the past 6 months
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinically Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time

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- Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Clinical Presentation

Patient usually presents after surgery having limited weight bearing, limited AROM, pain and swelling. There may be ecchymosis. Symptoms are usually localized. Range of motion may be restricted by a brace as directed by the physician/surgeon.

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Subjective Findings

- The examination begins with an appropriate clinical history that provides the necessary information to guide the clinical exam. It should provide a general overview of the patient's health status, as well as additional data related to current reason for seeking formal physical therapy.
  - date of initial onset of symptoms and /or most recent exacerbation
  - prior and current level of functioning
  - method of injury
  - living situation
  - pain rating using the Numerical Pain Rating Scale (Williamson, A., 2005).
  - Examination of the hip as a contributor to pain and/or dysfunction should be considered (Currier, L. L., 2007)
  - precautions or co-morbidities
  - diagnostic testing that has been performed to date
  - any durable medical equipment that the patient may be using
  - patient's goals
  - Psychosocial factors should be considered

Objective Findings

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care. Clinicians should assess for impairments in range of motion, motor control, strength, and endurance of the limb associated with the identified meniscal or articular cartilage pathology or following meniscal or chondral surgery (Logerstedt, D. S., et al 2010).

- Inspection
  - Infection
  - Swelling
  - Wound/scar
  - Color changes
- Palpation of bony and soft tissue
  - Pain
  - Temperature changes
  - Sensation
  - Pedal pulses
- Range of motion, active and passive movements of ipsilateral and contralateral joints
  - Knee (flexion, extension)
  - Ankle (dorsiflexion, plantarflexion, pronation, supination)
  - Hip (flexion, extension, abduction, adduction, external rotation, internal rotation)
- Manual muscle testing of ipsilateral and contralateral joints
  - Knee (flexion, extension)
  - Ankle (dorsiflexion, plantarflexion, pronation, supination)
  - Hip (flexion, extension, abduction, adduction, external rotation, internal rotation)

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- Orthopedic and neurologic testing if neurologic signs are present
  - Joint play movements of the knee and ankle joints
  - Measure leg length discrepancy
  - Test sensation along L5-S1
  - Reflexes: Patellar Tendon, Achilles Tendon
- Activity Limitation Measures (weak evidence)
  - The following 4 hop tests are primarily used in patients with knee lesions:
    - single-limb single hop for distance
    - single-limb triple crossover hop for distance
    - single-limb triple hop for distance
    - single-limb 6-meter timed hop

Outcome Measures

- (Moderate Evidence) Clinicians should consider the use of scientifically validated self-report patient /client functional outcome measures such as:
- Medical Outcomes Survey Short Form (SF-36) (Patel, 2007)
- IKDC 2000 Subjective Knee Form (Wright, 2009)
- KOS-ADLS (Irrgang, 1998)
- KOOS (Wright, 2009)
- Cincinnati Knee Rating Scale (Wright, 2009)
- Marx Activity Level Scale (Wright, 2009)
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (Pua, et al., 2009)
- Six Minute Walk Test (6MWT) (Geiger et al, 2007)
- Lower Extremity Functional Scale (LEFS) (Binkley, et al, 1999)
- Patient Specific Functional Scale (PSFS) (Chatman, et al, 1997)

Assessment of home's environment

- Adequate lighting
- Loose carpeting
- Clear hallways
- Accessibility to bathroom and bedroom
- Communication assessment
- Cognitive assessment

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Physical/Occupational Therapy Management

- Therapy must show measurable functional progress. Interventions should be determined based on patient presentation, surgical procedure, and current evidence. There is little evidence with respect to surgical procedure specific interventions and protocols (Bright, P., et al 2014).
- Therapy program goals are to:
  - Modalities to minimize the inflammation,
  - Normalize gait,
  - Normalize pain-free range of motion,
  - Prevent muscular atrophy,
  - Maintain proprioception,
  - Relieve joint pain, and
  - Increase strength so that other objectives may be achieved.
  - Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Generally Recommended Interventions (moderate to weak evidence)

- Continuous Passive Motion (CPM)
- Progressive passive and active range of motion (ROM)
- Post-operative bracing allowing or limiting ROM for complex meniscal repairs and transplants
- Early progressive return to activity for meniscal repairs
- Emphasis on Home Exercise Program (HEP)
- Strength Training/Therapeutic Exercise
- Neuromuscular Electrical Stimulation (NMES) for quadriceps strengthening

Interventions with Neutral Recommendation (conflicting evidence)

- Progressive early return to activity for OAT and ACI procedures.
- Early weight bearing post meniscal and cartilage surgeries
- Cryotherapy

Interventions Not Recommended (lack of evidence)

- Transcutaneus Electrical Nerve Stimulation (TENS)
- Kinesiotape
- Dry Needling

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OAT Considerations

- No universal rehabilitation protocol for OAT procedures exists.
- Use of CPM up to 8 weeks may occur.
- Patient is likely braced and non-weight bearing for up to 6 weeks with progressive weight bearing as tolerated. Slow progressive ROM can achieved through CPM and home program (Tetteh, E. S., 2012).
- Full weight bearing may be safely achieved by 8 weeks (Ebert, J. R., et al 2012).

ACI Considerations

- No universal rehabilitation protocol for ACI procedures exists.
- Use of CPM up to 8 weeks may occur.
- Patient is likely braced and non-weight bearing for the first 2 weeks following surgery (Tetteh, E. S., 2012).

Microfracture Considerations

- Microfracture procedures show the best outcomes for competitive athletes under 40 years of age with femoral condyle lesions smaller than 2 cm and moderate symptoms of less than 1 year in duration (Kovachevich, R., et al 2009). Other research confirms that younger, competitive players with small defect size, with a short duration of symptoms, fewer prior surgical interventions, and better repair cartilage morphology have a higher rate of return to sports/activity after microfracture (Mithoefer, K., et al 2010).

Factors to Consider During Individualized Cartilage Repair Rehabilitation (Mithoefer, K., et al 2012)

Considerations/Specific Factors	Implications
Individual	
Athlete's age	Slower cartilage repair with increased age
Body mass index	More gradual rehabilitation progression with body mass index greater than 30 kg/m^2
Type of sport	Higher demand on repair tissue in impact sports
Competitive level	Competitive athletes have better outcomes
Psychological	Less fear of reinjury and higher self-efficacy are associated with better outcomes
Lesion/defect	
Defect size	Smaller defects frequently improve faster with rehabilitation

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Considerations/Specific Factors	Implications
Repair technique	More rapid rehabilitation progression with restorative techniques
Defect location	Immediate weight bearing for patellofemoral defect (knee brace locked in full extension)
Duration of symptoms	Longer recovery if symptoms persist longer than 12 months (deconditioning)
Cartilage quality	Slower rehabilitation progression with generalized joint chondropenia
Concomitant injuries	
Concomitant procedures	Modified protocols for anterior cruciate ligament reconstruction, meniscal repair, osteotomy, etc
Meniscus status	Slower rehabilitation progression after meniscectomy (especially lateral meniscus)

Suggested Weight-Bearing Guidelines and Criteria for Progression After Articular Cartilage Repair (Mithoefer, K., et al 2012)

Phase 1. Weight-Bearing Guidelines (Protection and joint activation phase)

- Femoral defects
  - Restorative techniques (OATS/allograft): touch-down loading for 2 wk,
  - then progress to full weight bearing by 4 to 6 wk
  - Reparative techniques (microfracture/ACI): touch-down loading for 2 wk,
  - then progress by 25% body weight per wk
- Patellar/trochlear defects
  - Immediate weight bearing with brace locked in 0° to 10° of knee flexion

Progression Criteria to Go from Phase 1 to Phase 2 (Progressive joint loading and functional restoration phase)

- Full passive ROM equal to the nonoperated knee
- Minimal or absent pain (VAS less than 3/10)
- Minimal or no effusion (grade 0 or 1+)
- Recovery of muscular activation
- Recovery of normal gait cycle (equal stride length and stance time between limbs, no limp)

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Progression Criteria to Go from Phase 2 to Phase 3 (Activity restoration phase)

- Full and painless ROM
- No or minimal pain (VAS less than 3/10)
- No or minimal effusion (grade 0 or 1+)
- Maximum peak torque difference of less than 20% between limbs on isokinetic test
- Hop performance difference of less than 10% between limbs
- Self-report outcomes greater than 90%
- Ability to run on a treadmill at 8 km/h for more than 10 min
- MRI evaluation of the repaired cartilage to evaluate repair tissue

According to outcomes data, each of these procedures have a return to sport/activity rate around two thirds of cases. OAT and microfracture procedures have quicker return to activity rates than ACI. However ACI procedures have better long term outcomes and sustained participation, even at 5 years follow up (Mithoefer, K., et al 2009).

MCL Repair Considerations

- It is generally accepted that incomplete tears and isolated complete tears of the MCL can be treated non-operatively with early functional rehabilitation (Kovachevich, R., 2009). MCL repair or reconstruction is often done in conjunction with other repairs or reconstructions such as reconstruction of the ACL and/or posterolateral corner (PLC). Evidence regarding isolated MCL repair or reconstruction is lacking.

Meniscectomy Considerations

- There is no consensus on which treatment option is the best for patients following meniscectomy but usually lasts only 4 weeks (Anetzberger, H., et al 2014).
- Meniscectomies have fallen out of favor as an intervention as conservative approaches have shown to provide similar, if not better, outcomes (Kise, N. J., et al 2016; Yim, J. H., et al 2013; Katz, J. N., et al 2013).
- Positive prognostic factors are: age < 40 years, one simple lesion (bucket handle, flap, radial), short time elapsed between trauma and surgery, minimal chondromalacia (Frizziero, A., et al 2012).
- There is conflicting evidence as to the need for supervised rehabilitation (Goodyear-Smith, F., & Arroll, B. 2001; Goodwin PC, 2003). However there is evidence that physical therapy in addition to a home program may improve outcomes (Dias, J. M., et al 2013).

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- Electromyographic (EMG) biofeedback training may be helpful for quadriceps strengthening (Akkaya, N., et al 2012; Kirnap, M., et al 2005).
- Neuromuscular or gait correction training may be of no benefit (Hall, M., 2015).

Meniscal Repair Considerations

- No universal rehabilitation protocol for Meniscal repair exists.
- There are varied surgical and rehabilitation treatments and the timing of recovery from meniscal injuries after surgery is very different (Frizziero, A., et al 2012).
- Patient is likely in hinged leg brace with ROM limitations, and may be non-weight bearing or partial weight bearing, according to complexity of repair.
- Immediate knee motion the first postoperative day after meniscus repair (performed either alone or with anterior cruciate ligament reconstruction) is not deleterious to the healing meniscus tissue and prevents knee arthrofibrosis (Heckmann, T. P., et al 2006).
- It has been reported that 11 to 16 postoperative physical therapy visits are expected over the course of 9 to 12 months (Heckmann, T. P., et al 2006).
- Precautions are required in limiting high-loading activities, deep knee flexion, and full squatting for at least 4 to 6 months postoperatively (Heckmann, T. P., et al 2006).

Tibial Plateau Fracture ORIF Considerations

- CPM following operative fixation for a fracture of the tibial plateau may reduce the risk of the development of arthrofibrosis (Haller, J. M., et al 2015).
- Having undergone an ORIF post tibial plateau fracture increases the risk for osteoarthritis and potential additional surgeries (Wasserstein, D., et al 2014; Mehin, R., et al 2012).
- Weight bearing restrictions will be based on the extent and type of injury sustained, as well as the procedure performed. Once the weight bearing restrictions have been lifted, treatment should focus on restoring ROM, strength, and normalizing gait.

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

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Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Referral Guidelines

- Refer patient to their surgeon for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Atrophy of lower extremity occurs
  - Range of motion plateaus or decreases
  - Re-injury occurs
  - Signs of infection

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his/her residence.

Home Medical Equipment

- Hot packs/cold packs after incision heals
- Theraband, ankle weights, for home exercise
- Assistive gait devices
- Brace

Self-Care Techniques

- Home ROM exercises
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Home Exercise Program
- Acupuncture for pain
- General exercise

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Orthopedic – Lower Extremity

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Ankle and Foot Fracture

Diagnoses Included:

- Ankle fracture
- Distal tibial fracture
- Multi-malleolar fracture – bi- or tri-malleolar
- Tarsal fracture
- Calcaneal fracture
- Pylon fracture
- Lisfranc fracture

Definition

Any of the osseous structures making up the ankle, mid-foot and foot have potential to crack or break given the proper traumatic force. Ankle fractures are a common lower extremity injury, with fractures of the ankle and/or foot being even more common. Fractures to the distal lower extremities are more common in younger, active, men and older women. Some fractures may be the result of falling from high locations such as a ladder or scaffolding. Ankle and foot fractures can be very disabling due to necessity for immobilization and weight baring restrictions during the initial healing stages. Rehabilitation may be helpful in reducing disability and in the return of daily function.

The purpose of this guideline is to give direction in the rehabilitation care of a patient that has had an ankle or foot fracture, but has not had surgical interventions. Unfortunately, there is limited current quality evidence to help with decision making processes. Despite the variety of facture possibilities, current scientific or clinical evidence is not obtainable for most types of fracture specific to physical therapy care (Painter et al 2015). The majority of research focuses generally on “ankle fracture”. Please note specific recommendations below. Where applicable, decision making may need to be guided by a combination of guidelines and functional presentation.

Patient History

Special Considerations

- Knowledge of the specific fracture of the patient is important as is the time of injury, time of immobilization and time till weight bearing. It will also be important to know the bone health and stage of healing prior to beginning a rehabilitation program. An understanding of these specific details along with healing time periods can help guide progression of care.
  - Consideration of the patient’s health status should also be made. Chronic conditions can greatly affect the healing rates and risk of complication or non-union in lower extremity fractures. Some of primary conditions to watch for may be:
  - Diabetes – controlled or uncontrolled
  - Peripheral Neuropathy

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- Congestive heart conditions
- Kidney conditions
- Peripheral vascular disease
- Osteoporosis/osteopenia
- History of thrombosis
- Current or history of smoking

- Ankle and foot fractures are often the result of similar mechanisms as sprains or other injury. Even with radiographic confirmation of a fracture, consideration of secondary injuries should be made as well.

Differential Diagnoses

- Lateral Ankle sprain
- Syndesmotic sprain
- Deltoid Ligament injury
- Dislocation
- Unstable ankle or foot fracture
- Non-union of ankle or foot fracture

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Multiple joint involvement	Rheumatologic diseases
Diabetes	Neuropathy
Discoloration of foot, exertional foot or calf pain	Vascular occlusion; vascular insufficiency
Severe pain, swelling, discoloration, cold to touch	Compartment syndrome

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))

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- Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time

- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

- May report traumatic accident during higher level activity
- Radiologic findings from doctor indicating fracture
- Inability to bear weight or increased pain and difficulty with weight bearing
- Pain and tenderness over area of fracture
- Pain with movement of foot and/or ankle

Objective Findings

Outcome Measures – validated functional outcome measures, such as the Lower Extremity Functional Scale (LEFS) should be used throughout an episode of care to track function and progress from skilled care. Recommendation from strong evidence (Painter et al 2015, Moseley et al 2015, Martin et al 2013).

- Physical Impairment Measures – objective and reproducible measures of body function may be helpful over an episode of care for ankle fracture. (Moseley et al 2015) This may include:
  - Ankle range of motion – plantar flexion, dorsiflexion, inversion, eversion
  - Weight bearing
  - Stair use
  - Gait speed
- Activity limitation/participation measures – useful during the weight bearing phases of recovery, evaluation of activity limitation and participation over time is recommended. (Painter et al 2015, Martin et al 2013) Assessment may include but is not limited to:
  - Hop testing – lateral, side, figure 8, square
  - Diagonal movements
  - Lunge test

Specific Examination Considerations (evidence based)

- ***Ottawa Ankle Rules* –** these rules are recommended for use in determining whether a radiograph is required to rule out an ankle or foot fracture. Grade A recommendation from level I evidence (Martin et al 2013, Cook and Hedegus 2008)
- ***Special Clinical Tests* –** it is important that a test for screening or diagnosis be accurate, free from bias as possible and easily reproducible in the clinic. The closer to this standard a test has, the more benefit there is in its utility to correctly identify a patient's problem and in treatment decision making. Researchers and physical therapists Chad Cook and Eric Hegedus authored a collection of the most common physical examination tests in physical therapy. All the tests were evaluated based on available research including sensitivity, specificity, likelihood ratios and odds ratios. They were then evaluated for bias using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) and given a score; 0-14 with 14 indicating the least amount of bias. The following tests are based on their scoring and recommendation; common tests not listed did not meet quality standards of utility (Cook and Hegedus, 2008):
  - Syndesmotic sprains

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- Fibular Translation test (Moderate utility; QUADAS 8)
- External Rotation Test (Moderate utility; QUADAS 8)
- Test for anterior displacement of talus – Anterior Drawer Test (Moderate utility; QUADAS 8) – designed to measure damage to the ATF ligament.
- Test for subtalar joint stability – Medial Subtalar Glide Test (Moderate utility; QUADAS 8)
- Test for lateral integrity – Medial Talar Tilt Test (Minimal utility; QUADAS 8)
- Test for Achilles integrity – Thompson test (Minimal utility; QUADAS 7). Low sensitivity test.
- Test for tarsal tunnel syndrome – Tinel's Sign at tarsal tunnel (Minimal utility; QUADAS 5). Low sensitivity

- Tests for anterior ankle impingement
  - Forced Dorsiflexion Test (Moderate utility; QUADAS 8) reliability may be poor.
  - Clinical prediction rule of impingement (Moderate utility; QUADAS 8). 5 of 6 symptoms would be considered positive. Study quality suspect.
- Tests for deep vein thrombosis (DVT)
  - Calf swelling measurement (Moderate utility; QUADAS 7)
  - Homan's Sign (Minimal utility; QUADAS 7,4) several conditions can cause false positives

Management/Intervention (evidence based)

- Strong Recommendation – none currently available

- Moderate Recommendation
  - Supervised exercise and HEP versus HEP only –
    - Supervised therapeutic exercise and self-care advice did not improve activity limitation or quality of life when compared to self-care advice alone in participants with uncomplicated ankle fracture. Routine use of supervised exercise programs after removal of immobilization is not supported. Recommendation from one level II RCT (Moseley et al 2015)
    - Manual therapy, stretching and exercise did not appear to cause increased function following immobilization for ankle fracture compared to usual care. Regular supervised manual therapy and exercise may not be needed following ankle fracture immobilization. Recommendation from level I review (Lin et al 2012)
  - Physical therapy during immobilization –
    - There is very limited evidence that gentle exercise may begin during the immobilization period with removable type bracing however risk of adverse events may increase. Recommendation that therapy during the immobilization period for uncomplicated ankle fracture may not be necessary (Lin et al 2012)
  - Addition of manual therapy -
    - Addition of talar glides to exercise, gait training and advice did not result in any better outcomes after 4 weeks of treatment or after 24 weeks of follow up. Manual therapy was given 2x a week for 4 weeks. Control therapy attended 5 sessions. Manual therapy may not provide additional benefit over therapeutic

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exercise and advice following ankle fracture. Recommendation from 1 level II RCT (Lin et al 2008)

- Weak Recommendation
  - Manual therapy and exercise –
    - Evidence suggests that patients with stable, uncomplicated, ankle fractures improve from manual therapy and home exercise after the immobilization period. Treatment targeted functional impairments and was provided 1-2x a week for 6-8 visits. Treatment time was 30-45 minutes. Recommendation from level IV case series only (Painter et al 2015)
- Neutral Recommendation – none currently available
- Recommendation Against Use
  - Ultrasound for fracture –
    - Current available evidence is insufficient to support the routine use of ultrasound for acute fractures in adults. Based on level I review (Griffin et al 2014)
  - Kinesiotape for swelling –
    - Kinesiotape application for lymphatic stimulation does not appear to reduce swelling better than normal care in acute ankle sprains up 15 days post treatment. No indication application is beneficial or should be done. Grade B recommendation on moderate Level II evidence (Nunes et al 2015)
  - High-Volt Pulsed Current for Swelling –
    - Use of HVPC on lateral grade I-II ankle sprains had no effect on the time to return to play in injured athletes. Recommendation that HVPC is not necessary in the care of lateral ankle sprain rehabilitation. Moderate recommendation from level I RCT (Mendel et al 2010)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

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- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care techniques

For rehabilitation of uncomplicated ankle fractures the current evidence recommends primary self-care. There is little evidence that routine physical therapy is needed during or after immobilization in general cases. The overall research is limited, so complications or significant restrictions may need further consideration. (Moseley et al 2015, Lin et al 2012)

Home Medical Equipment

- Gait assistive devices – walker, crutches, scooter, cane

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Ankle Instability and Sprain

Diagnoses Included:

- Lateral ankle sprain – acute and chronic
- Chronic ankle instability

Definition

The ankle is made up of the distal tibiofibular syndesmosis, talocrural joint and subtalar joint. Stability of the joint is created through bony congruity of the articulations, ligamentous and non-contractile restraint, and surrounding muscular units. The lateral ligaments of the ankle are commonly injured through an excessive inversion or supination mechanism. Lateral ankle sprains are very common due to sport related injuries. Lateral ankle sprains also have a high reinjury rate as well as continued symptoms of pain and decreased stability over time. Those with long-term symptoms after an acute lateral ankle sprain are termed as having mechanical or functional ankle instability. Mechanical instability would classify those that have excessive joint motion; functional instability describes those who report instability symptoms but have normal motion. (Martin et al 2013)

Patient History

Special Considerations

Acute Lateral Ankle Sprains may be classified based on clinical findings including function, laxity, tenderness, bruising, joint motion, swelling and pain. Traditional classification has been as follows (Martin et al 2013):

- Grade I – no loss of function or laxity. Negative drawer and tilt tests. Little to no pain or swelling
- Grade II – some loss of function. Positive anterior drawer, negative talar tilt tests. Observable bruising. Tenderness. Decreased total ankle motion less than 10 degrees. Swelling less than 2 cm.
- Grade III – near total loss of function, positive anterior drawer and talar tilt tests. Marked bruising. Extreme point tenderness. Total loss of motion greater than 10 degress. Swelling greater than 2 cm. (May be further divided down to IIIA or IIIB based on radiographic stress testing).

Differential Diagnoses

- Fracture
- Avulsion fracture
- Syndesmotic sprain
- Peroneal injury – muscle, tendon, nerve
- Achilles tendon injury
- Medial ankle sprain
- Spring ligament injury

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Multiple joint involvement	Rheumatologic diseases
Diabetes	Neuropathy
Discoloration of foot, exertional foot or calf pain	Vascular occlusion; vascular insufficiency
Severe pain, swelling, discoloration, cold to touch	Compartment syndrome

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Report of inversion ankle injury during activity.
- Tenderness over lateral ankle
- Difficulty walking
- Difficulty with stairs
- Inability to participate in activity or sports
- May report previous lateral ankle sprains in the past
- Pain in lateral ankle, lower leg and even foot.
- Pain with foot unsupported

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Objective Findings

- Outcome Measures – validated functional outcome measures, such as the Lower Extremity Functional Scale (LEFS) should be used throughout an episode of care to track function and limitation progress from skilled care. Recommendation from strong evidence (Martin et al 2013).
- Physical Impairment Measures – objective and reproducible measures of body function may be helpful over an episode of care for lateral ankle sprain. (Martin et al 2013) This may include:
  - Ankle range of motion – plantar flexion, dorsiflexion, inversion, eversion
  - Single leg balance
  - Swelling
  - Supination and pronation
  - Muscle strength – inversion and eversion
- Activity limitation/participation measures – useful during the post acute phase of recovery, evaluation of activity limitation and participation over time is recommended. (Martin et al 2013) Assessment of jumping, hopping, lateral movements and directional change as well as single leg ability may include
  - Hop testing – lateral, side, figure 8, square
  - Diagonal movements
  - Timed walking
  - Stair tests

Specific Examination Considerations (evidence based)

- ***Ottawa Ankle Rules*** **–** these rules are recommended for use in determining whether a radiograph is required to rule out an ankle or foot fracture. Grade A recommendation from level I evidence (Martin et al 2013)
- ***Special Clinical Tests*** **–** it is important that a test for screening or diagnosis be accurate, free from bias as possible and easily reproducible in the clinic. The closer to this standard a test has, the more benefit there is in its utility to correctly identify a patient's problem and in treatment decision making. Researchers and physical therapists Chad Cook and Eric Hegedus authored a collection of the most common physical examination tests in physical therapy. All the tests were evaluated based on available research including sensitivity, specificity, likelihood ratios and odds ratios. They were then evaluated for bias using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) and given a score; 0-14 with 14 indicating the least amount of bias. The following tests are based on their scoring and recommendation; common tests not listed did not meet quality standards of utility (Cook and Hegedus, 2008):
  - Syndesmotic sprains
    - Fibular Translation test (Moderate utility; QUADAS 8)
    - External Rotation Test (Moderate utility; QUADAS 8)

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- Test for anterior displacement of talus – Anterior Drawer Test (Moderate utility; QUADAS 8) – designed to measure damage to the ATF ligament.
- Test for subtalar joint stability – Medial Subtalar Glide Test (Moderate utility; QUADAS 8)
- Test for lateral integrity – Medial Talar Tilt Test (Minimal utility; QUADAS 8)
- Test for Achilles integrity – Thompson test (Minimal utility; QUADAS 7). Low sensitivity test.
- Test for tarsal tunnel syndrome – Tinel's Sign at tarsal tunnel (Minimal utility; QUADAS 5). Low sensitivity

- Tests for anterior ankle impingement
  - Forced Dorsiflexion Test (Moderate utility; QUADAS 8) reliability may be poor.
  - Clinical prediction rule of impingement (Moderate utility; QUADAS 8). 5 of 6 symptoms would be considered positive. Study quality suspect.
- Tests for deep vein thrombosis (DVT)
  - Calf swelling measurement (Moderate utility; QUADAS 7)
  - Homan's Sign (Minimal utility; QUADAS 7,4) several conditions can cause false positives

Management/Intervention (evidence based)

- Strong Recommendation
  - External Support –
    - Use of external support during the acute/protected phase of recovery is recommended for severe lateral ankle sprains. Level I evidence (Martin et al 2013). Bracing may also be helpful in reducing recurrence of injury in cases of chronic instability (Doherty et al 2016)
  - Physical Agents –
    - There is good support to recommend the use of cryotherapy during the acute stage of an ankle sprain as it should reduce pain and use of pain medication as well as improve weigh baring tolerance. Level I-II evidence (Martin et al 2013)
  - Therapeutic Exercise and activity –
    - Balance and neuromuscular training appeared to have the most consistent improvement in function when compared with manual therapy, multimodal care, resistive training and orthotics. Multimodal care appears beneficial but with larger confidence intervals. Level I evidence (Kosik et al 2017, De Vries et al 2011). 4-8 weeks of supervised progressive balance activity (1-2 x a week) may be more effective than unsupervised home programs alone. Grade B recommendation (Powden et al 2017)
    - Appropriate exercise even during the acute phase of recovery has been recommended to improve function on acute ankle sprains. Exercise should be graded to tolerance and progressed. Clinic attendance was higher for participants who relied more on home-programs. Strong Level I-II evidence (Doherty et al 2016,Martin et al 2013)

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- Static stretching with a home program 2 weeks after an ankle sprain appears effective in improving dorsiflexion. Recommendation from level I evidence (Terada et al 2013).

- Manual Therapy –
  - Joint mobilization appears to be helpful in improving medial dynamic balance immediately after treatment. No long term benefit was found. Level I evidence (Weerasekara et al 2017). Dosage of manual technique has not been established for acute sprain or chronic ankle instability. Most often treatment of 3 to 6 sessions over 2 to 3 weeks has been reported. Grade B recommendation (Powden et al 2017)
  - During the progressive phase, manual therapy such as joint mobilization, manipulation and myofascial release may improve range of motion and weight baring tolerance during the short term. Improved outcomes have been found in as little as 3 visits. Level I-III evidence (Loudon et al 2013, Martin et al 2013, Truyols-Dominguez et al 2013).

- Moderate Recommendation
  - Manual Therapy –
    - Manual therapy provided during the acute recovery phase is recommended to improve lymphatic drainage, joint mobility and pain free movement. Limited level II evidence (Martin et al 2013). Evidence in unclear whether manual therapy during the acute phase of rehab improves function (Doherty et al 2016)
    - Manual manipulation (6 treatments) in cases of chronic ankle instability may help with short-term pain reduction, joint restriction and dynamic balance. Limited level II evidence (Lubbe et al 2015, Loudon et al 2013). Functional improvements may be very short term (1 week) (Hoch et al 2012).
  - Therapeutic Exercise –
    - During the post-acute progressive phase exercises to continue to progress weight bearing, single leg balance and stability on varying surfaces is recommended to improve dynamic control. Level I-V evidence (Martin et al 2013).
    - Balance training of 4-6 weeks appears to improve static and dynamic control in participants with chronic ankle instability. Significant improvements were made with varied programs at 1 time a week up to 3 times a week and progressed regularly or every two weeks. There was insufficient evidence to indicate one frequency over the other for number of visits or progressions. Recommendation from level II-III evidence (Wortmann et al 2013)
  - Multimodal care vs. home program –
  - 8, 30 minute, sessions of manual therapy and therapeutic exercise over 4 weeks resulted in better outcomes than 4 sessions for home program progression alone in participants with grade I and II lateral ankle sprains. However both groups experienced improvements. Short term specialized care may be helpful in improving the function of patients with lateral ankle sprains up to 6 months after

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care. Recommendation based on one moderate level 1b RCT (Cleland et al 2013).

- Self Care vs. Supervised Care –
  - Supervised program of physical therapy did not add significant value to patients with grade I-II ankle sprains that received a written self-care program including rest, ice, elevation and graduated weight-bearing activities. At 6 months, there was no indication of improved function or recover from supervised physical therapy. Self-directed care maybe as beneficial as supervised physical therapy in general for acute grade I-II sprains. Level II evidence (Brison et al 2016)
  - Short-term supervised rehabilitation after an ankle sprain may result in reduced pain and improved stability and strength when compared to a written self care program alone 6 weeks after the injury. There is evidence this may improve patient-rated function better at 3 months post-injury. Based on level II-III evidence (Gustafsson et al 2016, Feger et al 2015)

- Weak Recommendation
  - Kinesiotape for support – small, but good evidence that kinesiotape may increase proprioception and performance of activities in those with injured lateral ankles. This may provide some assistance during recovery on improved movement quality. Recommendation from level II-IV evidence (Wilson et al, 2015)
- Neutral Recommendation
  - Electrotherapy – there is moderate evidence both for and against the use of electrotherapy in treatment of acute ankle sprains. Not enough evidence to support a specific recommendation (Martin et al 2013).
  - Low-level Laser - there is moderate evidence both for and against the use of laser therapy in treatment of acute ankle sprains. Not enough evidence to support a specific recommendation (Martin et al 2013).
  - Supportive Taping – There is unclear evidence in the utility of supportive taping in chronic ankle instability (Doherty et al 2016)
- Recommendation Against Use
  - Ultrasound – Ultrasound has not been found to be more effective than sham treatment. It is not recommended to be used for acute ankle sprains. Grade A recommendation on strong level I evidence (Martin et al 2013, Van den Bekerom et al 2011).
  - Kinesiotape for swelling – Kinesiotape application for lymphatic stimulation does not appear to reduce swelling better than normal care in acute ankle sprains up 15 days post treatment. No indication application is beneficial or should be done. Grade B recommendation on moderate Level II evidence (Nunes et al 2015)
  - High-Volt Pulsed Current for Swelling – Use of HVPC on lateral grade I-II ankle sprains had no effect on the time to return to play in injured athletes. Recommendation that HVPC is not necessary in the care of lateral ankle sprain rehabilitation. Moderate recommendation from level I RCT (Mendel et al 2010)

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Home Medical Equipment

- **Orthotics –** there is moderate evidence that foot orthotics may help to improve postural control in patients with chronic ankle instability. There was no evidence to support that orthotics would reduce recurrence of ankle sprains or assist in other functional areas. Grade B recommendation from level II evidence (Gabriner et al 2015)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

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- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Ankle and Foot Post-Operative Conditions

Diagnoses Included:

- Reduction and Fixation of fracture – ORIF or other procedure
- Achilles Repair
- Tendon Related procedures
- Arthrodesis
- Arthroplasty
- Arthroscopy
- Osteotomy

Definition

Many of the injuries sustained to the foot and ankle have the possibility of needing surgical intervention to help restore healing ability, stability and function. Surgery is often the chosen intervention for unstable or displaced fractures, ruptured tendons and end stage joint degeneration. There are also several chronic conditions in which surgery may be indicated if conservative treatments fail. There is a wide array of surgical procedures and techniques for the foot and ankle. There appears to be good information on surgical technique in the scientific literature. There is also moderate information establishing that daily functional decrease and disability are a common result of surgery to the foot and ankle. Research is very limited, however, on the specificity and efficacy of rehabilitation and physical therapy following surgery in the lower extremity. The more common ankle and foot injuries such as chronic instability, Achilles tendinopathy and fractures also appear to make up the majority of need of surgical intervention.

Patient History

Special Considerations

Knowledge of the specific injury and surgical procedure of the patient is important as is the time of injury, time of immobilization and time till weight bearing is allowed. It will also be important to know the general health and stage of healing of the area prior to beginning a rehabilitation program. An understanding of these specific details along with healing time periods can help guide progression of care.

Consideration of the patient's health status should also be made. Chronic conditions can greatly affect the healing rates and risk of complication or surgical failure in lower extremities. Some of the co-morbid conditions to watch for may be:

- Diabetes – controlled or uncontrolled
- Peripheral Neuropathy
- Congestive heart conditions
- Kidney conditions
- Peripheral vascular disease
- Osteoporosis/osteopenia
- History of thrombosis
- Current or history of smoking

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Differential Diagnoses

- Lateral Ankle sprain
- Syndesmotic sprain
- Deltoid Ligament injury
- Dislocation
- Unstable ankle or foot fracture
- Non-union of ankle or foot fracture
- Venous thrombosis
- Compartment syndrome

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Multiple joint involvement	Rheumatologic diseases
Diabetes	Neuropathy
Discoloration of foot, exertional foot or calf pain	Vascular occlusion; vascular insufficiency
Severe pain, swelling, discoloration, cold to touch	Compartment syndrome

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided

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- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Pain around surgical site
- Complaint of swelling in toes, foot, ankle and lower leg
- Use of pain medication
- Unable to bear weight
- Report of traumatic accident
- History of high level activity or possible debility and fall risk
- Younger men (15-30 y/o) and older women (over 50)
- Report of previous ankle injury and instability

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Objective Findings

- Outcome Measures – validated functional outcome measures have been used regularly in ankle surgery research. They should be used throughout an episode of care as indicated in the "Requirements for physical therapy" section to track function and limitation progress from skilled care. Recommendation from strong evidence (Keene et al, 2014).
- Physical Impairment Measures – objective and reproducible measures of body function may be helpful over an episode of care following surgery. This may include:
  - Ankle range of motion – plantar flexion, dorsiflexion, inversion, eversion
  - Weight bearing
  - Stair use
  - Gait speed
- Activity limitation/participation measures – useful during the weight bearing phases of recovery, evaluation of activity limitation and participation over time is recommended. Assessment may include but is not limited to:
  - Hop testing – lateral, side, figure 8, square
  - Diagonal movements
  - Lunge test

Specific Examination Considerations (evidence based)

- ***Ottawa Ankle Rules*** **–** these rules are recommended for use in determining whether a radiograph is required to rule out an ankle or foot fracture. Grade A recommendation from level I evidence (Martin et al 2013, Cook and Hedegus 2008)

- ***Special Clinical Tests*** **–** it is important that a test for screening or diagnosis be accurate, free from bias as possible and easily reproducible in the clinic. The closer to this standard a test has, the more benefit there is in its utility to correctly identify a patient's problem and in treatment decision making. Researchers and physical therapists Chad Cook and Eric Hegedus authored a collection of the most common physical examination tests in physical therapy. All the tests were evaluated based on available research including sensitivity, specificity, likelihood ratios and odds ratios. They were then evaluated for bias using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) and given a score; 0-14 with 14 indicating the least amount of bias. The following tests are based on their scoring and recommendation; common tests not listed did not meet quality standards of utility (Cook and Hegedus, 2008):
  - Syndesmotic sprains
    - Fibular Translation test (Moderate utility; QUADAS 8)
    - External Rotation Test (Moderate utility; QUADAS 8)
    - Test for anterior displacement of talus – Anterior Drawer Test (Moderate utility; QUADAS 8) – designed to measure damage to the ATF ligament.
    - Test for subtalar joint stability – Medial Subtalar Glide Test (Moderate utility; QUADAS 8)
    - Test for lateral integrity – Medial Talar Tilt Test (Minimal utility; QUADAS 8)

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- Test for Achilles integrity – Thompson test (Minimal utility; QUADAS 7). Low sensitivity test.
- Test for tarsal tunnel syndrome – Tinel's Sign at tarsal tunnel (Minimal utility; QUADAS 5). Low sensitivity

- Tests for anterior ankle impingement
  - Forced Dorsiflexion Test (Moderate utility; QUADAS 8) reliability may be poor.
  - Clinical prediction rule of impingement (Moderate utility; QUADAS 8). 5 of 6 symptoms would be considered positive. Study quality suspect.
- Tests for deep vein thrombosis (DVT)
  - Calf swelling measurement (Moderate utility; QUADAS 7)
  - Homan's Sign (Minimal utility; QUADAS 7,4) several conditions can cause false positives

Management/Intervention (evidence based)

- Specific Post-Surgical Protocol
  - Peroneal tendon repair –
    - There is no consensus in the literature on best or preferred rehabilitation protocol for optimizing recovery and return of function following surgical repair of peroneal tendon tears. Recommendation from level I systematic review (Van Dijk et al 2016)
  - Tendon Transfer –
    - early mobilization for foot-drop correction tendon transfer does not appear to have added risk of tendon pullout. Independent walking was restored more quickly with early mobilization. Study was performed on patients at a Leprosy hospital in India. Carry over to patients without Hansen's disease was not studied. Recommendation from Level I RTC (Rath et al 2010)
  - Achilles repair -
    - There were no differences in outcomes up to 11 year follow up for those that had early mobilization compared to those with immobilization for 6 weeks following Achilles repair. Both groups improved in strength similarly. No indication one protocol is better than the other. Recommendation from level I RCT (Lantto et al 2015)
    - Evidence suggests allowance of immediate full weight bearing and mobilization after the 2nd week post-operatively allows for faster return to work and activity with less use of rehabilitation and no increase in adverse events. There is still no consensus in comparative results with any one specific protocol. Recommendation based on Level I systematic reviews (Brumann et al 2014, Huang et al 2014, Olsson et al 2013)
  - Ankle ORIF -
    - Early active exercise may accelerate return to work and daily function compared to immobilization following ankle ORIF surgery. Early weight bearing also tends to accelerate return to work and daily tasks. Consensus on how early has not been determined. Recommendation based on level I review of 25 Level II-III studies (Smeeing et al 2015)

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        - Early ankle activity after fracture related surgery may not have any long term difference. There is evidence of decreased risk of embolism, however increased risk of infection and fixation failure. Possibility of complications should warrant consideration of early activity in this population. Level I evidence (Keene et al 2014)
        - Home therapy of 4-6 days prior to ankle fracture ORIF helped reduce hospital stay postoperatively by several days. Home management for swelling and pain was taught by physiotherapist in the ER department and patient was discharged home. Home program may be beneficial in reducing hospital stay after ankle ORIF. Recommendation from level III study (Lloyd et al 2010)
    - Hallux Valgus correction –
        - Progressive rehabilitation has been shown to restore gait and improve plantar pressure on the first ray following hallux valgus correction. There is no consensus on time to start rehabilitation following surgery or specific treatment protocols. (Polastri 2011) At 4 weeks post-op, rehabilitation of one time per week for 4- 6 weeks was studied with functional improvements recorded at 6 months. There was no control group. (Schuh et al 2009)
- Strong Recommendation – none currently available
- Moderate Recommendation – none currently available
- Weak Recommendation
    - Early ROM and rehabilitation
        - Peroneal repair/tenodesis – Several studies have documented starting rehabilitation following surgery within 4 weeks post-op. However other studies started after 4 weeks. There has been no indication of increased adverse events from the trend of early initiation of therapy. Recommendation that early therapy may be safe in foot and ankle peroneal tendon surgeries, however should consider surgical time and communicate with surgeon as well. Recommendation from trend of multiple Level II and III studies, however none of the studies were directly studying rehabilitation timeline (Van Dijk et al 2016)
- Neutral Recommendation
    - Custom ankle-foot orthosis with rehabilitation –
        - an integrated orthotic and rehabilitation after ankle or subtalar-only fusion show improvement in function. Cohort study with no control in military population. No indication that custom support is needed following ankle fusion surgeries along with rehabilitation. Recommendation based on one small level III study (Sheean et al, 2017)

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- Recommendation Against Use
  - Ultrasound for fracture –
    - Current available evidence is insufficient to support the routine use of ultrasound for acute fractures in adults. Based on level I review (Griffin et al 2014)
  - Kinesiotape for swelling –
    - Kinesiotape application for lymphatic stimulation does not appear to reduce swelling better than normal care in acute ankle sprains up 15 days post treatment. No indication application is beneficial or should be done. Grade B recommendation on moderate Level II evidence (Nunes et al 2015)
  - High-Volt Pulsed Current for Swelling –
    - Use of HVPC on lateral grade I-II ankle sprains had no effect on the time to return to play in injured athletes. Recommendation that HVPC is not necessary in the care of lateral ankle sprain rehabilitation. Moderate recommendation from level I RCT (Mendel et al 2010)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

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- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

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- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care techniques

For rehabilitation of uncomplicated ankle fractures the current evidence recommends primary self-care. There is little evidence that routine physical therapy is needed during or after immobilization in general cases. The overall research is limited, so complications or significant restrictions may need further consideration. (Moseley et al 2015, Lin et al 2012)

Home Medical Equipment

- Gait assistive devices – walker, crutches, scooter, cane

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Ankle and Foot Tendinopathy

Diagnoses Included:

- Achilles Tendinopathy
- Posterior tibial tendinopathy

Definition

The ankle is made up of the distal tibiofibular syndesmosis, talocrural joint and subtalar joint. Stability of the joint is created through bony congruity of the articulations, ligamentous and non-contractile restraint, and surrounding muscular units. Tendons passing the ankle are some of the longest in the body, especially the Achilles tendon. It is named as the largest and strongest tendon in the body. There are several other tendons that cross the ankle and are of significance: those of the posterior and anterior tibials, flexor digitorum longus, flexor hallicus longus, Peronus longus and brevus. The Achilles is not encased in a true sheath as are many tendons. Due to the size and varied orientation of the Achilles tendon it is generally divided into three areas: Muscle-tendon junction, mid-body, tendon-bone insertion. Injury and irritation is possible to any of the tendons of the ankle-foot area. Symptoms are more common among very active middle aged adults, yet still not uncommon with more sedentary individuals. Tendinopathy of the Achilles tendon is much more prevalent and also more widely researched. (Carcia et al 2010)

Patient History

Special Considerations

Quality research to guide rehabilitation and physical therapy treatment of foot and ankle area tendinopathies is very limited. The majority of available research has been for Achilles related tendon issues. When considering assessment and treatment of tendinopathies of the lower leg and foot extrapolation of relevant information from other areas of the body may be needed.

Several risk factors for Achilles tendinopathy have been studied. Abnormal dorsiflexion and subtalar motion, increased pronation, varied tendon structure, obesity, diabetes, training errors and environmental factors have been named. Nonoperative treatment is favorable and often successful within 6-12 weeks (Carcia et al 2010).

Differential Diagnoses

- Tendon rupture
- Tendon tear
- Retrocalcaneal bursitis
- Posterior ankle impingement
- Tendon synovitis

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Multiple joint involvement	Rheumatologic diseases
Diabetes	Neuropathy
Discoloration of foot, exertional foot or calf pain	Vascular occlusion; vascular insufficiency
Severe pain, swelling, discoloration, cold to touch	Compartment syndrome

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Report of overuse such as increased athletic or sport training
- Common in activity that involves running
- 30-50 years of age higher incidence
- Male > Female incidence
- Gradual onset of pain
- Morning stiffness or after prolonged inactivity
- May have some decrease in pain with activity

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Objective Findings

- Outcome Measures – validated functional outcome measures should be used throughout an episode of care to track function and limitation progress from skilled care. Recommendation from strong evidence (Carcia et al 2010).
- Physical Impairment Measures – objective and reproducible measures of body function may be helpful over an episode of care are recommended to be tracked in treatment of tendinopathy. (Carcia et al 2010) This may include:
  - Ankle range of motion – plantar flexion, dorsiflexion, inversion, eversion
  - Single leg balance
  - Swelling
  - Foot alignment
  - Gait
  - Muscle strength – Plantar flexion, inversion, eversion
- Activity limitation/participation measures – useful during all phases of recovery, evaluation of activity limitation and participation over time is recommended. Measures of activity limitation should be objective and reproducible. (Carcia et al 2010) They may include:
  - Hop testing – lateral, side, figure 8, square
  - Heel raises
  - Timed walking
  - Stair tests
  - Percentage of participation

Specific Examination Considerations (evidence based)

- ***Ottawa Ankle Rules*** **–** these rules are recommended for use in determining whether a radiograph is required to rule out an ankle or foot fracture. Grade A recommendation from level I evidence (Martin et al 2013; Cook and Hegedus 2008)
- ***Special Clinical Tests*** **–** it is important that a test for screening or diagnosis be accurate, free from bias as possible and easily reproducible in the clinic. The closer to this standard a test has, the more benefit there is in its utility to correctly identify a patient's problem and in treatment decision making. Researchers and physical therapists Chad Cook and Eric Hegedus authored a collection of the most common physical examination tests in physical therapy. All the tests were evaluated based on available research including sensitivity, specificity, likelihood ratios and odds ratios. They were then evaluated for bias using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) and given a score; 0-14 with 14 indicating the least amount of bias. The following tests are based on their scoring and recommendation; common tests not listed did not meet quality standards of utility (Cook and Hegedus, 2008):
  - Syndesmotic sprains
    - Fibular Translation test (Moderate utility; QUADAS 8)
    - External Rotation Test (Moderate utility; QUADAS 8)

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- Anterior displacement of talus – Anterior Drawer Test (Moderate utility; QUADAS 8) – designed to measure damage to the ATF ligament.
- Subtalar joint stability – Medial Subtalar Glide Test (Moderate utility; QUADAS 8)
- Lateral integrity – Medial Talar Tilt Test (Minimal utility; QUADAS 8)
- Achilles integrity – Thompson test (Minimal utility; QUADAS 7). Low sensitivity test.
- Tarsal tunnel syndrome – Tinel's Sign at tarsal tunnel (Minimal utility; QUADAS 5). Low sensitivity

- Anterior ankle impingement
  - Forced Dorsiflexion Test (Moderate utility; QUADAS 8) reliability may be poor.
  - Clinical prediction rule of impingement (Moderate utility; QUADAS 8). 5 of 6 symptoms would be considered positive. Study quality suspect.
- Deep vein thrombosis (DVT)
  - Calf swelling measurement (Moderate utility; QUADAS 7)
  - Homan's Sign (Minimal utility; QUADAS 7,4) several conditions can cause false positives

Management/Intervention (evidence based)

- Strong Recommendation
  - Eccentric Loading – The most promising evidence for rehabilitation that results in reduced pain and improved function of Achilles tendinopathy involves eccentric loading. Especially for Mid-body pathology. Research appears mixed in duration of care and specific protocol, however most show improvement within 6-8 weeks with a program where the resistance is progressed. Evidence from several level I studies. (Frizziero et al 2014, Wiegerinck et al 2013, Rowe et al 2012,Carcia et al 2010). There is some evidence that isolation of eccentric only loading may not be necessary and eccentric-concentric has benefit in achilles tendinopathy. (Malliaras et al 2013)
  - Physical Agents –
    - **Shockwave therapy** – Midportion and insertional Achilles tendinosis may respond to extra corporeal shockwave therapy. Good quality evidence from Level I systematic reviews of controlled trials, however, after 12 month follow up groups using shockwave therapy were no better that eccentric groups. (Hainan et al 2016; Wiegerinck et al 2013, Rowe et al 2012).
- Moderate Recommendation
  - Low level Laser Therapy –
    - Based on one good quality RCT 12 sessions over 8 weeks helped to reduce pain and stiffness. Research is still limited with no indication of improvement of function. (Carcia et al 2010)
    - Iontophoresis – in Achilles tendinopathy of less than 3 months duration 4 treatments of iontophoresis with dexamethasone helped reduce pain and improve function. Based on one level II RCT (Carcia et al 2010)

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- Therapeutic Exercise –
  - Progressive functional rehabilitation appeared similar to immobilization in treatment of Achilles tendon rupture. However the groups using functional rehabilitation there was a trend toward earlier return to work. Re-rupture rate did not appear to be increased. Recommendation from level II evidence. (Mark-Christensen et al 2014)
  - Eccentrics – The addition of an eccentric program to multimodal care of insertional Achilles tendinopathy did not increase improvements from control group participants after 4 visits plus a 12 week home program. Eccentrics may not be as effective in patients with insertional tendinopathy. However it does not appear to decrease therapeutic effectiveness. Level II recommendation (Kedia et al 2014).
- Multimodal care vs. home program for tibial tendon dysfunction – Home based care (ice, strengthening and stretching) and center-based care (of HEP + PNF, estim, manual therapy and taping; 15x in 3 weeks) appeared to be equally effective in reducing pain and improving function in subjects with tibial tendon dysfunction. Recommendation that intensive supervised care may not be superior to more home based care with progression. Based on one Level II Randomised trial (Nilgun et al 2012)
- Self Care vs. Supervised Care –
  - Home-based programs of orthotics with stretching or stretching and exercise both significantly improved in pain and function over 12 week trial in individuals with posterior tibial tendinopathy. Recommendation from 1 level RCT. (Houck et al 2015)

- Weak Recommendation
  - Stretching – Stretching may be helpful in pain reduction and functional improvement in Achilles tendinopathy. There is very little evidence to support its benefit in isolated studies. Level II low quality study (Carcia et al 2010).
  - Manual Therapy – soft tissue mobilization may be useful in reducing pain and improving mobility in those with Achilles tendinopathy. However, there is not moderate or high level evidence to support this. Based on one level IV case study (Carcia et al 2010)
  - Running retraining – There is limited evidence that supports the use of training to transition from rearfoot strike pattern to a more anterior placement in Achilles tendinopathy. Most research reviewed used from 3 to 8 sessions with prolonged break afterword for final follow up. The few studies available have low participant numbers. Recommendation from low quality studies and expert opinion. (Barton et al 2016)

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- Neutral Recommendation
  - Low-level Laser – addition of LLLT to an eccentric program for Achilles tendinopathy did not result in improved outcomes. Its utility alone has not been established. It may not be an effective modality based on the study parameters. Recommendation based on one level II RCT (Tumilty S et al 2012)
  - Specific Soft-tissue mobilization – there is only very limited, low-quality research from a case study that included soft tissue therapy as part of their protocol. Expert opinion was that they may use soft tissue mobilization even being aware there was little supportive evidence (Rowe et al 2012)
  - Supportive Taping – There is unclear evidence in the utility of supportive taping in Achilles tendinopathy. There does not appear to be formal research. Recommendation on expert opinion only (Carcia et al 2016)
- Recommendation Against Use
  - Ultrasound – Ultrasound has not been found to be more effective than other traditional therapeutic exercise or to add benefit to loading programs. Recommendation to not use US in Achilles tendinopathy. Based on one inconclusive RCT and expert opinion (Rowe et al 2012).

Home Medical Equipment

- Orthotics –
  - There is mixed weak evidence; however orthotics may produce equivalent positive effects as eccentric training. However, they may not be beneficial when added to an eccentric training program. Weak evidence from level I systematic review (Scott et al 2015).
  - There is minimal evidence that foot orthotics may help to reduce pain in and alter foot mechanics while running in patients with Achilles tendinopathy. Grade C recommendation from level II-III evidence (Carcia et al 2010)
- **Heel lifts –** There is conflicting evidence as to if heel lifts are beneficial for Achilles tendinopathy. They do not appear to add benefit to an eccentric program (Carcia et al 2010)
- **Night Splint** – night splints do not appear to have any benefit when compared to an eccentric program (Rowe et al 2013, Carcia et al 2010)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care techniques

Alternatives/Adjunct Management

- Injections
- Surgery

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Plantar Fasciitis, Fasciosis

Diagnoses Included:

- Plantar Fasciitis
- Plantar Fasciosis
- Plantar Fasciopathy
- Plantar Heel Pain

Definition

The plantar fascia is an aponeurosis that spans the medial tubercle of the calcaneus to the phalanges. This arrangement allows the plantar aponeurosis to act like a pulley that creates tension in the foot during dorsiflexion of the 1st toe. This is commonly called the Windlass Mechanism. Together with the intrinsic foot muscles, the aponeurosis provides stability to the medial longitudinal arch during functional activities. Dysfunction of this plantar aponeurosis, or fascia, resulting in pain and difficulty in activity is very common. The entire etiology of plantar pain and dysfunction is not fully understood. It does appear that chronic overload either from lifestyle or frequent activity is related. Athletic, elderly and high BMI individuals are most affected. Primary symptoms of plantar dysfunction are pain radiating from the medial heel into the arch of the foot, pain with the first steps of the day and with warm up activity. Symptoms can become more pronounced as it progresses. It is common for symptoms to have been going on a year or more before seeking medical help.

Patient History

Special Considerations

- Most often plantar pain should be considered as a chronic condition. Patients with these conditions most often present for help after a year of more of having symptoms. Risk factors associated with plantar fascia pain are limited dorsiflexion, high-BMI less-active, Frequent running and work-related weight bearing with poor shock absorption. (Martin et al 2014)
- Specific consideration should be made of individuals exhibiting symptoms due to high BMI and low activity. Advice on general activity and weight reduction may need to be discussed with the patient. Additional referral to appropriate providers such as dietitian may need to be made. (Martin et al 2014)
- Whereas plantar fasciitis appears to be much more prevalent in adults, youth presenting with similar symptoms should be screened for Sever's disease (calcaneal apophysitis) and referred for imaging. (Huffer et al 2016) Treatment for this condition should not be guided by this specific guideline.

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Differential Diagnoses

- Fat pad contusion
- Calcaneal fracture
- Tarsal tunnel syndrome
- Talar fracture
- Calcaneal bursitis
- Sever's Disease

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Lower extremity deep vein thrombosis
Immune-compromised state	Infection
Multiple joint involvement	Rheumatologic diseases
Diabetes	Neuropathy
Discoloration of foot, exertional foot or calf pain	Vascular occlusion; vascular insufficiency
Severe pain, swelling, discoloration, cold to touch	Compartment syndrome

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Report of prolonged standing, possible on hard surfaces, regularly
- Report of running mileage above 30 miles a week or increase in training around time of beginning of symptoms
- Intense pain when first stepping out of bed or after prolonged rest
- Pain at start of activity
- Sharp pain in posteriomedial heel
- Chronic symptoms

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Objective Findings

- Outcome Measures – validated functional outcome measures, such as the LEFS scale should be used throughout an episode of care to track function and limitation progress from skilled care. Recommendation from strong evidence (Martin et al 2016).
- Physical Impairment Measures – objective and reproducible measures of body function that may be helpful over an episode of care are recommended to be tracked in treatment of plantar fasciopathy. Recommendation from moderate evidence (Martin et al 2016) This may include:
  - Ankle range of motion – plantar flexion, dorsiflexion, inversion, eversion
  - Pain rating with morning steps
  - Gait
  - Muscle strength – Plantar flexion, dorsiflexion of ankle and great toe
- Activity limitation/participation measures – The use of easily reproducible, performance based measures of activity is recommended to track progress from care. Based on expert opinion (Martin et al 2014) They may include:
  - Timed standing
  - Distance running
  - Heel raises

Specific Examination Considerations (evidence based)

- **Ottawa Ankle Rules** these rules are recommended for use in determining whether a radiograph is required to rule out an ankle or foot fracture. Grade A recommendation from level I evidence (Martin et al 2013; Cook and Hegedus 2008)
- **Special Clinical Tests** it is important that a test for screening or diagnosis be accurate, free from bias as possible and easily reproducible in the clinic. The closer to this standard a test has, the more benefit there is in its utility to correctly identify a patient's problem and in treatment decision making. Researchers and physical therapists Chad Cook and Eric Hegedus authored a collection of the most common physical examination tests in physical therapy. All the tests were evaluated based on available research including sensitivity, specificity, likelihood ratios and odds ratios. They were then evaluated for bias using the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) and given a score; 0-14 with 14 indicating the least amount of bias. The following tests are based on their scoring and recommendation; common tests not listed did not meet quality standards of utility (Cook and Hegedus, 2008):
  - Syndesmotic sprains
    - Fibular Translation test (Moderate utility; QUADAS 8)
    - External Rotation Test (Moderate utility; QUADAS 8)
  - Anterior displacement of talus – Anterior Drawer Test (Moderate utility; QUADAS 8) – designed to measure damage to the ATF ligament.
  - Subtalar joint stability – Medial Subtalar Glide Test (Moderate utility; QUADAS 8)
  - Lateral integrity – Medial Talar Tilt Test (Minimal utility; QUADAS 8)

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- Achilles integrity – Thompson test (Minimal utility; QUADAS 7). Low sensitivity test.
- Tarsal tunnel syndrome – Tinel's Sign at tarsal tunnel (Minimal utility; QUADAS 5). Low sensitivity
- Anterior ankle impingement
  - Forced Dorsiflexion Test (Moderate utility; QUADAS 8) reliability may be poor.
  - Clinical prediction rule of impingement (Moderate utility; QUADAS 8). 5 of 6 symptoms would be considered positive. Study quality suspect.
- Deep vein thrombosis (DVT)
  - Calf swelling measurement (Moderate utility; QUADAS 7)
  - Homan's Sign (Minimal utility; QUADAS 7,4) several conditions can cause false positives

Management/Intervention (evidence based)

- Strong Recommendation
  - Manual Therapy
    - Joint and soft tissue mobilization to help improve flexibility and joint mobility can help reduce pain and improve function in people with heel pain. Benefit has been demonstrated in 6 treatments over 4 weeks. Grade A recommendation based on strong evidence. (Martin et al 2014)
    - Addition of 8 treatments of ankle and foot mobilization to improve dorsiflexion to stretching did not appear to be more effective than stretching alone on improving dorsiflexion in those with plantar pain. Routine use of dorsiflexion specific mobilizations may not be needed. Level I evidence (Shashua et al 2015)
  - Stretching
    - Plantar-specific and gastrocnemius/soleus stretching can provide short term pain relief in patients with plantar facial pain. Most benefit appears to be between 2 weeks for 4 months. No evidence of long term or functional benefit from stretching alone. Grade A recommendation on strong evidence. (Martin et al 2014, Garrett et al 2012)
    - Stretching exercises specific to the plantar fascia is superior to repetitive radial shock-wave therapy in the treatment of acute plantar fasciopathy. Stretching should be tried prior to shock-wave therapy. Recommendation from one Level I RCT (Rompe et al 2010)
  - Taping
    - Short term anti-pronation taping (up to 3 weeks) has shown to be helpful in reducing pain and improving function in individuals with plantar fasciitis. Grade A recommendation from strong evidence. (Podolsky et al 2015, Martin et al 2014)
- Moderate Recommendation
  - Low level Laser Therapy
    - Based on one good quality RTC 12 sessions over 8 weeks helped to reduce pain and stiffness. Research is still limited with no indication of improvement of function. (Carcia et al 2010)

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- Shock Wave Therapy –
  - Extracorporeal shock wave therapy appears to reduce pain and especially morning pain in cases of plantar pain that have failed other treatments. ESWT may be helpful in more chronic plantar conditions with failed trials of traditional physical therapy. Recommendation from limited level I evidence (Lou et al 2017, Martin et al 2014) It may be more effective when combined with stretching (Rompe et al 2015)
- Concentric–Eccentric strengthening
  - High load strength training with specific concentric-eccentric heel raise exercise demonstrated higher improvement in function than stretching alone in those with plantar fasciial pain. Patients had 1 supervised visit and were instructed to perform the exercise every other day for 3 months. Use of concentric-eccentric exercise that stresses the plantar fascia maybe beneficial over 3 months. Recommendation from level II RTC. (Rathleff et al 2014)
- Self Care vs. Supervised Care
  - A program of 7 exercises performed at home after 1 supervised visit was as effective as a corticosteroid injection plus stretching for plantar heel pain and function over 12 weeks. Patients may be able to reduce pain and improve function with minimal supervised care. (Ryan et al 2013)

- Weak Recommendation
  - Low-level Laser
    - LLLT may reduce pain in some individuals with planter pain and allow tolerance to activity. There is little evidence to guide dosing or frequency. Grade C recommendation from limited moderate evidence. (Martin et al 2014)
    - Use of 15 laser sessions was more effective than 15 US sessions on pain and function in chronic plantar pain. LLLT may be more beneficial than ultrasound for plantar pain. One, level II RCT. (Ulusoy et al 2017)
  - Myofascial release
    - After 12 sessions of myofascial release therapy, the intervention group showed significant improvements in pain and function at 4 and 12 weeks. Control group was sham ultrasound. Can only surmise that myofascial release is superior to no treatment at all. May be helpful option but not additional information on specific dosage/frequency. Recommendation from one limited RCT (Aminsha et al 2014)

- Neutral Recommendation
  - Phonophoresis
    - There is limited evidence that phonophoresis with ketoprofen may reduce pain in individuals with plantar pain. Grade C recommendation from limited moderate evidence. (Martin et al 2014)
  - Foot intrinsic strengthening
    - There is limited evidence to advise on the use of exercises specific to foot intrinsic strengthening in the overall care of people with plantar pain. (Huffer et al 2016)

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        - **Lower extremity strengthening** hip and lower extremity strength deficits have been identified with lower extremity overuse injuries. There is little evidence in those with plantar pain specifically. Strengthening may be prescribed to help control pronation and force attenuation. Expert Opinion. (Martin et al 2014)

- Recommendation Against Use
  - Dry Needling
    - There is limited evidence to support the use or clinical benefit from dry needling for plantar fasciitis. Its use cannot be recommended. Based on lack of evidence. Expert opinion (Martin et al 2014)
  - Electrotherapy
    - There appears to be little to no benefit from electrotherapies in patients with heel pain and plantar fasciitis. Recommendation to use manual therapy, stretching and foot orthoses instead for the short and long term (1-6 months). Grade D recommendation for use of electrotherapy based on strong evidence against benefit. (Martin et al 2014)
  - Ultrasound
    - Ultrasound has not been found to be more effective than other treatment options. Recommendation to not use US in plantar pain conditions. Grade C recommendation based on one weak study. (Martin et al 2014)

Home Medical Equipment

- Orthotics
  - Supporting the medial longitudinal arch with orthotics (custom or pre-fabricated) appears to reduce pain and improve function from 2 weeks up to 1 year, especially to those that respond to supportive taping. Grade A recommendation from strong to moderate evidence (Martin et al 2014)
- Heel lifts
  - There is conflicting evidence as to if heel lifts are beneficial for Achilles tendinopathy. They do not appear to add benefit to an eccentric program (Carcia et al 2010)
- Night Splint
  - A 1-3 month program of night splints in individuals with heel pain may help reduce pain, especially first-step pain in the morning. Grade A recommendation from strong evidence. (Martin et al 2014)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

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Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

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Overuse/Sport

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Hypermobility

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Home and Self-Care techniques

Alternatives/Adjunct Management

- Injections
- Surgery

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Hip Fracture, With or Without ORIF

Diagnoses Included

- Intracapsular proximal femoral fracture
- Extracapsular proximal femoral fracture
- Surgical interventions to fixate proximal femoral fracture (Superior edge of femoral head to approx. 5cm distal of the lesser trochanter) except total hip arthoplasty (THA). THA has its own guideline in this publication. (Ftouh et al 2017)

Definition

Hip fracture is the plain term for a proximal femoral fracture. The fracture occurs in the area from the tip of the femoral head to approximately 5 cm distal to the lesser trochanter. The fractures can be divided into intra- and extra-capsular depending on location. This categorization is often of more importance for surgical approach and technique. (Ftouh et al 2017)

Patient History

Specific Considerations

- Rule out Red Flags
- Identify surgical complications if applicable
- Familiarize with extent and success of surgery
- Familiarize with length of hospitalization and any inpatient care
- Age and health of patient
- Pain control
- Post-operative precautions from the surgeon
- Any level of dementia, confusion or other altered mental status
- Osteoporosis, osteopenia, weakness and otherwise frail

The average age of a person with a hip fracture has been reported as 83-84 years old with up to 76% occurring in women (Ftouh et al 2017). Hip fracture is most often associated with a fall-related injury in elderly people. It has reported that over 40% of people with hip fracture have dementia or other cognitive impairment. (Smith et al 2015). A majority of research on the aftercare of a hip fracture includes participants over the age of 65 (Handoll et al 2011). A primary goal is to reduce risk of continued disability and decline in quality of life (Crotty et al 2010). In general, the first line of treatment for a hip fracture is a surgical fixation.

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Red Flag	Possible Consequence or Cause
Severe trauma post op	Fracture, dislocation, ligament tear, avascular necrosis
Fever, severe pain, drainage	Possible infection
Lower extremity shortening or external rotation	Fracture
Unilateral edema	Lower extremity deep vein thrombosis
Recent invasive procedures post op (dental work, urologic procedures)	Infection
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
History of steroid use	Avascular necrosis
Immune-compromised state	Infection

Differential Diagnoses

- Pelvic Fracture
- Hip Dislocation
- Bony pathology - tumor
- Avascular necrosis

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al 1999; Stratford et al 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:

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- Minimally Clinical Important Difference has been met in the Functional Outcome Measure
- The Numeric Pain Rating Scale is reduced by 2 points
- Range of Motion remains below what is required for personal care or essential employment requirements

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

- Fractures are usually the result of trauma or falls.
- The elderly and women have a higher incidence.
- Depending on the specific fracture and surgical repair, weight bearing may be protected for a period of weeks.
- Patient usually has pain complaints over the lateral thigh and/or the groin, occasionally on the buttock.
- Ecchymosis and swelling may be present.
- Functional limitations immediately post-procedure are very common.
- May be a report of bone density decrease
- Very common for patients to report a surgical repair with a stay in the hospital or other rehab facility prior to any home care or outpatient care.

Objective Findings

Clinicians should use functional outcome measures to assist in tracking outcomes as a result of skilled care (see "Requirements for physical therapy"). These should be used before and after interventions. A primary outcome of skilled care for hip fracture should be mobility (ability to move around, walk and maintain body position) and may be recorded through use of an outcome measure. (Diong et al 2015, Handoll et al 2011, Binkley et al 1999).

Objective findings should be focused on impairments as a result of the fracture and surgery. They should also be tracked over time to show progress from care. There is no evidence to support or refute the use of specific objective findings during the care of a patient for rehabilitation of a hip fracture. It is recommended that clinicians take into account various findings based on clinical judgment. These will likely guide treatment decisions (but are not inclusive or exclusive):

- Affected daily abilities
- ROM limitations of affected joints and surrounding areas including the spine
- Inspection/palpation
- Pain ratings
- Radiologic reports
- Edema and swelling levels – grades, LE girth measures, volumetric
- Surgical site findings – level of healing, incision measurements, presence of drainage, redness or other signs of complication or infection
- Screen for blood clot, infection or other complications
- Use of assistive device
- Gait
- Strength
- Level of assistance needed for transfers and daily tasks
- Level of cognitive ability
- Fall history or risk of falls
- Assessment of cardiovascular status – HR, BP, RR
- Neuromuscular screen
- Caregiver status

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- Assessment of living location/home

Specific Examination Considerations (evidence based)

There is currently no evidence to indicate the need for specific orthopedic physical examination tests during the skilled rehabilitation following a hip fracture surgery. The need to assess mobility and function has already been discussed and should be considered as usual care throughout the rehabilitation program.

Secondary outcomes more specific to mobility, balance and daily life have been shown as ways to record and track specific impairments in several peer reviewed studies (Diong et al 2015, Crotty et al 2010). Some of the more common specific outcomes in the literature are:

- Sit to Stand Test
- Timed Up and Go Test
- Gait Speed
- Berg Balance Scale
- Record of daily activity ability

Concern for and understanding of the mental status of patients with hip fracture should be established. Recent evidence suggests up to 40% of patients with hip fracture will have some level of dementia. (Smith et al 2015). Use of the Mini-Mental State Exam has been found in use with patients with hip fracture (Karlsson et al 2016).

Management/Intervention (evidence based)

Quality, peer reviewed, evidence to guide the skilled physical therapy care following a hip fracture is limited in amount and quality of the evidence. There is no one protocol that has been established as best practice. Relevant evidence applicable to the care of these patients will be outlined with recommendations where possible.

Initiation of Physical Therapy Care – Early mobilization with a physical therapist appears safe and effective in promoting early recovery of the ability to transfer without assistance. A moderate recommendation from a RCT indicates mobilization can occur as soon as the day after surgery. Further recommendations are that nursing can reinforce patient mobility at other times without help from skilled care providers (Ftouh et al 2017)

- Special care for patient with dementia or psychological factors
  - There have been low quality trials of enhanced care for patients with dementia that led to reduced rates of complication and institutionalization up to 3 months after discharge. However, there was not enough evidence to support any recommendation of enhanced care above usual active care for people with dementia being seen for hip fracture rehabilitation. Neutral recommendation from low quality studies (Smith et al 2015).
  - Those with dementia or living in care facilities showed greater need for supervision in the transition to a home program instead of continuing with hospitalization. They were able to show improvement with a home program however. Moderate recommendation from high quality RCT (Karlsson et al 2016).

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- Interdisciplinary care in patients with mild to moderate dementia is supported for those who have sustained a hip fracture in helping them to improve functional outcomes. Strong recommendation (AAOS 2014).
- Trials using reorientation, intensive skilled therapy and/or cognitive behavior therapy were not found to have significant differences in outcomes at 12 months after discharge. Evidence was too low of quality to recommend any change to usual practice. (Crotty et al 2010)

- Strength training
  - Progressive strength training increased leg extensor and hip flexor strength as well as walking speed compared to just motor training by 3 months after surgery. Strong recommendation based on high quality evidence. (Ftouh et al 2017).
  - Strength training up to 70-80% of a 1 repetition maximum intensity is recommended to help improve balance, mobility and ADL's in patients after discharge from the hospital. Even up to 6 months post fracture. Recommendation based on strong evidence (AAOS 2014, Sylliaas et al 2011)
  - There is no statistically significant evidence that ADL, gait and balance testing improves better after 3 months post-surgery with strength training versus motor training. High-moderate evidence. (Ftouh et al 2017, Handoll et al 2011)
  - Inclusion of structured progressive resistance training after hip fracture appears to be important to improve mobility. It appears that training done in other settings then the hospital show greater improvements from the intervention exercise. Moderate recommendation from moderate quality evidence (Diong et al 2015)
  - Exercise programs extending up to 12 months after surgery may result in significant improvement in some functional areas: knee extension, balance, timed-up-and –go Test, "fast" gait speed. Some evidence to suggest better adherence with a community based program. Strong evidence (Mohammad et al 2012)
- Gait training
  - There is no evidence that specific treadmill training is better than control on walking speed or pain. High evidence (Ftouh et al 2017, Handoll et all 2011)
  - There is no evidence that specific treadmill training reduces length of hospital stay compared to control. Moderate evidence (Ftouh et al 2017)
- Transition to home care
  - Consider early supported discharge from hospital to home if patient is medically stable and patient has the ability to participate in continued rehabilitation. Is able to transfer and walk short distances. There is a significant increase in functional independence measures with home-based care compared to usual care. Strong recommendation with high quality evidence (Ftouh et al 2017).
  - Participants in a home program had a significantly shorter hospital stay. Those with dementia or living in care facilities showed greater need for supervision. Participants also gained walking ability similar to those staying a rehab program. Strong level of evidence from one RCT (Karlsson et al 2016)
  - Patients who had completed standard rehabilitation after hip fracture showed improved physical function at both 6 and 9 months with the use of a self-led home exercise program. Moderate evidence from RCT (Latham et al 2014)

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- Home program following hospital discharge versus continued outpatient care
  - Participants discharged from the hospital to home improved mobility recovery better than standard care after a yearlong home-based progressive rehab program. Study participants were seen 5-6 times over that year by a physiotherapist (including 4-5 program updates). A year long home program with minimal home visits and no special training or equipment is feasible. Moderate recommendation, one RCT of moderate quality (Salpakoski et al 2014)
- Physical agents and modalities
  - Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence. There is no current best evidence to give recommendations on the use of modalities after hip fracture.
- Trigger Point Dry Needling

Very low quality to moderate quality evidence suggests that dry needling is more effective that no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes with compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017).

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  - Selection of activity that does not exacerbate symptoms.
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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence. Evidence has already been presented recommending an early discharge from the hospital or care facility can be as beneficial as standard care. Also that mobility may improve better with a home program vs standard care. The evidence would suggest that for most patients following hip fracture surgery, discharge to home with a progressive program may result in equal or better outcomes than standard care. It is understandable that there may be some need for minimal visits to progress a home program over time. (Ftouh et al 2017, Karlsson et al 2016, Salpakoski 2014)

Home Medical Equipment

- Hot packs/cold packs after incision heals
- Theraband, ankle weights, for home exercise
- Assistive gait devices, wheelchair
- ADL assistive devices – shower chairs, rails

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Community exercise and wellness programs

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Tendinopathy (non-OA, non-surgical)

Diagnoses Included:

- Hip pain unspecified
- Greater trochanteric pain syndrome
- Hip bursitis
- Groin pain
- Osteitis pubis
- Proximal hamstring strain
- Proximal iliotibial band pain/friction
- Gluteal tendinopathy
- TFL tendinopathy

Definition

- The extra-capsular areas of the hip are mostly comprised of soft tissues and their attachments to the proximal femur or origins on the pelvic bones. The tendons and other fascia attaching and supporting the muscles are certainly important to the utility of the hip. Major muscle groups surround the hip joint and allow for movement in all planes. Several bursa are also present in the hip area, especially near the greater trochanter. Any of these structures can become irritated, overworked, injured or even ruptured. It appears that injuries in these categories are more often seen in patients that are young and active, however some can be result of underuse and general weakness. (Barratt et al 2017, Grimaldi et al 2015
- There are a multitude of diagnoses possible in regards to the soft tissue structures surrounding the hip. Unfortunately, there is very limited quality evidence for most of these diagnoses. The mechanism of injury, demographic of patients and rehabilitation possibilities of these injuries are not similar to intra-capsular injuries/deterioration or surgery. Dysfunctions such as femoroacetabular impingement and labral tears both appear to be associated with osteoarthritis of the hip joint (Enseki et al 2014). They will not be included in this guideline. Lack of evidence does not allow creation of individual guidelines at this time. For the purposes of this guideline the following categories of extra-capsular hip pathology will be considered:
  - Gluteal tendinopathy (Greater trochanteric pain syndrome(GTPS))
  - Proximal hamstring tendinopathey
  - Adductor/Groin tendinopathy /Osteitis pubis
  - Proximal Iliotibial band syndrome/TFL

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Patient History

Special Considerations

- **Gluteal tendinopathy/GTPS –** Recently, scientific and expert consensus appears to be advising against the use of trochanteric bursitis in most cases of lateral hip pain. Imaging studies have started show decreased incidence of actual bursal inflammation in lateral hip pain with a greater incidence of gluteal tendinopathy. The possibility of tendionpathy of the gluteus minimus and/or medius either alone or in combination of bursal irritation should be considered. Common presentation of lateral hip pain over the greater trochanter, pain with trying to lie on the same side and aggravation with repetitious activity has been reported. Up to 2/3^{rds} of people presenting with GTPS also have some level of hip OA, low back pain. Having a high BMI also appears to be a factor (Grimaldi et al 2015, Reid 2015)
- **Proximal Hamstring tendinopathy** – It appears this type of injury is most commonly encountered during sports, or high level, activity participation. There have been several factors associated with hamstring injury including weakness, decreased motor control, flexibility and posture deviations (Mason et al 2012). Participants in sporting events that require high speed sprinting (football, track, soccer) or that require extreme ranges of motion (dancing) have an increased susceptibility. Special concern should be given to the high incidence of recurring hamstring injury; especially during the first two weeks following the return to sport. (Heiderscheit et al 2010)
- **Adductor/Groin Tendinopathy** – Consideration should be made of the complex anatomy in the medial hip/groin region. With proximity to urogenital, gynecological and gastrointestinal structures a thorough history and exam will be important to rule out red flags or the need to refer to other specialties. These issues, both acute and long standing, are frequently problems in sports with rapid changes of direction (Serner et al 2015). Consideration should also be made of the pubic symphysis and the possibility of osteitis pubis; inflammation of the pubic symphysis and the surrounding structures. (Choi et al 2011).
- **Iliotibial band Syndrome/TFL tendinopathy** – Even though the majority of ITB issues present with symptoms at the knee, some consideration should be made for the proximal origins and the tensorfascialata (TFL) muscle. It is possible for a more proximal presentation or tendinopathy of the TFL.

Differential Diagnoses

- Lumbar referral
- SI joint dysfunction
- Nerve entrapment
- Hip osteoarthritis
- Femeroacetabular Impingement
- Labral tears

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- Hip fracture
- Rheumatoid arthritis
- Avulsion/apophysitis
- Avascular necrosis of femoral head
- Sports hernia
- Hip dysplasia
- Gynecological disorders
- Neoplasm or malignancy

Red Flag	Possible Consequence or Cause
Severe trauma post op	Fracture, dislocation
Fever, severe pain	Possible infection
Lower extremity shortening or internal rotation	Dislocation
Unilateral edema	Lower extremity deep vein thrombosis
Recent invasive procedures post op (dental work, urologic procedures)	Infection
"Pistoning" during gait	Dislocation

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.

Subjective Findings

- Gluteal tendinopathy/GTPS -
  - Lateral hip pain over the greater trochanter that is aggravated by activity
  - Generally mid age in athletes and inactive adults
  - Presents in females more than males
  - Pain at night, especially with trying to lie on the same side
  - Report of repetitive activity
- Proximal Hamstring tendinopathy
  - Often patient will report participation in activities involving running and sprinting
  - May report participation in activities that require extreme range of motion demands of the hamstrings (dancing, cheer)
  - May have report of similar injuries in the past
  - Pain near the gluteal cleft
  - Pain with sitting
- Adductor/Groin Tendinopathy
  - Often patient will report participation in activities involving running, kicking and changing directions.
  - Active populations
  - Younger active populations more often specific to osteitis pubis
  - Pain with activity, especially changing directions
  - Pain starting in medial hip/groin that may also spread down medial thigh
- Iliotibial band Syndrome/TFL tendinopathy
  - Often will report regular running
  - Often will have pain at the knee, however can also present with pain at the lateral hip and thigh
  - Pain at night, especially with trying to lie on the same side
  - Report of repetitive activity
  - May have pain with prolonged weight bearing, especially on one limb

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Objective Findings

- **Activity limitation and outcome self-report measures –** It has been recommended that clinicians use validated outcome measures that include areas of hip pain, function and activity limitations. Visual analog pain scales and Lower Extremity Functional Scale (LEFS) have been included in these recommendations. Recommendation based on strong evidence (Enseki et al 2014, Binkely et al 1999).
- **Specific physical impairment examination** – Periodic assessment of activities specific to the patient and their goals may be helpful. Tracking of function in daily tasks will be helpful in assessing progress from the skilled care. Recommendation based on moderate evidence (Enseki et al 2014). Some examples may be:
  - Patient Specific Functional Scale
  - Running or walking assessment
  - Single leg squat or step down
  - Sitting or standing tolerance
  - Ability in self-care and dressing
  - Especially for younger/active populations ability to participate in running, squatting, jumping, lunging, dancing or other chosen activity
  - Joint range of motion
- Muscle testing
  - Active hip abduction, adduction, flexion, extension to create load on potential pain generating musculotendinous areas or to test for weakness may be helpful in diagnosis and treatment of hip problems. Addition of overpressure may enhance provocation. (Grimaldi et al 2015)

Specific Examination Considerations (evidence based)

- Specific physical examination tests for the hip have limited utility due to poor study designs, low numbers of designs and risk of bias. (Cibulka et al 2017, Reiman et al 2014, Tijssen et al 2012, Cook and Hedegus 2008). However, it is generally accepted as normal practice to use these tests as screening tools to help guide treatment and rule out differential diagnoses.
  - FABER – Flexion Abduction External Rotation Test (Patrick Test). Moderate utility score for assessing anterior or lateral hip capsular restriction (Cook and Hegedus 2008). When replicates the patient's lateral hip pain with absence of ROM restriction may be more indicative of GTPS (Grimaldi et al 2015, Fearon et al 2012)
  - Thomas Test – minimal utility for capsular tightness, can help to screen for hip flexor tightness. (Cook and Hegedus 2008)
  - Passive Hip Abduction Test – Moderate utility in assessment of possible early hip dysplasia. (Cook and Hegedus, 2008)
  - Patellar-Pubic Percussion Test – Good level support and utility as a diagnostic screening tool for hip/femur fracture (Cook and Hegedus, 2008)
  - Ober's Test – Very common in practice, however its diagnostic value has not been determined. (Grimaldi et al 2015, Cook and Hegedus 2008)

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- Sustained Single Leg Stance test – appears to have moderate utility in diagnosis of gluteal tendinopathy with excellent sensitivity and specificity (Lequesne et al 2008)
- Trendelenburg's Sign – Should performed in standing and during gait. Significant weakness in the test may be indication of gluteal tear. Moderate utility (Cook and Hedegus 2008)
- GTPS – Lateral hip pain in the absence of trouble putting on shoes and socks, combined with a positive FABER with pain over the greater tronchanter and pain with palpation of the greater trochanter is indicative of GTBS over hip OA (Fearon et al 2012)
- Hip OA pain – Recommendation to document and track Flexion-Abduction-External Rotation Test (FABER/Patrick's Test) at start of care and over an episode of care. Grade A recommendation with level I and III evidence. (Cibulka et al 2017).
  - Combined symptoms of hip pain, IR < 15 degrees with pain, morning stiffness up to 60 minutes and age > 50 have shown moderate utility in the clinical diagnosis of hip OA. Based on one study looking at combined results in OA tests. (Cook and Hedgus, 2008)
  - Range of Motion – limitation in three planes of hip motion or more may be indicative of hip OA. Moderate utility recommendation (Cook and Hedegus, 2008)
- Femoroacetabular impingement (FAI) and labral tear specific tests – There are currently not enough quality studies in regards to specific test for FAI and labral tears that can reliably confirm or deny a diagnosis. Out of 11 investigated tests, only Flexion-adduction-internal rotation Test and Flexion-Internal Rotation test have shown mild utility as a screening tool. (Reiman et al 2014, Tijssen et al 2012)
  - Hip Scour – moderate utility supported by poorly designed studies in identifying potential labrum tears. (Cook and Hedegus, 2008)
  - Hip Quadrant – Mild ultility for partial tear of the labrum. Only supported by one study. (Cook and Hedegus, 2008)

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Management/Intervention (evidence based)

- Evidence to guide treatment of extra-capsular hip pathology is very limited. Much of the scientific evidence on the conservative treatment through rehabilitation to date is of low or very low quality. Often due to risk of bias, low participants or no randomization (case studies) it is difficult to extrapolate any result for clinical purposes. There is also not enough evidence to support one protocol over another. Evidence does suggest that physical therapy is beneficial, however, and may be helpful in reducing the time to return to function (Barratt et al 2017, Enseki et al 2015, King et al 2015, Reid et al 2016, Mason et al 2012). Where possible, best evidence recommendations have been outlined below based on the level of recommendation, followed by population specific recommendations:
  - Moderate recommendation – based on moderate quality evidence including randomized trials
    - Dry Needling vs Cortisone injection – Dry needling does not appear to be inferior to cortisone injection after 6 weeks. Number of dry needling and injection was not investigated. Short term trial of dry needling may have similar result to cortisone injection for patients with GTPS. Level 1b evidence, 1 RCT only (Brennan et al 2017)
    - Lengthening exercise in hamstring injury – addition of lengthening exercise in the rehabilitation of hamstring injury was more effective than traditional care alone on reducing return to play time. This did not have an effect on re-injury rate however, which is high in this type of injury. Meta-analysis, level I(Pas et al 2015)
    - Progressive agility and trunk stabilization may help reduce reinjure rates for those with hamstring injuries after a rehabilitation program (Pas et al 2015, Heiderscheit et al 2010)
  - Minimal recommendation – based on low quality evidence or expert opinion only
    - Manual Therapy –
      - joint mobilization may be indicated when capsular restrictions of the hip are present and impair mobility or function. Soft tissue mobilization such as deep tissue or friction massage may be indicated when muscle and fascia impair hip mobility. Expert opinion (Reid et al 2016, Enseki et al 2014)
    - Therapeutic exercise –
      - Exercise therapy may improve short-term outcomes better than passive modalities in groin pain (Almeida et al 2013)
      - may address mobility, strength, power and deconditioned deficits identified through examination and functional assessment. Expert opinion (Enseki et al 2014)
      - Eccentric Exercise – evidence in tendinopathies of other body areas appears to support its use with good results. There does not appear to be current evidence specific to the hip however. Expert opinion based on strong evidence from results in other body areas but not hip (Reid et al 2016)

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- Neuromuscular re-education/Pain science – neuromuscular re-education procedures to address coordination may be used. Discussions involving more recent theories on pain science may be helpful (Enseki et al 2014)

- No/neutral recommendation – Low quality evidence with no indication of preference
  - Aquatic vs land based exercise – No difference in hip abductor or knee extensor strength in aquatic vs land based therapeutic exercise. Application of resistance may be inadequate in aquatic exercise reviewed. Level I review of low quality studies (Heywood et al 2017)
  - Osteitis Pubis – Current best evidence is of low quality and no recommendations on specific treatments that may be more effective than another of this specific diagnosis. Level I review (Choi et al 2011)
- Recommendation against – current evidence demonstrates no benefit
  - In cases of insertional tendinopathies passive stretching for elongation or that places a tensile and compressive load may be counterproductive and is not recommended (Grimaldi et al 2015)
  - Sacroiliac mobilization does not appear to have any therapeutic effect in acute hamstring injury. Moderate recommendation against. Level I (Pas et al 2015)
  - Ultrasound does not appear to have a beneficial effect on muscle healing in hamstring injuries. Expert Opinion based on moderate evidence (Heiderscheit et al 2010)
- Athletic Considerations –
  - Hip tendinopathies are often the result of high level athletic participation. Controlling tendon load will be of importance in their rehabilitation. Activity modification while still allowing some levels of participation may be helpful. This may also involve movement retraining and alteration (gait, mechanics, form, cadence, etc). Low quality evidence and expert opinion (Grimaldi et al 2015)
  - Return to play time for groin related injuries may be much shorter for cases treated with multimodal physical therapy than cases treated surgically. Consideration should be made for rehabilitation based on with or without surgical technique. Low quality level IV evidence reported in level I review (King et al 2015, Serner et al 2015)
  - Progressive agility and stabilization appears to reduce re-injury rate when compared to standard strengthening program for hamstring injury but does not appear to reduce return to play time (Pas et al 2015)
  - Runners might benefit from mobilization, hip strengthening and advice about running shoes and surfaces when dealing with ITBS. Expert opinion (Van der Worp et al 2012)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

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- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care techniques

Participation by the patient in a home program, as taught by their provider, is considered part of usual care. Patients should be consistent with performing a home program of mobility, exercise and modification.

- Alternatives/Adjunct ManagementReferral to medical doctor for cases that do not progress in a timely manner may be necessary. Other treatment options may be – injection, shock wave therapy, medication or surgery.

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Hip Replacement, Resurface

Diagnoses:

- Total hip arthroplasty
- Hip arthroplasty
- Hip resurfacing procedure

Definition

- Total hip arthroplasty involves the implantation of an artificial femoral head and acetabulum to replace a degenerative and painful joint. THA is one of the most common orthopedic surgeries performed. The primary indication for hip replacement surgery is pain arthritis. (Smith et al 2016) The procedure may involve replacing only the femoral component (Hemiarthroplasty). Components may be cemented, non-cemented, or hybrid (femoral component cemented, with non-cemented acetabular component).
- More recently, the use of a resurfacing procedure is being used in patients that are relatively younger and more active than traditional patients that would receive a full hip replacement (Barker et al 2013). This procedure utilizes prosthetics that only replace joint surfaces and there is much less sacrifice of bone tissue

Patient History

Patient History may include

Special Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of the traumatic event.
- Identify surgical complications if applicable
- Familiarize with extent and success of surgery
- Familiarize with length of hospitalization and inpatient care
- Age and health of patient
- Pain control
- Post-operative precautions from the surgeon

Traditional physical therapy has been routine in the rehabilitation following surgery for some time. However, impairments in muscle strength, postural stability and functional ability up to one year after hip replacement have been documented. There is continued uncertainty regarding effectiveness of physical therapy following hip replacement (Minns Lowe et al 2015).

Some consideration of the surgical technique and approach used should be made while establishing a post-operative plan of care. The type of component, any cement and anatomical location of surgical site can all have effects on precautions from the surgeon and healing required.

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Red Flag	Possible Consequence or Cause
Severe trauma post op	Fracture, dislocation
Fever, severe pain	Possible infection
Lower extremity shortening or internal rotation	Dislocation
Unilateral edema	Lower extremity deep vein thrombosis
Recent invasive procedures post op (dental work, urologic procedures)	Infection
"Pistoning" during gait	Dislocation

Differential Diagnoses

- Hip fracture – please refer to Orthopedic Hip Fracture Guideline
- Bony pathology/malignancy
- Avascular Necrosis

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al 1999; Stratford et al 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

Discharge Criteria

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- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- History of progressive hip pain over several years
- History of progressive decline in functional ability
- Pain around the hip, groin, thigh, buttocks and back
- Swelling
- Joint stiffness
- Lower extremity weakness
- Antalgic gait and difficulty walking
- Report of stay in hospital and/or rehabilitation inpatient unit
- May report requires help aides such as cane, walker and caregiver.

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Objective Findings

- Clinicians should use standardized functional outcome measures to assist in tracking outcomes as a result of skilled care (see "Requirements for physical therapy"). These should be used before and after interventions at logical time intervals to allow for change**.** The use of secondary specific outcomes also appears to be common practice (Smith et al 2016, Minns Lowe et al 2015, Strattford et al 2000). It is recommended that clinicians take into account various findings based on clinical judgment to guide treatment (not inclusive):
  - ROM limitations to affected joints
  - Pain ratings
  - Gait Assessment
  - Stair ability
  - Walking trials
  - Muscle strength
  - May need to screen for blood clot, infection or other complication

Specific Examination Considerations (evidence based)

There is currently no evidence to indicate the need for specific orthopedic physical examination tests ("special tests") during the skilled rehabilitation following a hip replacement surgery. There does not appear to be specific validation of such tests for this particular diagnosis. The need to assess mobility and function has already been discussed and should be considered as usual care throughout the rehabilitation program.

Management/Intervention (evidence based)

Quality, peer reviewed, evidence to guide the skilled physical therapy care following a hip replacement procedure is very limited (Smith et al 2016, Minns Lowe et al 2015, Coulter et al 2013, Di Monaco et al 2013). There is no one protocol that has been established as best practice. (Minn Lowe et al 2015, Di Monaco et al 2013) Relevant evidence applicable to the care of these patients will be outlined with recommendations where possible

- Outpatient-supervised care vs home-based unsupervised –
  - Outcomes at 6 months post-surgery were statistically similar for supervised and unsupervised care for participants following hip replacement. Recommendation that early rehab programs can be effectively completed in the home for low-risk patients. Moderate recommendation. One blinded RCT (Coulter et al 2016).
  - Outpatient supervised rehabilitation did not provide any additional benefit from unsupervised home exercise programs for outcomes of strength, gait speed and cadence. There was a slight higher outcome for timed-up-and-go after supervised physical therapy after 8 weeks of care. Recommendation that strength and function and be improved with a home program. Moderate level evidence. (Coulter et al 2013).

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- Use of post-operative assistive devices and environmental modifications
  - Further quality trials are needed to establish and assess the outcomes of using assistive device and home modification following hip replacement. There is some very limited information to suggest use of such devices may be counter productive. Not enough evidence for recommendation for or against. (Smith et al 2016)
- Progressive Resistance Training
  - Consistent report from studies that muscles trained via PRT will increase in strength after THA. There is also some weak to moderate evidence that PRT can improve functional capacity. Resistance training before and after hip replacement is safe and feasible. Strong recommendation for strengthening in general. (Skoffer et al 2015).
  - Maximal strength training 1 week post-op is feasible and efficient after hip replacement in regaining muscular strength. (Husby et al 2009).
- Task Specific vs Traditional Rehabilitation –
  - inpatient task oriented exercise with an emphasis on early weight bearing appeared superior in functional outcomes of participants when compared to traditional partial weight bearing and open-chained activity. Recommendation for early weight bearing and function related activity for patients with hip fracture. Weak to moderate recommendation. One RTC with limitations (Monticone et al 2014).
  - Use of an accelerated, tailored rehab exercise program resulted in better functional and strength outcomes after hip resurfacing when compared to traditional care. They also had higher rate of achieving self-selected goals. Participants were seen two weeks after discharge from hospital and were given updated exercises every two weeks over 8 weeks. Superior outcomes may be had with use of exercise programs tailored specific to the patient and their surgical procedure (resurfacing vs replacement). Moderate level evidence but study only included men. RCT (Barker et al 2013).
- Physical Agents and Modalities
  - Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence. There is no current best evidence to give recommendation on the use of modalities after hip replacement or resurfacing surgeries.
- Trigger Point Dry Needling
  - Very low quality to moderate quality evidence suggests that dry needling is more effective that no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes with compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017)

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence. Evidence has already been presented recommending potential for an early discharge from the hospital or care facility can be as beneficial as standard care. Also that functional outcomes and strength may improve better with a home program vs standard outpatient care. The evidence would suggest that for most patients following hip replacement surgery, discharge to home with a progressive program may result in equal or better outcomes than standard care. It is understandable that there may be some need for minimal visits to progress a home program over and extended time. (Coulter et al, 2016,2013; Barker et al 2013)

Home Medical Equipment

- Cold packs/hot packs after incision heals
- Theraband, ankle weights, for home exercise
- Assistive gait devices, wheelchair, rails or other environmental equipment used sparingly and for more at risk patients (Smith et al 2016).

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Community exercise and wellness programs

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Hip Joint Degeneration and Pathology with or without Arthroscopy

Diagnoses Included:

- Hip Osteoarthritis
- Femoroacetabular impingement
- Hip labral tear or pathology
- Hip dysfunction following arthroscopic procedure – chondroplasty, microfracture, labral repair.

Definition

- In adults older than 50 years, hip degeneration and osteoarthritis (OA) is the most common cause of hip pain. OA is a progressive disease of the joints. The disease is characterized by cartilage damage, loss and abnormal bone growth at the joint surface. (Fransen et al 2014). The OA will progress at varied rates from person to person. Some risk factors have been suggested such as hip retroversion, acetabular impingement, advanced age, higher BMI and regular hip pain. OA in the hip commonly manifests with decreases in internal rotation and flexion ROM and morning stiffness of about 60 minutes. (Cibulka et al 2017)
- Femoroacetabular impingement (FAI) is a hip joint syndrome where abnormalities to the acetabulum or proximal femur result in a bony impingement during movement. This impingement typically occurs at the rim of the acetabulum during flexion and internal rotation at the hip. It appears that a larger proportion of diagnosis is in young, active adults. It is a common cause of hip and groin pain in active individuals, especially with activities requiring greater ranges of motion. Hip arthroscopy is a common choice of treatment; however some may choose to try more conservative care. (Bennell et al 2017, Wall et al 2013)
- Hip arthroscopic procedures can vary based on pathology and technique. There may be one technique or a combination during one surgery. Some common procedures can be debridement, chondroplasty, osteoplasty, osteotomy, microfracture, synovectomy, ligamentum repair and loose body removal. Rates of hip arthroscopic procedures continue to rise. Unfortunately, there is limited evidence on the rehabilitation following these procedures. (Cheatham et al 2015).

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Patient History

Special Considerations

- ***Hip Osteoarthritis*** – This is the most common cause of hip pain in people over the age of 50. There is generally a report of morning stiffness up to 60 minutes. It may be more prevalent in men. There also appears to be a relationship with higher BMI/weight individuals. As this is a progressive disease patients will present at differing pain and ability levels. These changes develop more frequently in those with history of hip dysplasia and acetabular deformities. (Cibulka et al 2017). Consideration should be given for potential age related issues, progressive bone loss, potential for fall risk and comorbidities.
- ***Femoralacetabular impingement (FAI) (non-operative)*** – FAI is becoming more widely recognized. It appears to be more common in young, active adults and potential older teens. There appears to be common complaints of pain nearing end range of functional movements such as deep squats, but there may also be pain with other activity. Consideration should be given to specific goals of the population and higher activity level. There is evidence to suggest prolonged FAI symptoms increase risk of OA. Patients not showing progress may be better served by surgical intervention. (Wall et al 2013, Bennell et al 2017).
- ***Rehabilitation following hip arthroscopy*** – Arthroscopic procedures for hip issues can vary significantly. As such, rehabilitation following each procedure will vary. Understanding of the procedure, as performed by the surgeon, may be helpful. Patient report of functional limitations will be important as each procedure will be different and generalized protocol should not be applied to each situation. (Edelstein et al 2012)

Differential Diagnoses

- Rheumatoid arthritis
- Non-specific hip pain
- Radicular symptoms from lumbar region
- Malignancy
- Mild hip fracture
- Hip Dysplasia

Red Flag	Possible Consequence or Cause
Severe trauma post op	Fracture, dislocation
Fever, severe pain	Possible infection
Lower extremity shortening or internal rotation	Dislocation
Unilateral edema	Lower extremity deep vein thrombosis
Recent invasive procedures post op (dental work, urologic procedures)	Infection
“Pistoning” during gait	Dislocation

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score = 1.2 points (Hefford, 2012)) OR Lower Extremity Functional Scale (LEFS) with a score of 64 or less (Minimum detectable change 9 points (Binkley et al, 1999; Stratford et al, 2000))
  - Range of Motion: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Numeric Pain Rating Scale: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services are considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure
  - The Numeric Pain Rating Scale is reduced by 2 points
  - Range of Motion remains below what is required for personal care or essential employment requirements

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion**.**

Subjective Findings

- Hip pain – generally progressive over long period of time aside from surgical cases
- Activity limitations with gait and other lower extremity movements
- Pain with high level activity or during sports and recreation
- Reports from young adults may be more indicative of FAI
- Reports from patients older than 50 may be more indicative of OA
- Morning stiffness
- Feelings of weakness and instability with weight bearing.

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Objective Findings

- **Activity limitation and outcome self-report measures –** It has been recommended that clinicians use validated outcome measures that include areas of hip pain, function and activity limitations. Visual analog pain scales and Lower Extremity Functional Scale (LEFS) have been included in these recommendations (Cibulka et al 2017, Binkely et al 1999)
- **Physical performance measures –** It has been recommended that clinicians utilize reliable and valid physical performance measures and balance testing. (Cibulka et al 2017):
  - 6 min Walk Test
  - 30-sec Sit to Stand Test
  - Timed up and Go Test
  - Self paced walk distance
  - Berg Balance Scale
  - Single leg stance
- Range of Motion –
  - When assessing patients with hip pain and hip OA providers should record and track hip flexion, abduction and external rotation. Tracking of strength and passive movement for all hip motions may also be helpful. (Cibulka et al 2017)
  - Specificity for hip OA increases if three or more planes are restricted (Cook and Hegedus, 2008)

Specific Examination Considerations (evidence based)

- Diagnosis of hip OA and labral pathology may require specific imaging or arthroscopy. Specific physical examination tests for the hip have limited utility due to poor study designs, low numbers of designs and risk of bias. (Cibulka et al 2017, Reiman et al 2014, Tijssen et al 2012, Cook and Hedegus 2008). However, it is generally accepted as normal practice to use these tests as screening tools to help guide treatment and rule out need for referral.
  - FABER – Flexion Abduction External Rotation Test (Patrick Test). Moderate utility score for assessing anterior or lateral hip capsular restriction (Cook and Hegedus 2008)
  - Thomas Test – minimal utility for capsular tightness, can help to screen for hip flexor tightness. (Cook and Hegedus 2008)
  - Passive Hip Abduction Test – Moderate utility in assessment of possible early hip dysplasia. (Cook and Hegedus, 2008)
  - Patellar-Pubic Percussion Test – Good level support and utility as a diagnostic screening tool for hip/femur fracture (Cook and Hegedus, 2008)
  - Hip OA pain – Recommendation to document and track Flexion-Abduction-External Rotation Test (FABER/Patrick's Test) at start of care and over an episode of care. Grade A recommendation with level I and III evidence. (Cibulka et al 2017).
    - Combined symptoms of hip pain, IR < 15 degrees with pain, morning stiffness up to 60 minutes and age > 50 have shown moderate utility in the clinical

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diagnosis of hip OA. Based on one study looking at combined results in OA tests. (Cook and Hedgus, 2008)
    - Range of Motion – limitation in three planes of hip motion or more may be indicative of hip OA. Moderate utility recommendation (Cook and Hedegus, 2008)

- **FAI and labral tear specific tests –** There are currently not enough quality studies in regards to specific test for FAI and labral tears that can reliably confirm or deny a diagnosis. Out of 11 investigated tests, only Flexion-adduction-internal rotation Test and Flexion-Internal Rotation test have shown mild utility as a screening tool. (Reiman et al 2014, Tijssen et al 2012)
    - Hip Scour – moderate utility supported by poorly designed studies in identifying potential labrum tears. (Cook and Hedegus, 2008)
    - Hip Quadrant – Mild ultility for partial tear of the labrum. Only supported by one study. (Cook and Hedegus, 2008)

Management/Intervention (evidence based)

- Hip OA Non-Surgical Care –
    - Patient Education – education should be provided by clinician to the patient regarding activity modification, exercise, weight reduction and unloading of joints. Strong recommendation. Level I-II support (Cibulka et al 2017)
    - Manual Therapy –
        - Manual therapy may be beneficial in mild hip OA who present with some limitation of joint mobility and/or pain. Dose and duration continues to be vague in the literature. As hip motion improves transition to strengthening should take place. No evidence to suggest manual therapy is superior to exercise in care of hip OA. Strong recommendation. Level I-IV support (Cibulka et al 2017).
        - There was moderate evidence that manual therapy alone does not significantly improve function. There was limited low quality evidence that manual therapy may reduce pain. Evidence is limited, therefore no recommendation was given on the use of manual therapy for hip OA. Level I review (Wang et al 2015).
        - Manual physical therapy along with education and a home exercise program of 10 sessions over 12 weeks did not show any benefit over sham ultrasound in participants with hip OA in reducing pain or improving function. No evidence to support multi-modal type physical therapy. Moderate level evidence, RCT (Bennell et al 2014).
        - There was no improved benefit to function, range of motion or perceived improvement with the addition of manual therapy to exercise therapy when treating those with hip OA. Participants were given 8 treatment over 8 weeks (French et al 2014). Similar result up to 1 year follow-up. No additional benefit to combined manual and exercise therapy (Abbott et al 2013)

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- Therapeutic Exercise –
  - Clinicians should prescribe individualized exercise in the treatment of hip OA including flexibility, strengthening and endurance to address functional limitation. Patients should be prescribed these activities 1-5 times a week over 6-12 weeks. No evidence to support exercise in clinic only versus at home only. Strong recommendation, Level I-III support (Cibulka et al 2017).
  - Exercise therapy is more effective than minimal control in reducing pain in the short term for people with hip OA. No additional benefit from adding manual therapy. Recommendation for use of exercise in hip OA. Strong recommendation. Level I support (Beumer et al 2016).
  - Among therapeutic exercise, strength training appears to result in greatest improvements for pain, disability, function and range of motion from 8-24 weeks time. Moderate improvements in physical function and pain also appear to result from stretching and mobility. Strong recommendations. Level I evidence (Brosseau et al 2015, Fransen et al 2014).
  - Not sufficient evidence to recommend on High vs low intensity exercise for improving pain and function in those with hip OA. Level I review (Regnaux et al 2015).
- Manual therapy vs therapeutic exercise vs combined – High quality evidence to recommend exercise therapy over control in the short and long term. Low quality evidence to recommend manual therapy alone and manual therapy combined with exercise over control in the short and long term. Exercise appears to reduce pain and improve function. Limited evidence to recommend manual therapy to reduce pain and improve function post treatment and at follow up. Higher level evidence for exercise, not enough evidence to indicate exercise alone over manual care alone. Level I recommendations (Sampath et al 2015)
- Ultrasound – Short term use (2 weeks) of ultrasound at 1Mhz; 1 Wcm2 for 5 minutes each to the anterior, lateral and posterior hip may reduce pain when part of a hip exercise rehab program. Moderate recommendation from 1 RCT. Level I support (Cibulka et al 2017).

- FAI Conservative and Post-Surgical Care –
  - Post-surgical rehab – 7 skilled care visits (30 min) over 14 weeks lead to greater outcomes in pain and function when compared to control in participants who had undergone arthroscopic surgery for FAI. Moderate level RCT (Bennell et al 2017).
  - Protocol Specific – No current evidence to support the use of one rehabilitation protocol versus another in the rehabilitation following FAI surgery. Current published protocols appear to be descriptive and of opinion only. Expert opinion that skilled care is important after FAI surgery. Recommendation for individualized approach in care. Level I systematic review (Cheatham et al 2015, Voight et al 2010).
  - Non-operative care – There is limited evidence to show clinical effectiveness in physical therapy for the non-operative care for FAI. Some evidence to suggest that physical therapy and activity modification may have initial benefit compared to no care. Recommendation for trial of minimal skilled care and activity

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modification for non-surgical care of FAI. Level I systematic review (Wall et al 2013).

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

- There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally

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faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care techniques

- **Home Exercise Program –** strong recommendation that exercise regularly reduces pain and improves function in those with hip OA. Strong recommendation to give education and advice on a home program. (Cibulka et al 2017,Bennell et al 2014)
- **Activity modification** – activity modification to reduce pain is recommended (Cibulka et al 2017)

Home Medical Equipment

- Assistive devices may be needed for a time, especially recently following hip arthroscopic surgery
- Bracing – not recommended as a first line of treatment in hip OA (Cibulka et al 2017)

Alternatives/Adjunct Management

- Supplements – there is insufficient evidence to support use of joint/chondral supplements such as glucosamine, chondroitin, hyaluronic acid or similar for hip OA. Level I evidence (Cibulka et al 2017)
- Weight Loss – clinicians should collaborate with physicians and other health care providers to support weight reduction in those with hip OA that are overweight or obese. (Cibulka et al 2017)
- Community services – weight loss, aquatic exercise, group exercise.

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Lower Extremity, Amputation with Subsequent Prosthesis, AKA & BKA

Synonyms
None

Definition
Amputation of the lower leg occurs either above the knee (above knee amputation—AKA), through the knee—(TKA), or below the knee (below knee amputation—BKA), and at multiple sites in the ankle and foot. In general, age, level of amputation, and presence of comorbidities will most significantly impact degree of regaining function. The greater the sparing of the residual limb, the higher the functional level may be achieved.

Patient History
Patient History may include:

Patient Data
Diabetes accounts for 45% of non-traumatic amputations, of which the majority are elderly, and frequently in poor health. Frostbite and peripheral vascular disease are also common in the etiology. There is usually a higher incidence in the elderly.

Specific Considerations
- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Assessment of employment, home environment, and social support
- Pain assessment

Red Flag	Possible Consequence or Cause
Fever, severe pain	Infection
Diabetes	Neuropathy
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of residual limb, progressive pain with ambulation	Arterial occlusion
Skin rash with fever and tenderness	Cellulitis
Immune-compromised state	Infection

Presentation
Presents with soft or semi-rigid dressing, bulbous swelling, non-healing wound, phantom limb pain, hypersensitivity, joint contractures, balance and gait impairments.

Subjective Findings
- Pain in the distal residual limb
- May experience phantom pain
- May have pain with prosthesis wearing, may be due to hypersensitivity vs a poorly fitting prosthesis

Scope of Musculoskeletal Examination
- Examine musculoskeletal system

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- Examine nervous system
- Examine skin around residual limb

Specific Elements of Musculoskeletal Examination

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Inspection
  - Assessment of shape of residual limb
  - Skin, wound, edema, type of dressing
- Palpation of bony and soft tissue
  - Pressure points
  - Joint play movements
- Range of motion, active and passive
  - Test active and passive range of motion for remaining joints of the residual limb and contralateral limb
- Manual muscle testing
  - Test resisted isometric movements of the residual limb and the contra-lateral limb
- Orthopedic testing
  - Balance (Tinetti)
  - Gait Analysis
  - Proprioception/Kinesthetic awareness
  - Endurance (muscular/cardiovascular)
  - Assess need for durable medical equipment
- Neurologic testing, if neurologic signs are present
  - Sensation
  - Reflexes
- Circulation assessment
- ADL assessment (Use the Functional Independence Measure scale to track progress)
  - Feeding
  - Grooming
  - Bathing
  - Dressing
  - Toileting
  - Transfers
  - Ambulation
  - Stair mobility
- Functional assessment - The following standardized test may be used to assess functional limitations:
  - Lower Extremity Functional Scale (LEFS)

Findings of Amputation, AKA, TKA, or BKA

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Post amputation patients present with a combination of issues impacting their future functional success.

- Initially there may be wound healing and edema control problems.
- Risk for contractures that can limit effective use of prosthesis.
- Mechanically, loss of limb will create body alignment, balance, strength, and proprioception changes.
- Pain can also be a limiting factor, both acutely after surgery, and later due to phantom pain and hypersensitivity.
- Some patients find amputation psychologically distressing to the extent that it interferes with their rehabilitation.

Differential Diagnosis

Not Applicable.

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Care Classifications

- Therapeutic Care
  - Therapeutic care is care provided to relieve the functional loss associated with an injury or condition and is necessary to return the patient to the functioning level required to perform their daily needs and work activities. Therapeutic care generally occurs within a reasonable period of time and is guided by evidence based practice of physical therapy.
- Acute Care
  - Acute care is care of an injury or condition characterized by short and relatively severe symptom complex, generally up to the first month following onset of injury. The condition may be induced by either traumatic or non-traumatic factors and may consist of a new condition or an exacerbation of an existing one. Need for care is proportional to the severity of the signs and symptoms of the particular case, modified by the status of healing tissues. The therapeutic goals of acute care are patient education in the recovery/healing process, reduction of symptoms and minimization of functional loss, in preparation for resolution of the injury or condition. Means and methods include a combination of direct care and a home management program to progress towards recovery of function.

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- Subacute Care
  - Subacute care is care of an injury or condition characterized by a less severe symptom complex and intermediate course. Typically, it follows an acute injury or exacerbation, and can extend up to three months from onset. Subacute care is characterized by a combination of direct care and home management consisting of exercise, symptom management, patient education, and an emphasis on compliance. The therapeutic goal of this phase is to improve functional status by increasing existing range of motion and muscle strength and reducing signs and symptoms associated with the condition or injury. Means and methods include progression of exercise, instruction in self-care, and monitoring patient compliance and motivation. Intensity of care is guided by the condition of healing tissue structures, generally including therapy visits supplemented by a home management program.
- Corrective or Rehabilitative Care
  - Corrective or rehabilitative care is the stage of ongoing care beyond the sub-acute phase. This phase of care may last up to 6 month from onset. It may also refer to treatment of conditions that are chronic in nature and do not occur in conjunction with an acute or subacute phase. The therapeutic goals of this phase are reduction and management of symptoms with a goal of maximizing function over time. Means and methods include progression of exercise, continued patient education, and transition to self-management. Intensity of care is guided by functional status, focusing on home management, supplemented by therapy visits.
- Skilled Maintenance Care
  - Maintenance care is defined as services required to maintain the member's current condition or to prevent or slow deterioration of the member's condition. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)
  - Skilled maintenance care for Medicare and Medicaid enrollees is covered if the specialized skill, knowledge and judgment of a qualified therapist are required:
    - To establish or design a maintenance program appropriate to the capacity and tolerance of the member
    - To educate/instruct the member or appropriate caregiver regarding the maintenance program
    - For periodic re-evaluations of the maintenance program
    - When skilled services are required in order to provide reasonable and necessary care to prevent or slow further deterioration, coverage will not be denied based on the absence of potential for improvement or restoration as long as skilled care is required.

Skilled Maintenance Programs in an Outpatient and Home Health setting will not be covered if furnished by a Physical Therapist Assistant. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)

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Condition Severity Classifications

Severity is classified as mild, moderate and severe conditions. Mild conditions result from a variety of conditions, may or may not require treatment, symptoms are low-grade and generally do not affect activity of daily living tasks. Moderate conditions also result from a variety of causes; pain is usually mid-range (5-6/10), may have work restrictions and may affect performance of activities of daily living. Severe conditions mostly result from accidents or injuries, symptoms are intense, may result in loss of work, and will have a pronounced decrease in the ability to perform activities of daily living.

Conditions Severity Criteria Table

Criteria	Mild Condition	Moderate Condition	Severe Condition
Mode of Onset	Variable	Variable	Severe
Anticipated duration of care	1-6 weeks	6-10 weeks	10 or more weeks
Loss of work days	No loss of work days	0-4 days of work lost	5 or more days of work lost
Work restriction	None	Possible, depends on occupation; 0-2 weeks	Restriction, depending on occupation; 2 or more weeks
Functional deficits: 1. Range of motion	Mild/no loss	Mild to moderate loss	Considerable loss
2. Muscle Strength	Mild/no loss	Mild to moderate loss	Considerable loss
3. Neurologic findings	None	May be present	May be present
4. BADL (Basic daily function such as walking in the home, bathing, dressing, grooming, feeding, positioning, and elimination)	Mild/no loss	Mild to moderate	Moderate to severe

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations

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- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement.

Treatment Methods

The overall goal of treatment is the resumption of prior level mobility and self-care, which will involve greater, or less rehabilitation depending on co-morbidities, and the anatomical level of amputation.

Partial Foot Amputation	➢ Generally only a custom molded shoe filler is needed
Ankle Disarticulation (Symes Amputation)	➢ May require compression ➢ Can be fitted with prosthesis with SACH foot (Solid Ankle Cushioned Heel)
Below Knee Amputation	➢ Approximately two-thirds of amputees at this level are ambulatory with a prosthesis ➢ Very short residual limb worsens functional prognosis
Knee Disarticulation	➢ Present with cosmetic issues, as axis of knee joints will not be at equal levels ➢ Provides good weight bearing surface ➢ Good sitting balance for non-ambulatory patients
Above Knee Amputation	➢ Increased danger of hip flexion, abduction and external rotation contracture ➢ Decreased probability of successful prosthesis use, may need a trial prosthesis
Hip Disarticulation and Hemipelvectomy	➢ Wound healing may be most significant issue ➢ For stronger patients prostheses are available

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.

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- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines, or improvement has reached a plateau
  - Skin breakdown of the residual limb or of the contralateral lower extremity
  - Inadequate cardiopulmonary fitness for required tasks
  - Inadequate pain control
  - Contracture not responding to treatment

Goals of Treatment

- The goals of treatment are:
  - Stump care and shaping
  - Upper Extremity and Lower Extremity strengthening
  - Range of motion (ROM) maintenance or improvement
  - Gait training without prosthesis
  - Gait training with prosthesis
  - Higher level of mobility
  - Improved performance in activities of daily living

Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

- Acute Phase
  - Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.
- Subacute Phase
  - Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

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- Corrective/Rehabilitative Phase
  - Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Decrease pain and edema	➢ Moist heat, Ice, electrical stimulation, intermittent compression
Normalize pain-free range of motion	➢ Passive stretching ➢ Active assisted/active range of motion
Strengthen lower extremity musculature	➢ Isometric strengthening exercises ➢ Isotonic strengthening exercises
Patient education, self-management and home exercise program	➢ Teach home exercise program of stretching, strengthening and application of hot/cold packs ➢ Prevent post-operative complications i.e. edema, skin breakdown, contractures, phantom limb pain ➢ Apply ace wrap to residual limb ➢ Donn/doff prosthesis ➢ Teach progressive desensitization
Improve balance and proprioception	➢ Kinesthetic awareness ➢ Balance retraining
Correct gait abnormality and proper biomechanics	➢ Postural re-education ➢ Teach normal gait pattern with prosthesis on level and uneven surfaces ➢ Use of crutches, walker ➢ Progress ambulatory distance, and community ambulation ➢ Teach stair mobility
Achieve independence with ADLs	➢ Assess need for and order durable medical equipment to assist with ADLs ➢ Transfer training ➢ Stair mobility ➢ ADL training (bathing, dressing, IADLs) ➢ Community integration

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Cold packs/hot packs
- Theraband for therapeutic exercises
- Ace wrap for wrapping of residual limb, stump shrinker/socks
- Electrical stimulation for pain relief
- Assistive gait devices
- Prosthesis

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Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening
- Hot packs/cold packs, if needed, to relieve discomfort
- Education in skin care guidelines, ace wrapping the residual limb, donning and doffing prosthesis
- Home exercise program, instruct patients and caregivers in use of prosthesis
- Instruct caregivers in assisting mobility as required
- Instruct patient in edema control
- Refer to community resources for access and support

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Prosthetist
- Chiropractic
- Medication

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Orthopedic – Lumbosacral Disc-Radicular

Lumbar Post-Surgical Conditions	**406**
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Lumbar Post-Surgical Conditions

Conditions Included

- Post Arthroscopic Discectomy
- Post Laminectomy
- Post Laminectomy with Interbody Fusion
- Failed back surgery syndrome

Definition

Post-surgical condition, in which patient continues to present with abnormal findings in strength, ROM, and pain referred to the sacro-iliac, and/or lower extremity. Patient may also have altered reflexes and sensation.

Patient History

Patient history may include:

- Patient Data
- General demographics
- Occupation/employment
- Living environment
- History of current condition
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)
- Prior level of function

In addition to the standard information gathered, a complete understanding of surgical procedure performed should be obtained from surgeon.

Specific Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- Determine if trauma occurred post-operatively; determine nature and extent of traumatic event.

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Red Flag	Possible Consequence or Cause
Onset following minor fall or heavy lifting in elderly, or osteoporotic patient	Fracture
Direct blow to the back in young adult	Fracture
Saddle anesthesia	Cauda equina syndrome
Severe, or progressive neurologic complaints	Cauda equina syndrome
Global, or progressive motor weakness in the lower extremities	Cauda equina syndrome
Recent onset of bowel dysfunction, or acute onset of bladder dysfunction in association with low back pain	Cauda equina syndrome
Unexplained weight loss	Malignancy
Prior history of cancer	Malignancy
Pain that is worse with recumbency, or worse at night	Malignancy
Fever, or recent bacterial infection	Infection
Intravenous drug abuse, or immunosupression	Infection
Prolonged steroid use	Osteoporosis

Note: Extraspinal diseases that may refer pain to the back include: aortic aneurysm, colon cancer, endometriosis, hip disease, kidney stones, ovarian disease, pancreatitis, pelvic infections, tumors or cysts of the reproductive tract, uterine cancer.

The most serious cause of low back pain is malignant tumor. Most malignant tumors are metastatic and some may cause bony collapse and paralysis. Primary cancers that most commonly metastasize to bone consist of adrenal, breast, kidney, lung, prostate, and thyroid.

Differential Diagnoses

- Extraspinal nerve entrapment (due to abdominal or pelvic mass)
- Cauda equina syndrome (saddle anesthesia, bladder or bowel dysfunction, bilateral involvement)
- Myelopathy due to thoracic disc herniation
- Demyelinating disease
- Lateral femoral cutaneous nerve entrapment (lateral thigh, sensory only, reverse SLR or femoral nerve stretch test)
- Trochanteric bursitis (no nerve root tension signs, pain on lateral thigh/leg, exquisite tenderness to palpation over trochanter)
- Symptoms may arise from lesions, or pathology at sites other than the surgical level

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score =1.2 points (Horn, K. K., 2012)) OR The Oswestry Disability Index (ODI) with a score of 20% or higher (Minimally Clinically Important Difference of 12.8% or 6.4 raw points (Davidson, M., 2002)) OR The StarT Back Screening Tool (SBT) with a score of >3 (Fritz JM, 2011)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Surgery date within the past 6 months
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider, for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines or improvement reaches a plateau;
  - Atrophy of lower extremity occurs;
  - Signs of fracture or dislocation occurs;
  - Increased neurologic signs/symptoms: increased LE numbness/tingling, increased LE weakness, increased LE pain, decreased LE reflexes.

Clinical Presentation

- Patient may report trauma, or insidious onset.
- Disc herniations tend to occur more frequently in younger patients due to the gradual dehydration of the nucleus pulposus that normally occurs with aging.
- Patient will probably have spinal precautions in the acute and sub-acute phases that vary by method of surgery and surgeon preference.

Subjective Findings

- Pain, numbness, tingling, paresthesias in lower extremity following lumbar nerve root distribution may persist
- Complaints of weakness in the lower extremities, trunk
- Better with rest
- Flexing knee may provide relief by decreasing tension on irritated lumbar nerve
- Pain in the low back

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- Worse with prolonged sitting, and standing (early on, patient will generally have precautions to avoid bending, stooping and lifting)
- Post-surgical precautions may limit daily activities
- Post-surgical scarring may contribute to pain and activity restrictions

Objective Findings

Objective Findings may include:

- Scope of Examination
  - Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

General Examination Considerations

- Mobility (ICF category: Measurement of impairment of body function- mobility of several joints; good level of documentation and moderate level of evidence)
  - Mobility of the spine in lateral flexion, rotation, and ventral flexion and extension (Alaranta, 1994; Johnson, 1990; van Tulder, et al., 2006;M agnussen, 1999; Strand, Ljunggren, Haldorsen, & Espehaug, 2001; Saur, Ensink, Frese, Seeger, & Hildebrandt, 1996)
  - Neurological examination of the lower extremities to rule out nerve root involvement. (ICF category: Measurement of impairment of bodily function—mobility and function of nerves; very good level of documentation and very good level of evidence).
  - Muscle function (Devillé, Van der Windt, Dzaferagic, Bezener, & Bouter, L., 2000; Deyo, Rainville & Kent, 1992; Waddell, McIntosh, Hutchinson, Feder, & Lewis, 1999).
- Nerve stretch tests
  - Lasegues/straight leg raise- dural and lower limb nerve mobility sign (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000; Deyo, Rainville & Kent, 1992; The Swedish Council, 2000; Vroomen, de Krom & Knottnerus, 1999; Waddell, McIntosh, Hutchinson, Feder & Lewis, 1999).
  - Cross Lasegues test (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000).
  - Prone knee flexion test- dural and lower limb nerve mobility sign performed in prone position (Asquier, Troussier, Chirossel, Chardonnet, Mouries, Juvin, & Phelip, 1996; Kreitz, Cute, & Yong-Hing, 1996).
  - Slump test- a dural and lower limb nerve mobility test (Philip, Lew, & Matyas, 1989; Massey, 1985)
- Trunk Muscle Power/Endurance (ICF category- Measurement of impairment of body function—pain in back; pain in lower limb; very good level of documentation and very good level of evidence) using tests that assess performance of trunk flexor, extensor, lateral abdominal, transverse abdominis, hip abductor and extensor musculature (Evans, Refshauge, & Adams, 2007; Godges, MacRae, & Engelke, 1993; Hodges, Richardson, & Jull, 1996; Krause, Youdas, Hollman, & Smith, 2005;

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McGill, Childs, & Liebenson, 1999; Nelson-Wong, Flynn, & Callaghan, 2009; Schellenberg, Lang, Chan, & Burnham, 2007).

- Segmental Mobility Tests (ICF category- measurement of impairment of body function- mobility of joint functions, specified as mobility of vertebral segment; moderate level of documentation and moderate level of evidence)
  Prone lumbar instability test (Hicks, Fritz, Delitto, & Mishock, 2003).
  Presence of aberrant movement (Hicks, Fritz, Delitto, & Mishock, 2003).
- Passive hip internal rotation, external rotation, flexion and extension- (ICF category--measurement of impairment of body function; moderate level of documentation and moderate level of evidence.) This is the amount of passive hip rotation, flexion and extension movement (Clapis, Davis, & Davis, 2008; Cliborne, Wainner, Rhon, et al., 2004; Ellison, Rose, & Sahrmann, 1990; Godges, MacRae, & Engelke, 1993); Van Dillen, McDonnell, Fleming, & Sahrmann, 2000)

Outcome measures (Very good documentation and very good level of evidence)

- Medical Outcomes Survey Short form (SF-36) in particular the physical functioning domain (Deyo, et al., 1994)
- Oswestry Disability Index (Fritz & Irrgang, 2001; Frost, Lamb, & Steward-Brown, 2008),
- Roland-Morris Disability Questionnaire (Roland & Morris, 1983).
- Patient Specific Functional Scale (Cleland et al, 2006)
- STaRT Back Screening Tool (Beneciuk, J.M., Bishop, M.D., Fritz, J.M., Robinson, M.E., Asal, N.R., Nisenzon, A.N. and George, S.Z., 2012)
- Identify factors indicating the risk of long term disability including yellow flags (Lentz, T. A., 2016)

Findings of Lumbar Examination

- Lumbar ROM restrictions may be present, due to pain or by precaution
- Muscle spasms in corresponding myotomes
- Dejerine's triad may be positive
- Posture may be antalgic
- Dural tension signs
- Follow a nerve root path if extremities symptoms and findings are present:
  - Sensory abnormalities in dermatome
  - Loss of reflex
  - Motor power weakness of lower extremity
  - Decreased lower extremity girth may be present

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- The most commonly involved nerve root is L5, followed in frequency by the S1 and L4 nerve roots.
- Examination should also include any wound care or incisional care if necessary.
- Signs of upper motor neuron involvement (clonus, hyperreflexia, Babinski reflex) may suggest compression of the spinal cord, which should be evaluated medically.

Management/Intervention

Therapy provided should be based on the individual presentation with the following considerations:

- Depending on level of pain, modalities to address pain may be utilized.
- Flexibility and lumbar stabilization exercises are common once patient is taken off post-surgical precautions.
  - Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.
  - Because multiple factors can contribute to this syndrome, patients are considered to be suffering from a chronic pain syndrome. It is recommended that these patients be treated by a multi-disciplinary team, including at least an MD anesthesiologist, physical therapist, occupational therapist and psychologist to help manage the rehabilitation.
  - Physician specific protocols will be considered in the context of the plans definition of medical necessity.

Lumbar Discectomy

- Two-year recurrent low back pain may occur in 15% to 25% of patients depending on the level of recurrent pain considered clinically important, and this leads to worse patient reported outcomes at 1 and 2 years postoperatively (Parker, S., 2015).
- Exercise programs starting four to six weeks post-surgery seem to lead to a faster decrease in pain and disability than no treatment, with small to medium effect sizes, and high-intensity exercise programs seem to lead to a slightly faster decrease in pain and disability than is seen with low-intensity programs, but the overall quality of the evidence is only low to very low. No significant differences were noted between supervised and home exercise programs for pain relief, disability or global perceived effect (Oosterhuis T, 2014).
- Weak evidence suggests osteopathic type manipulation may be a feasible approach for postoperative management for lumbar disc surgery (Kim, B., 2014).
- No differences have been found between general and patient-specific exercise programs. Local factors such as the individual patient characteristics identified by specific assessment findings, clinician expertise and patient preferences should direct exercise selection (Hebert JJ, 2013).
- Inconclusive evidence exists for the effectiveness of outpatient physical therapy post first lumbar discectomy. Best practice remains unclear (Rushton, A., 2011).

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- However, the subgroup of patients who presented with longstanding symptoms (> 22 weeks), sequestered-type herniation, and large disc herniation size (> 8.7 mm AP diameter), should undergo early surgical decompression, if initial non-operative treatment fails to yield satisfactory results (Sutheerayongprasert, C., 2012; Parker, S. L., 2014).
- Studies reported that surgical interventions could be performed at periods of 6 months of onset or greater without impacting recovery (Schoenfeld AJ, 2015).

Lumbar Fusion

- Inconclusive, very low-quality evidence exists for the effectiveness of physiotherapy management following lumbar spinal fusion. Best practice remains unclear (Rushton A, 2012).
- Early start of rehabilitation (6 wk vs. 12 wk) after lumbar spinal fusion resulted in inferior outcomes (Oostergaard, L.G., 2012).
- Rehabilitation approaches should include measures to modify psychological as well as motor functions (Abbott, A. D., 2010). Psychomotor therapy combines cognitive behavioral and motor relearning strategies to modify maladaptive pain cognitions, behavior, and motor control while exercise therapy encompasses physical training focusing on muscular strength, endurance, and cardiovascular fitness (Abbott, A. D., 2010).
- Use of modalities and or passive treatments should be limited. The goal is to transition patient as quickly as possible to active care, self-management and functional independence.
- The following table lists the procedures for **Acute Phase** presentation.
- Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.

Expected Outcome	Procedures/Modalities Such As
Decrease pain	◆ Modalities to relieve pain e.g. Cryotherapy, TENS, interferential current
Improve vascularity and extensibility of soft tissue and connective tissue	◆ Soft tissue mobilization ◆ Myofascial Release
Improve lumbar flexibility	◆ Gentle Flexibility exercises (hamstring stretch, Hip flexors stretch, Quadriceps stretch)
Improve strength and power of back musculature and ability to walk for least 30 minutes	◆ Isometric exercises of abdominal and back muscles ◆ Stability exercises in side-lying, standing
Patient education and initiation of home exercise program	◆ Physician protocol may require lumbar orthotics/brace ◆ Avoid bending, twisting, or lifting more than 5 pounds ◆ Application of ice or hot-packs ◆ Remain as active as possible ◆ Body mechanics ◆ Teach home exercise program

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The following table lists the procedures for **Subacute Phase** presentation. Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.

Expected Outcome	Procedures/Modalities Such As
Restore flexibility of lumbar spine	◆ Flexibility exercises (hamstring stretch, Hip flexors stretch, back muscle stretch, Quadriceps stretch, pelvic mobilization) ◆ Endurance training ◆ Lumbar range of motion exercises once restrictions are lifted
Increase strength and endurance of Lumbar spine and lower extremities	◆ Advanced dynamic stabilization exercises ◆ Strengthening exercises to trunk and lower extremity
Improvement in body mechanics and postural stabilization	◆ Postural stabilization activities ◆ Postural Control ◆ Body mechanics
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual resumption of activities relating to self-care and home management ◆ Self-management of symptoms ◆ Functional restoration ◆ Teach home exercise program

- The following table lists procedures for **Corrective/Rehabilitative Phase** presentation.
- Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Increase strength and endurance of Lumbar spine and lower extremities	◆ Advanced dynamic stabilization exercises ◆ Progressive resistive exercise program
Ability to perform physical actions, tasks or activities related to self-care, home management, work, community and leisure	◆ Gradual resumption of activities relating to work, community and leisure ◆ Self-management of symptoms ◆ Work hardening or vocational rehabilitation to learn different job skills ◆ Postural control and body mechanics ◆ Teach home exercise program

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

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Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self- care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband
- Gymball
- Home electrical stimulation unit

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Lumbar stabilization exercises, flexibility exercises, as indicated
- Aerobic conditioning
- Cold/heat applications, if needed, to relieve discomfort/stiffness
- Brief use of lumbar support, if necessary, in the acute stages to limit motion
- Instruct patient in any surgery specific precautions

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Physiatry
- Medication
- Acupuncture
- Chiropractic
- Anesthesia/pain management

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Lumbosacral Radicular Conditions

Synonyms

- Lumbar Radiculopathy
- Lumbago with Sciatica
- Pain in lower limb
- Radiating pain in a dermatome
- Disc herniation
- Bulging disc
- Lumbosacral Radicular Conditions can be categorized according to the International Classification of Functioning, Disability and Health (ICF) impairment-based category of low back pain (World Health Organization [WHO], 2005) in the following ways:
  - Acute low back pain with related (referred) lower extremity pain (b28015 Pain in lower limb)
  - Acute, subacute, or chronic low back pain with radiating pain (b2804 Radiating pain in a segment or region)

Definition

Lumbosacral radicular conditions are those involving lumbar nerve root irritation as a result of lumbar disc or other spondylitic pathology.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below.
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Differential Diagnoses

- Extraspinal causes (ovarian cyst, kidney stone, pancreatitis, ulcer)
- Osteoporosis and compression fractures (major trauma, or minor trauma in elderly/osteoporotic patient)
- Infection in disc or bone (fever, history of IV drug use, history of severe pain)
- Inflammatory arthritides (family history, patient age/sex, morning stiffness)
- Metastatic disease, myeloma, lymphoma (pathologic fracture, severe night pain)
- Spinal tuberculosis (lower socioeconomic groups, AIDS)
- Depression

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Onset following minor fall or heavy lifting in elderly or osteoporotic patient	Fracture
Direct Blow to the back in young adult	Fracture
Saddle anesthesia	Cauda equina syndrome
Severe or progressive neurologic complaints	Cauda equina syndrome
Global or progressive motor weakness in the lower extremities	Cauda equina syndrome
Recent onset of bowel dysfunction, or acute onset of bladder dysfunction in association with low back pain	Cauda equina syndrome
Unexplained weight loss	Malignancy
Prior history of cancer	Malignancy
Pain that is worse with recumbency, or worse at night, pain at rest	Malignancy
Fever, or recent bacterial infection	Infection
Intravenous drug abuse or immunosuppression	Infection
Prolonged steroid use	Osteoporosis
Pain that does not change with change in position	Kidney disease

Note: Extraspinal diseases that may refer pain to the back include: aortic aneurysm, colon cancer, endometriosis, hip disease, kidney stones, ovarian disease, pancreatitis, pelvic infections, tumors or cysts of the reproductive tract, uterine cancer.

The most serious cause of low back pain is malignant tumor. Most malignant tumors are metastatic and some may cause bony collapse and paralysis. Primary cancers that most commonly metastasize to bone consist of adrenal, breast, kidney, lung, prostate, and thyroid.

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score =1.2 points (Horn, K. K., 2012)) OR The Oswestry Disability Index (ODI) with a score of 20% or higher (Minimally Clinically

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Important Difference of 12.8% or 6.4 raw points (Davidson, M., 2002)) OR The StarT Back Screening Tool (SBT) with a score of >3 (Fritz JM, 2011)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Positive neurological signs
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures

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- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

Refer patient to their primary care provider, for evaluation of alternative treatment options if:

- Improvement does not meet above guidelines or improvement reaches a plateau;
- Atrophy of lower extremity occurs;
- Signs of fracture or dislocation occurs;
- Increased neurologic signs/symptoms: increased LE numbness/tingling, increased LE weakness, increased LE pain, decreased LE reflexes.

Subjective Findings

- Typical patient is between ages of 25-60.
- Activity precipitating pain, typically involves bending, twisting, and/or lifting.
- No aggravating event in 50% of patients.
- Usually reports history of several or more resolved low back pain episodes previous to current onset.
- Pain and stiffness in low back
- Often associated with numbness, pain, and/or weakness that may reach to the distal ends of lower extremities
- Extremity symptoms may predominate
- Midline disc protrusions may involve both extremities
- Type and radiation of pain vary
- Worse with prolonged sitting, standing, bending, stooping, lifting
- Better with rest.

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Specific Examination Considerations

- Mobility (ICF category: Measurement of impairment of body function- mobility of several joints; good level of documentation and moderate level of evidence)
  - Mobility of the spine in lateral flexion, rotation, and ventral flexion and extension (Alaranta, 1994; Johnson, 1990; van Tulder, et al., 2006;M agnussen, 1999; Strand, Ljunggren, Haldorsen, & Espehaug, 2001; Saur, Ensink, Frese, Seeger, & Hildebrandt, 1996)
- Neurological examination of the lower extremities to rule out nerve root involvement. (ICF category: Measurement of impairment of bodily function—mobility and function of nerves; very good level of documentation and very good level of evidence).
  - Muscle function (Devillé, Van der Windt, Dzaferagic, Bezener, & Bouter, L., 2000; Deyo, Rainville & Kent, 1992; Waddell, McIntosh, Hutchinson, Feder, & Lewis, 1999).
- Nerve stretch tests
  - Lasegues/straight leg raise- dural and lower limb nerve mobility sign (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000; Deyo, Rainville & Kent, 1992; The Swedish Council, 2000; Vroomen, de Krom & Knottnerus, 1999; Waddell, McIntosh, Hutchinson, Feder & Lewis, 1999).
- Cross Lasegues test (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000).
  - Prone knee flexion test- dural and lower limb nerve mobility sign performed in prone position (Asquier, Troussier, Chirossel, Chardonnet, Mouries, Juvin, & Phelip, 1996; Kreitz, Cute, & Yong-Hing, 1996).
  - Slump test- a dural and lower limb nerve mobility test (Philip, Lew, & Matyas, 1989; Massey, 1985)
- Trunk Muscle Power/Endurance (ICF category- Measurement of impairment of body function—pain in back; pain in lower limb; very good level of documentation and very good level of evidence) using tests that assess performance of trunk flexor, extensor, lateral abdominal, transverse abdominis, hip abductor and extensor musculature (Evans, Refshauge, & Adams, 2007; Godges, MacRae, & Engelke, 1993; Hodges, Richardson, & Jull, 1996; Krause, Youdas, Hollman, & Smith, 2005; McGill, Childs, & Liebenson, 1999; Nelson-Wong, Flynn, & Callaghan, 2009; Schellenberg, Lang, Chan, & Burnham, 2007).
- Segmental Mobility Tests (ICF category- measurement of impairment of body function- mobility of joint functions, specified as mobility of vertebral segment; moderate level of documentation and moderate level of evidence)
  Prone lumbar instability test (Hicks, Fritz, Delitto, & Mishock, 2003).
  Presence of aberrant movement (Hicks, Fritz, Delitto, & Mishock, 2003).

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- Passive hip internal rotation, external rotation, flexion and extension- (ICF category--measurement of impairment of body function; moderate level of documentation and moderate level of evidence.) This is the amount of passive hip rotation, flexion and extension movement (Clapis, Davis, & Davis, 2008; Cliborne, Wainner, Rhon, et al., 2004; Ellison, Rose, & Sahrmann, 1990; Godges, MacRae, & Engelke, 1993); Van Dillen, McDonnell, Fleming, & Sahrmann, 2000)
- Outcome measures (Very good documentation and very good level of evidence)
  - Medical Outcomes Survey Short form (SF-36) in particular the physical functioning domain (Deyo, et al., 1994)
  - Oswestry Disability Index (Fritz & Irrgang, 2001; Frost, Lamb, & Steward-Brown, 2008),
  - Roland-Morris Disability Questionnaire (Roland & Morris, 1983).
  - Patient Specific Functional Scale (Cleland et al, 2006)
  - STaRT Back Screening Tool (Beneciuk, J.M., Bishop, M.D., Fritz, J.M., Robinson, M.E., Asal, N.R., Nisenzon, A.N. and George, S.Z., 2012)
- Identify psychosocial factors including yellow flags (Lentz, T. A., 2016)

Management/Intervention

- Natural history studies demonstrated that 70% of patients with lumbar radiculopathy showed improvement within 4 weeks following onset of symptoms (Alentado et al. 2014).
- General Activity Advice and Education (high level of evidence)
  - Clinicians are encouraged to educate patient/clients to continue/rapidly resume normal daily activities which have been shown to lead to quicker recovery and improved overall function. Patients should progressively increase their physical activity levels according to an agreed plan rather than being guided by their pain level. (Chou, Qaseem, Snow, et al., 2007; Dahm, Brurberg, Jamtvedt, & Hagen, 2010; Hagen, Hilde, Jamtvedt, & Winnem, 2004; National Health committee, 2004; Swedish Council, 2000; Waddell, Feder, & Lewis, 1997)
- Manual therapies (moderate to high level of evidence)
  - Mobilization/manipulation technique interventions for the lumbar spine are recommended to provide added help to shorten pain duration, range of motion and patient satisfaction. Moderate evidence for recommending thrust manipulation within 1-2 weeks after onset of symptoms. (Assendelft, Bouter, & Knipschild, 1996; Bronfort, 1999; Brox, Hagen, Juel, & Storheim, 1999; Fritz, Childs, & Flynn, 2005; Childs, Fritz, Flynn, & et al., 2004; Cleland, Fritz, Kulig, et al., 2009; Koes, Assendelft, van der Heijden, & Bouter, 1996; Shekelle, Adams, Chassin, Hurwitz, & Brook, 1992; The Swedish Council, 2000; Franke, H., Franke, J.D. and Fryer, G., 2014).
  - Mobilization/Manipulation may not be effective in chronic LBP (Rubinstein SM, van Middelkoop M, Assendelft WJ, de Boer MR, van Tulder MW 2011)

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- Manual therapy techniques for improvement of hip mobility is recommended due to emerging evidence of moderate to high level supporting improvement in lumbar symptoms with improvement in hip passive movement (Burns, Mintken, & Austin, 2011; Fogel, & Esses, 2003; Mellin, 1988; Offierski, & MacNab, 1983; Reiman, Harris, & Cleland, 2009; Whitman, Flynn, Childs, et al., 2006; Whitman, Flynn, Fritz, 2003.

- Exercise/training and centralization/directional preference exercise (moderate to high level of evidence)
  - It is not recommend that clinicians prescribe specific exercises during the first few weeks after an initial onset of low back pain. Both systematic and guidelines show varying or no effect of early exercise (Brox, Hagen, Juel, & Storheim, 1999; Faas, 1996; van Tulder, Koes, & Bouter, 1997; van Tulder, Schoolmen, Koes, & Deyo, 2000).
  - Centralization and directional preference exercises (Aina, May, & Clare, 2004; Clare, Adams, & Maher, 2004; Browder, Childs, Cleland, & Fritz, 2007; Long, Donelson, & Fung, 2004; Long, May, & Fung, 2008; Murphy, Hurwitz, Gregory, & Clary, 2006; Simotas, Dorey, Hansraj, & Cammisa, 2000; Werneke, Hart, Cutrone, et al., 2011).
  - Motor Control, Core specific, or Stabilization exercises are no better than General Exercises in the long term (Smith, B.E., Littlewood, C. and May, S., 2014.; Wang X-Q, Zheng J-J, Yu Z-W, Bi X, Lou S-J, et al. 2012; Saragiotto BT, Maher CG, Yamato TP, Costa LOP, Menezes Costa LC, Ostelo RWJG, Macedo LG 2016)
  - Clinician's should consider Group Exercise programs for non-specific LBP (O'Keeffe M, Hayes A, McCreesh K, Purtill H, O'Sullivan K 2016; Robertson B, Harding KE 2014; Toomey E, Currie-Murphy L, Matthews J, Hurley DA 2015)
  - Trunk coordination, endurance and strengthening exercises (Choi, Verbeek, Tam, & Jiang, 2010; Costa, Maher, & Latimer, et al., 2009; Hayden, van Tulder, Malmivaara, & Koes, 2005; Hides, Jull, & Richardson, 2001; Kulig, Beneck, Selkowitz, et al., 2009; Macedo, Maher, Latimer, & McAuley, 2009; Rasmussen-Barr, Ang, Arvidsson, & Nilsson-Wikmar, 2009; Yilmaz, Yilmaz, Merdol, Parlar, Sahin, & Kuran, 2003; Ishak NA, Zahari Z, Justine M 2016; . Steffens D, Maher CG, Pereira LSM, Stevens ML, Oliveira VC, Chapple M, Teixeira-Salmela LF, Hancock MJ 2016).
  - Aerobic Exercise is suggested (chronic) (Meng, X.G. and Yue, S.W., 2015; Lawford BJ, Walters J, Ferrar K 2016)
  - Multidisciplinary Rehabilitation (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJ, Ostelo RWJG, Guzman J, van Tulder MW 2014)
  - Superficial Heat (acute) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016)
  - Dry Needling (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Furlan AD, van Tulder MW, Cherkin D, Tsukayama H, Lao L, Koes BW, Berman BM. 2005)

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- Clinical Interventions Not Recommended (moderate to high level of evidence or lacks sufficient evidence (noted) to recommend)
  - Traction (Beurskens, de Vet, Koke, et al., 1995; Fritz, Lindsay, Matheson, et al., 2007; Schimmel, de Kleuver, Horsting, Spruit, Jacobs, & van Limbeek, 2009; van der Heijden, Beurskens, Assendelft, de Vet, & Bouter, 1995; van Tulder, Koes, Assendelft, & Bouter, 1999; Wegner I, Widyahening IS, van Tulder MW, Blomberg SEI, de Vet HCW, Bronfort G, Bouter LM, van der Heijden GJ 2013; Delitto A, George SZ, Dillen LV, Whitman JM, Sowa G, Shekelle P, Denninger TR, Godges JJ 2012; Thackeray, Anne et al 2016)
  - Therapeutic ultrasound (der Windt, van der Heijden, & Berg, 1999; Gam, & Johannsen, 1995; Ebadi S, Henschke N, Nakhostin Ansari N, Fallah E, van Tulder MW 2014)
  - Electrotherapy modalities including TENS and electrical stimulation (Van der Heijden, G.J.M.G., Torenbeek, M., van der Windt, Hidding, Dekker, & Bouter, 1999; van Tulder, Koes, Assendelft, & Bouter, 1999; Nnoaham KE, Kumbang J.2008; Dubinsky, R.M. and Miyasaki, J., 2010)
  - Laser modality (De Bie, Verhagen, Lenssen, de Vet, van de Wildenberg, Kootstra, & Knipschild, 1998; Gam, & Johannsen, 1995; Gam, Thorzen, & Lonnberg, 1993;
  - Kinesiotaping (Vanti, C., Bertozzi, L., Gardenghi, I., Turoni, F., Guccione, A.A. and Pillastrini, P., 2014; Added, M.A.N., Costa, L.O.P., Freitas, D.G.D., Fukuda, T.Y., Monteiro, R.L., Salomão, E.C., Medeiros, F.C.D. and Costa, L.D.C.M., 2016)
  - Phonophoresis (Durmus D, Alayli G, Goktepe AS et al, 2013)
  - Low Level Laser Therapy- insufficient evidence (Yousefi-Nooraie R, Schonstein E, Heidari K, Rashidian A, Pennick V, Akbari-Kamrani M, Irani S, Shakiba B, Mortaz Hejri S, Jonaidi AR, Mortaz-Hedjri S. 2008
  - Pilates- insufficient evidence (Yamato TP, Maher CG, Saragiotto BT, Hancock MJ, Ostelo RWJG, Cabral CMN, Menezes Costa LC, Costa LOP 2015)
  - Muscle Energy Technique- insufficient evidence (Franke H, Fryer G, Ostelo RWJG, Kamper SJ. 2015)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

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Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care techniques

The importance of educating patients to understand that uncomplicated mechanical low back pain (LBP) has a natural course of recovery cannot be overemphasized. The patient can be taught to use medical equipment and administer self-care at his residence. General recommendations are to resume normal, or near normal, activity as soon as possible.

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Home Medical Equipment

- Hot pack/cold pack

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Flexibility exercises
- Lumbar stabilization exercises
- Aerobic conditioning, such as walking or swimming
- Heat applications, cold packs, if needed, to relieve discomfort/stiffness
- Proper Nutrition
- Stress management

Alternatives/Adjunct Management

- Osteopathic manipulation
- Chiropractic
- Physiatry
- Medication
- Yoga
- Pilates
- Cognitive Behavioral Therapy
- Acupuncture

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Lumbar Spinal Stenosis

Synonym

- Degenerative spinal stenosis (DSS)
- Spinal Stenosis
- Lumbar Stenosis

Definition

Lumbar spinal stenosis is defined as any narrowing of the lumbar spinal canal, nerve root canals, and/or intervertebral foramina that may encroach on the nerve roots of the lumbar spine. Facet joint arthrosis and hypertrophy, bulging and thickening of the ligamentum flavum, posterior/lateral bulging of the disk, and degenerative spondylolisthesis are the most common changes contributing to lumbar spinal stenosis. Spinal stenosis is largely a degenerative condition; however, in some cases it occurs as a congenital narrowing of the spinal canal. Because degenerative changes are the predominant cause of lumbar spinal stenosis, patients are generally older than age 50 with a long history of low back pain (Yuan PS, 2009).

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Specific Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below.
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Differential Diagnoses

- Extra spinal nerve entrapment (due to abdominal or pelvic mass)
- Cauda equina syndrome (saddle anesthesia, bladder or bowel dysfunction, bilateral involvement)
- Myelopathy due to thoracic disc herniation
- Demyelinating disease
- Lateral femoral cutaneous nerve entrapment (lateral thigh, sensory only, reverse SLR or femoral nerve stretch test)
- Trochanteric bursitis (no nerve root tension signs, pain on lateral thigh/leg, exquisite tenderness to palpation over trochanter)
- Disc protrusion
- Herniated nucleus pulposus
- Peripheral vascular disease
- Vascular claudication or insufficiency
- Signs of upper motor neuron involvement (clonus, hyperreflexia, Babinski reflex) may suggest compression of the spinal cord that should be evaluated medically.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Onset following minor fall, or heavy lifting in elderly or osteoporotic patient	Fracture
Direct blow to the back in young adult	Fracture
Saddle anesthesia	Cauda equina syndrome
Severe or progressive neurologic complaints	Cauda equina syndrome
Global or progressive motor weakness in the lower extremities	Cauda equina syndrome
Recent onset of bowel dysfunction or acute onset of bladder dysfunction in association with low back pain	Cauda equina syndrome
Unexplained weight loss	Malignancy
Prior history of cancer	Malignancy
Pain that is worse with recumbency or worse at night	Malignancy
Fever or recent bacterial infection	Infection
Intravenous drug abuse or immunosuppression	Infection
Prolonged steroid use	Osteoporosis

Note: Extraspinal diseases that may refer pain to the back include: aortic aneurysm, colon cancer, endometriosis, hip disease, kidney stones, ovarian disease, pancreatitis, pelvic infections, tumors or cysts of the reproductive tract, uterine cancer.
The most serious cause of low back pain is malignant tumor. Most malignant tumors are metastatic and some may cause bony collapse and paralysis. Primary cancers that most commonly metastasize to bone consist of adrenal, breast, kidney, lung, prostate, and thyroid

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score =1.2 points (Horn, K. K., 2012)) OR The Oswestry Disability Index (ODI) with a score of 20% or higher (Minimally Clinically Important Difference of 12.8% or 6.4 raw points (Davidson, M., 2002)) OR The StarT Back Screening Tool (SBT) with a score of >3 (Fritz JM, 2011)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Positive neurological findings
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
  - Patient's level of independence
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinically Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures.
- No objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.
- Complete elimination of symptoms of lumbar spinal stenosis is not likely and should be considered when deciding when to discharge (Barr, KP 2011)

Referral Guidelines

Refer patient to their primary care provider, for evaluation of alternative treatment options if:

- Improvement does not meet above guidelines or improvement reaches a plateau;
- Atrophy of lower extremity occurs;
- Signs of fracture or dislocation occurs;
- Increased neurologic signs/symptoms: increased LE numbness/tingling, increased LE weakness, increased LE pain, decreased LE reflexes.

Clinical Presentation

- Most patients have symptoms of pain, and/or numbness of one or both legs.
- Chronic nerve compression may lead to diminished lower extremity reflexes and strength or sensation deficits.
- Lumbar range of motion, particularly in extension, is limited and painful, often reproducing leg symptoms.
- Symptoms tend to be posture dependent, worsening with spinal extension, and improving with flexion.
- Compression of the nerve within the canal may result in a limitation of the arterial supply or claudication resulting from the compression of the venous return (neurogenic claudication).

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- Neurogenic claudication presents as poorly localized pain, paresthesias, and cramping of one or both lower extremities.
- Symptoms are provoked by walking and relieved by sitting or bending (Haskins, R., 2015).
- Flattened lumbar lordosis
- Lumbar ROM restrictions side bending is often limited bilaterally
- Deficits in vibratory or pinprick sensation
- Strength and reflex deficits
- Diminished walking tolerance

Subjective Findings

- Unilateral or bilateral complaints of leg pain
- May complain of weakness in the lower extremity
- Better with rest
- Flexing spine may provide relief by decreasing pressure on lumbar nerve root
- Symptoms increase with lumbar extension activities such as walking and prolonged standing
- Lower back pain may or may not be present
- Aim is to distinguish spinal stenosis from vascular insufficiency (Thomas S.2003)
  - With neurogenic claudication due to spinal stenosis:
    - Pain comes on slowly during exercise
    - Pain lessens post exercise through trunk flexion or sitting
    - Some degree of pain will linger despite rest
  - With vascular claudication
    - Symptoms are alleviated in 1–5 minutes through any form of rest (position does not factor in to pain relief)
    - Symptoms return with equivalent activity (exercise which originally brought on symptoms) in same time frame

Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy post-surgically, but should be assessed as the member's condition allows during the course of care.

- Mobility (ICF category: Measurement of impairment of body function- mobility of several joints; good level of documentation and moderate level of evidence)
  - Mobility of the spine in lateral flexion, rotation, and ventral flexion and extension (Alaranta, 1994; Johnson, 1990; van Tulder, et al., 2006;M agnussen, 1999; Strand, Ljunggren, Haldorsen, & Espehaug, 2001; Saur, Ensink, Frese, Seeger, & Hildebrandt, 1996)

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- Neurological examination of the lower extremities to rule out nerve root involvement. (ICF category: Measurement of impairment of bodily function—mobility and function of nerves; very good level of documentation and very good level of evidence).
- Muscle function (Devillé, Van der Windt, Dzaferagic, Bezener, & Bouter, L., 2000; Deyo, Rainville & Kent, 1992; Waddell, McIntosh, Hutchinson, Feder, & Lewis, 1999).

- Nerve stretch tests
  - Lasegues/straight leg raise- dural and lower limb nerve mobility sign (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000; Deyo, Rainville & Kent, 1992; The Swedish Council, 2000; Vroomen, de Krom & Knottnerus, 1999; Waddell, McIntosh, Hutchinson, Feder & Lewis, 1999).
  - Cross Lasegues test (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000).
  - Prone knee flexion test- dural and lower limb nerve mobility sign performed in prone position (Asquier, Troussier, Chirossel, Chardonnet, Mouries, Juvin, & Phelip, 1996; Kreitz, Cute, & Yong-Hing, 1996).
  - Slump test- a dural and lower limb nerve mobility test (Philip, Lew, & Matyas, 1989; Massey, 1985)
  - Kemp's test- Lumbar extension combined with rotation reproduces low back and leg pain in patients with lumbar spinal stenosis (Thomas, S 2003)
- Trunk Muscle Power/Endurance (ICF category- Measurement of impairment of body function—pain in back; pain in lower limb; very good level of documentation and very good level of evidence) using tests that assess performance of trunk flexor, extensor, lateral abdominal, transverse abdominis, hip abductor and extensor musculature (Evans, Refshauge, & Adams, 2007; Godges, MacRae, & Engelke, 1993; Hodges, Richardson, & Jull, 1996; Krause, Youdas, Hollman, & Smith, 2005; McGill, Childs, & Liebenson, 1999; Nelson-Wong, Flynn, & Callaghan, 2009; Schellenberg, Lang, Chan, & Burnham, 2007).
- Segmental Mobility Tests (ICF category- measurement of impairment of body function- mobility of joint functions, specified as mobility of vertebral segment; moderate level of documentation and moderate level of evidence)
  Prone lumbar instability test (Hicks, Fritz, Delitto, & Mishock, 2003).
  Presence of aberrant movement (Hicks, Fritz, Delitto, & Mishock, 2003).
- Passive hip internal rotation, external rotation, flexion and extension- (ICF category--measurement of impairment of body function; moderate level of documentation and moderate level of evidence.) This is the amount of passive hip rotation, flexion and extension movement (Clapis, Davis, & Davis, 2008; Cliborne, Wainner, Rhon, et al., 2004; Ellison, Rose, & Sahrmann, 1990; Godges, MacRae, & Engelke, 1993); Van Dillen, McDonnell, Fleming, & Sahrmann, 2000)
- Outcome measures (Very good documentation and very good level of evidence)
  - Medical Outcomes Survey Short form (SF-36) in particular the physical functioning domain (Deyo, et al., 1994)

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  - Oswestry Disability Index (Fritz & Irrgang, 2001; Frost, Lamb, & Steward-Brown, 2008),
  - Roland-Morris Disability Questionnaire (Roland & Morris, 1983).
  - Patient Specific Functional Scale (Cleland et al, 2006)
  - STaRT Back Screening Tool (Beneciuk, J.M, et al, 2012)
- Assess Gait - Walking capacity is a primary outcome indicator for patients with lumbar spinal stenosis (Tomkins-Lane CC, 2014). A two stage walking test may be used to differentially diagnose lumbar stenosis (Fritz, JM, 1997)
- Postural assessment (Thomas, S 2003)
- Palpation of bony and soft tissue (Thomas, S 2003)
- Vascular assessment- check pulses of Dorsalis Pedis Artery and Tibialis Posterior muscle pulse (Lee, SY 2015; Yuan, PS 2009)
- Neurologic testing (Thomas, S 2003)
  - Myotomes: Hip Flex. (L2), Knee ext. (L3), Ankle dorsiflexion. (L4)
  - Dermatomal Sensation Tests (L1-S1)
  - Deep Tendon Reflexes: Patella, Dorsiflexion, and Hamstring
- Test balance, coordination, endurance. Patients with lumbar spinal stenosis are at increased risk for falls (Schneider, M 2014)
- Differential diagnosis can also be aided by the use of exercise treadmill testing (Fritz, JM 1997)
- Evaluate psychosocial status (Besen, E. et al 2015)

Physical/Occupational Therapy Management

Current evidence for surgical and non-surgical treatment to improve walking ability is of low and very low quality and thus prohibits strong recommendations to guide clinical practice (Ammendolia, C., et al 2014).

The treatment plan needs to be individualized based on patient presentation (Besen, E., et al 2015; Whitman, JM et al 2006). There is moderate evidence showing patients with lumbar spinal stenosis who were surgical candidates and who consented to surgery achieved similar long-term functional gains when offered surgical decompression compared with an evidence-based PT regimen. (Delitto, A, et al 2015). Self-management strategies may be a practical and effective means to improve walking ability, functional status, and quality of life in this chronic and often progressive condition (Atlas, SJ, 2005).

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General Treatment Considerations when lower back pain is present

- Manual therapies (moderate to high level of evidence)
  - Mobilization/manipulation technique interventions for the lumbar spine are recommended to provide added help to shorten pain duration, range of motion and patient satisfaction. Moderate evidence for recommending thrust manipulation within 1-2 weeks after onset of symptoms. (Assendelft, Bouter, & Knipschild, 1996; Bronfort, 1999; Brox, Hagen, Juel, & Storheim, 1999; Fritz, Childs, & Flynn, 2005; Childs, Fritz, Flynn, & et al., 2004; Cleland, Fritz, Kulig, et al., 2009; Koes, Assendelft, van der Heijden, & Bouter, 1996; Shekelle, Adams, Chassin, Hurwitz, & Brook, 1992; The Swedish Council, 2000; Franke, H., Franke, J.D. and Fryer, G., 2014).
  - Mobilization/Manipulation may not be effective in chronic LBP (Rubinstein SM, van Middelkoop M, Assendelft WJ, de Boer MR, van Tulder MW 2011)
  - Manual therapy techniques for improvement of hip mobility is recommended due to emerging evidence of moderate to high level supporting improvement in lumbar symptoms with improvement in hip passive movement (Burns, Mintken, & Austin, 2011; Fogel, & Esses, 2003; Mellin, 1988; Offierski, & MacNab, 1983; Reiman, Harris, & Cleland, 2009; Whitman, Flynn, Childs, et al., 2006; Whitman, Flynn, Fritz, 2003.
- Exercise/training and centralization/directional preference exercise (moderate to high level of evidence)
  - It is not recommend that clinicians prescribe specific exercises during the first few weeks after an initial onset of low back pain. Both systematic and guidelines show varying or no effect of early exercise (Brox, Hagen, Juel, & Storheim, 1999; Faas, 1996; van Tulder, Koes, & Bouter, 1997; van Tulder, Schoolmen, Koes, & Deyo, 2000).
  - Centralization and directional preference exercises (Aina, May, & Clare, 2004; Clare, Adams, & Maher, 2004; Browder, Childs, Cleland, & Fritz, 2007; Long, Donelson, & Fung, 2004; Long, May, & Fung, 2008; Murphy, Hurwitz, Gregory, & Clary, 2006; Simotas, Dorey, Hansraj, & Cammisa, 2000; Werneke, Hart, Cutrone, et al., 2011).
  - Motor Control, Core specific, or Stabilization exercises are no better than General Exercises in the long term (Smith, B.E., Littlewood, C. and May, S., 2014.; Wang X-Q, Zheng J-J, Yu Z-W, Bi X, Lou S-J, et al. 2012; Saragiotto BT, Maher CG, Yamato TP, Costa LOP, Menezes Costa LC, Ostelo RWJG, Macedo LG 2016)
  - Clinician's should consider Group Exercise programs for non-specific LBP (O'Keeffe M, Hayes A, McCreesh K, Purtill H, O'Sullivan K 2016; Robertson B, Harding KE 2014; Toomey E, Currie-Murphy L, Matthews J, Hurley DA 2015)
  - Trunk coordination, endurance and strengthening exercises (Choi, Verbeek, Tam, & Jiang, 2010; Costa, Maher, & Latimer, et al., 2009; Hayden, van Tulder, Malmivaara, & Koes, 2005; Hides, Jull, & Richardson, 2001; Kulig, Beneck, Selkowitz, et al., 2009; Macedo, Maher, Latimer, & McAuley, 2009; Rasmussen-Barr, Ang, Arvidsson, & Nilsson-Wikmar, 2009; Yilmaz, Yilmaz, Merdol, Parlar, Sahin, & Kuran, 2003; Ishak NA, Zahari Z, Justine M 2016; . Steffens D, Maher

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CG, Pereira LSM, Stevens ML, Oliveira VC, Chapple M, Teixeira-Salmela LF, Hancock MJ 2016).
- Aerobic Exercise is suggested (chronic) (Meng, X.G. and Yue, S.W., 2015; Lawford BJ, Walters J, Ferrar K 2016)
- Multidisciplinary Rehabilitation (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJ, Ostelo RWJG, Guzman J, van Tulder MW 2014)
- Superficial Heat (acute) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016)
- Dry Needling (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Furlan AD, van Tulder MW, Cherkin D, Tsukayama H, Lao L, Koes BW, Berman BM. 2005)

- Clinical Interventions Not Recommended (moderate to high level of evidence or lacks sufficient evidence (noted) to recommend)
  - Traction (Beurskens, de Vet, Koke, et al., 1995; Fritz, Lindsay, Matheson, et al., 2007; Schimmel, de Kleuver, Horsting, Spruit, Jacobs, & van Limbeek, 2009; van der Heijden, Beurskens, Assendelft, de Vet, & Bouter, 1995; van Tulder, Koes, Assendelft, & Bouter, 1999; Wegner I, Widyahening IS, van Tulder MW, Blomberg SEI, de Vet HCW, Bronfort G, Bouter LM, van der Heijden GJ 2013; Delitto A, George SZ, Dillen LV, Whitman JM, Sowa G, Shekelle P, Denninger TR, Godges JJ 2012; Thackeray, Anne et al 2016)
  - Therapeutic ultrasound (der Windt, van der Heijden, & Berg, 1999; Gam, & Johannsen, 1995; Ebadi S, Henschke N, Nakhostin Ansari N, Fallah E, van Tulder MW 2014)
  - Electrotherapy modalities including TENS and electrical stimulation (Van der Heijden, G.J.M.G., Torenbeek, M., van der Windt, Hidding, Dekker, & Bouter, 1999; van Tulder, Koes, Assendelft, & Bouter, 1999; Nnoaham KE, Kumbang J.2008; Dubinsky, R.M. and Miyasaki, J., 2010)
  - Laser modality (De Bie, Verhagen, Lenssen, de Vet, van de Wildenberg, Kootstra, & Knipschild, 1998; Gam, & Johannsen, 1995; Gam, Thorzen, & Lonnberg, 1993;
  - Kinesiotaping (Vanti, C., Bertozzi, L., Gardenghi, I., Turoni, F., Guccione, A.A. and Pillastrini, P., 2014; Added, M.A.N., Costa, L.O.P., Freitas, D.G.D., Fukuda, T.Y., Monteiro, R.L., Salomão, E.C., Medeiros, F.C.D. and Costa, L.D.C.M., 2016)
  - Phonophoresis (Durmus, D., Alayli, G., Goktepe, A.S. et al.2013)
  - Low Level Laser Therapy- insufficient evidence (Yousefi-Nooraie R, Schonstein E, Heidari K, Rashidian A, Pennick V, Akbari-Kamrani M, Irani S, Shakiba B, Mortaz Hejri S, Jonaidi AR, Mortaz-Hedjri S. 2008
  - Pilates- insufficient evidence (Yamato TP, Maher CG, Saragiotto BT, Hancock MJ, Ostelo RWJG, Cabral CMN, Menezes Costa LC, Costa LOP 2015)
  - Muscle Energy Technique- insufficient evidence (Franke H, Fryer G, Ostelo RWJG, Kamper SJ. 2015)

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Considerations Specific to Lumbar Spinal Stenosis

- Exercise/training and directional preference exercise (based on favorable evidence)
  - Flexion exercises for the lumbar spine should be emphasized, as they reduce lumbar lordosis and decrease stress on the spine. Spinal flexion exercises increase the spinal canal dimension, thus reducing neurogenic claudication (NC). Williams' flexion-biased exercises target increased lumbar lordosis, paraspinal and hamstring inflexibility, and abdominal muscle weakness (Whitman, JM, et al 2006).
  - Lumbar extension exercises should be avoided in this population, as spinal extension and increased lumbar lordosis are known to worsen this condition. (Whitman, JM, et al 2006).
  - Ultrasound may provide transient analgesia and increased soft tissue flexibility (Whitman, JM, et al 2006)
  - General conditioning activities are useful and may include stationary cycling and treadmill walking (Pua, YH, 2007)
- Manual therapies (based on favorable evidence)
  - Manual therapy may be of benefit in addition to exercise and self-management programs (Whitman, JM, et al 2006; Reiman, M, et al 2009; Ammedolia, C, 2016)
- Acupuncture- Acupuncture may be helpful as an adjunct therapy (Kim, KH 2013)
- Clinical Interventions Not Recommended (moderate to high level of evidence or lacks sufficient evidence (noted) to recommend)
  - Traction- lacks sufficient evidence
  - Transcutaneus Electrical Nerve Stimulation (TENS)- lacks sufficient evidence

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self -care at his residence.

Home Medical Equipment

- Hot packs
- Cold packs
- Home electrical stimulation unit
- Treadmill
- Stationary Bicycle

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Lumbar stabilization exercises, flexibility exercises, as indicated
- Aerobic conditioning
- Cold/heat applications, if needed, to relieve discomfort/stiffness
- Brief use of lumbar corset type support

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Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Physiatry
- Medication
- Chiropractic
- Surgery
- Acupuncture

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Orthopedic – Lumbrosacral Non Specific

Non-Specific Low Back Pain 456

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Non-Specific Low Back Pain

Diagnoses Included:

- Lumbago
- Backache
- Non-Specific Low Back Pain
- Non-radicular Low Back Pain
- Lumbosacral segmental/somatic dysfunction
- Spinal instabilities
- Flatback syndrome
- Lumbago due to displacement of intervertebral disc
- Disorder of central nervous system, specified as central nervous system sensitivity to pain
- Persistent somatoform pain disorder

Definition

Low Back Pain is a term used to describe low back pain, nonspecific in origin, and/or nature. It can be acute, or chronic in nature. It is generally not used to describe episodes that involve radicular symptoms.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below.
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Differential Diagnoses

- Extraspinal causes (ovarian cyst, kidney stone, pancreatitis, ulcer)
- Osteoporosis and compression fractures (major trauma, or minor trauma in elderly/osteoporotic patient)
- Infection in disc or bone (fever, history of IV drug use, history of severe pain)
- Inflammatory arthritides (family history, patient age/sex, morning stiffness)
- Metastatic disease, myeloma, lymphoma (pathologic fracture, severe night pain)
- Spinal tuberculosis (lower socioeconomic groups, AIDS)
- Depression

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Onset following minor fall or heavy lifting in elderly or osteoporotic patient	Fracture
Direct Blow to the back in young adult	Fracture
Saddle anesthesia	Cauda equina syndrome
Severe or progressive neurologic complaints	Cauda equina syndrome
Global or progressive motor weakness in the lower extremities	Cauda equina syndrome
Recent onset of bowel dysfunction, or acute onset of bladder dysfunction in association with low back pain	Cauda equina syndrome
Unexplained weight loss	Malignancy
Prior history of cancer	Malignancy
Pain that is worse with recumbency, or worse at night, pain at rest	Malignancy
Fever, or recent bacterial infection	Infection
Intravenous drug abuse or immunosuppression	Infection
Prolonged steroid use	Osteoporosis
Pain that does not change with change in position	Kidney disease

Note: Extraspinal diseases that may refer pain to the back include: aortic aneurysm, colon cancer, endometriosis, hip disease, kidney stones, ovarian disease, pancreatitis, pelvic infections, tumors or cysts of the reproductive tract, uterine cancer.

The most serious cause of low back pain is malignant tumor. Most malignant tumors are metastatic and some may cause bony collapse and paralysis. Primary cancers that most commonly metastasize to bone consist of adrenal, breast, kidney, lung, prostate, and thyroid.

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimally Clinically Important Difference (90%CI) for average score =1.2 points (Horn, K. K., 2012)) OR The Oswestry Disability Index (ODI) with a score of 20% or higher (Minimally Clinically Important Difference of 12.8% or 6.4 raw points (Davidson, M., 2002)) OR The StarT Back Screening Tool (SBT) with a score of >3 (Fritz JM, 2011)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

- Refer patient to their primary care provider, for evaluation of alternative treatment options if:
  - Improvement does not meet above guidelines or improvement reaches a plateau;
  - Atrophy of lower extremity occurs;
  - Signs of fracture or dislocation occurs;
  - Increased neurologic signs/symptoms: increased LE numbness/tingling, increased LE weakness, increased LE pain, decreased LE reflexes.

Subjective Findings

- The onset of pain is usually insidious, typically but not limited to occurring between the 3rd and 6th decades of life.
- Patient may report a prior history of episodic low back pain lasting over several years.
- Pain may be at rest but typically worse with motion
- May report pain in the lower back, hips, or posterior thigh (above the knee) with active motion
- Stiffness upon arising from a seated position
- Essentially constant awareness of some level of back discomfort, or limitations in motion
- Pain and stiffness in the low back which may have intermittent, sporadic, sharp local pain
- Patient is in general good health
- May relate tenderness to palpation in the lumbar spine and sacroiliac joints
- May demonstrate ROM restrictions in the lumbar spine
- Absence of neurological signs

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Specific Examination Considerations

The physical therapy objective examination begins with an appropriate clinical history that provides the necessary information to guide the clinical examination (Deyo, Rainville, & Kent, 1992; The Swedish Council, 2000; Van den Hoogen, Koes, van Eijk, & Bouter, 1995) and includes the following criteria for non-specific low back pain without a radicular or neurologic component.

- Mobility (ICF category: Measurement of impairment of body function- mobility of several joints; good level of documentation and moderate level of evidence)
  - Mobility of the spine in lateral flexion, rotation, and ventral flexion and extension (Alaranta, 1994; Johnson, 1990; van Tulder, et al., 2006;M agnussen, 1999; Strand, Ljunggren, Haldorsen, & Espehaug, 2001; Saur, Ensink, Frese, Seeger, & Hildebrandt, 1996)
  - Neurological examination of the lower extremities to rule out nerve root involvement. (ICF category: Measurement of impairment of bodily function—mobility and function of nerves; very good level of documentation and very good level of evidence).
  - Muscle function (Devillé, Van der Windt, Dzaferagic, Bezener, & Bouter, L., 2000; Deyo, Rainville & Kent, 1992; Waddell, McIntosh, Hutchinson, Feder, & Lewis, 1999).
  - Nerve stretch tests
  - Lasegues/straight leg raise- dural and lower limb nerve mobility sign (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000; Deyo, Rainville & Kent, 1992; The Swedish Council, 2000; Vroomen, de Krom & Knottnerus, 1999; Waddell, McIntosh, Hutchinson, Feder & Lewis, 1999).
  - Cross Lasegues test (Deville, Van der Windt, Dzaferagic, Bezener & Bouter, 2000).
  - Prone knee flexion test- dural and lower limb nerve mobility sign performed in prone position (Asquier, Troussier, Chirossel, Chardonnet, Mouries, Juvin, & Phelip, 1996; Kreitz, Cute, & Yong-Hing, 1996).
  - Slump test- a dural and lower limb nerve mobility test (Philip, Lew, & Matyas, 1989; Massey, 1985)
- Trunk Muscle Power/Endurance (ICF category- Measurement of impairment of body function—pain in back; pain in lower limb; very good level of documentation and very good level of evidence) using tests that assess performance of trunk flexor, extensor, lateral abdominal, transverse abdominis, hip abductor and extensor musculature (Evans, Refshauge, & Adams, 2007; Godges, MacRae, & Engelke, 1993; Hodges, Richardson, & Jull, 1996; Krause, Youdas, Hollman, & Smith, 2005; McGill, Childs, & Liebenson, 1999; Nelson-Wong, Flynn, & Callaghan, 2009; Schellenberg, Lang, Chan, & Burnham, 2007).
- Segmental Mobility Tests (ICF category- measurement of impairment of body function- mobility of joint functions, specified as mobility of vertebral segment; moderate level of documentation and moderate level of evidence)
  - Prone lumbar instability test (Hicks, Fritz, Delitto, & Mishock, 2003).
  - Presence of aberrant movement (Hicks, Fritz, Delitto, & Mishock, 2003).

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- Passive hip internal rotation, external rotation, flexion and extension- (ICF category--measurement of impairment of body function; moderate level of documentation and moderate level of evidence.) This is the amount of passive hip rotation, flexion and extension movement (Clapis, Davis, & Davis, 2008; Cliborne, Wainner, Rhon, et al., 2004; Ellison, Rose, & Sahrmann, 1990; Godges, MacRae, & Engelke, 1993); Van Dillen, McDonnell, Fleming, & Sahrmann, 2000)
- Outcome measures (Very good documentation and very good level of evidence)
  - Medical Outcomes Survey Short form (SF-36) in particular the physical functioning domain (Deyo, et al., 1994)
  - Oswestry Disability Index (Fritz & Irrgang, 2001; Frost, Lamb, & Steward-Brown, 2008),
  - Roland-Morris Disability Questionnaire (Roland & Morris, 1983).
  - Patient Specific Functional Scale (Cleland et al, 2006)
  - STaRT Back Screening Tool (Beneciuk, J.M., Bishop, M.D., Fritz, J.M., Robinson, M.E., Asal, N.R., Nisenzon, A.N. and George, S.Z., 2012)
- Identify factors indicating the risk of long term disability such as those proposed in the Guide to Assessing Psychosocial Yellow Flags in Acute Low Back Pain.
  - "Presence of a belief that back pain is harmful or potentially severely disabling"
  - "Fear- avoidance behavior (avoiding a movement or activity due to misplaced anticipation of pain) and reduced activity levels"
  - "Tendency to low mood and withdrawal from social interaction"
  - "An expectation that passive treatments rather than active participation will help."

Management/Intervention

General Activity Advice and Education (high level of evidence)

- Clinicians are encouraged to educate patient/clients to continue/rapidly resume normal daily activities which have been shown to lead to quicker recovery and improved overall function. Patients should progressively increase their physical activity levels according to an agreed plan rather than being guided by their pain level. (Chou, Qaseem, Snow, et al., 2007; Dahm, Brurberg, Jamtvedt, & Hagen, 2010; Hagen, Hilde, Jamtvedt, & Winnem, 2004; National Health committee, 2004; Swedish Council, 2000; Waddell, Feder, & Lewis, 1997)

Manual therapies (moderate to high level of evidence)

- Mobilization/manipulation technique interventions for the lumbar spine are recommended to provide added help to shorten pain duration, range of motion and patient satisfaction. Moderate evidence for recommending thrust manipulation within 1-2 weeks after onset of symptoms. (Assendelft, Bouter, & Knipschild, 1996; Bronfort, 1999; Brox, Hagen, Juel, & Storheim, 1999; Fritz, Childs, & Flynn, 2005; Childs, Fritz, Flynn, & et al., 2004; Cleland, Fritz, Kulig, et al., 2009; Koes, Assendelft, van der Heijden, & Bouter, 1996; Shekelle, Adams, Chassin, Hurwitz, & Brook, 1992; The Swedish Council, 2000; Franke, H., Franke, J.D. and Fryer, G., 2014).

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- Mobilization/Manipulation may not be effective in chronic LBP (Rubinstein SM, van Middelkoop M, Assendelft WJ, de Boer MR, van Tulder MW 2011)
- Manual therapy techniques for improvement of hip mobility is recommended due to emerging evidence of moderate to high level supporting improvement in lumbar symptoms with improvement in hip passive movement (Burns, Mintken, & Austin, 2011; Fogel, & Esses, 2003; Mellin, 1988; Offierski, & MacNab, 1983; Reiman, Harris, & Cleland, 2009; Whitman, Flynn, Childs, et al., 2006; Whitman, Flynn, Fritz, 2003.

Exercise/training and centralization/directional preference exercise (moderate to high level of evidence)

- It is not recommend that clinicians prescribe specific exercises during the first few weeks after an initial onset of low back pain. Both systematic and guidelines show varying or no effect of early exercise (Brox, Hagen, Juel, & Storheim, 1999; Faas, 1996; van Tulder, Koes, & Bouter, 1997; van Tulder, Schoolmen, Koes, & Deyo, 2000).
- Centralization and directional preference exercises (Aina, May, & Clare, 2004; Clare, Adams, & Maher, 2004; Browder, Childs, Cleland, & Fritz, 2007; Long, Donelson, & Fung, 2004; Long, May, & Fung, 2008; Murphy, Hurwitz, Gregory, & Clary, 2006; Simotas, Dorey, Hansraj, & Cammisa, 2000; Werneke, Hart, Cutrone, et al., 2011).
- Motor Control, Core specific, or Stabilization exercises are no better than General Exercises in the long term (Smith, B.E., Littlewood, C. and May, S., 2014.; Wang X-Q, Zheng J-J, Yu Z-W, Bi X, Lou S-J, et al. 2012; Saragiotto BT, Maher CG, Yamato TP, Costa LOP, Menezes Costa LC, Ostelo RWJG, Macedo LG 2016)
- Clinician's should consider Group Exercise programs for non-specific LBP (O'Keeffe M, Hayes A, McCreesh K, Purtill H, O'Sullivan K 2016; Robertson B, Harding KE 2014; Toomey E, Currie-Murphy L, Matthews J, Hurley DA 2015)
- Trunk coordination, endurance and strengthening exercises (Choi, Verbeek, Tam, & Jiang, 2010; Costa, Maher, & Latimer, et al., 2009; Hayden, van Tulder, Malmivaara, & Koes, 2005; Hides, Jull, & Richardson, 2001; Kulig, Beneck, Selkowitz, et al., 2009; Macedo, Maher, Latimer, & McAuley, 2009; Rasmussen-Barr, Ang, Arvidsson, & Nilsson-Wikmar, 2009; Yilmaz, Yilmaz, Merdol, Parlar, Sahin, & Kuran, 2003; Ishak NA, Zahari Z, Justine M 2016; . Steffens D, Maher CG, Pereira LSM, Stevens ML, Oliveira VC, Chapple M, Teixeira-Salmela LF, Hancock MJ 2016).
- Aerobic Exercise is suggested (chronic) (Meng, X.G. and Yue, S.W., 2015; Lawford BJ, Walters J, Ferrar K 2016)
- Multidisciplinary Rehabilitation (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJ, Ostelo RWJG, Guzman J, van Tulder MW 2014)

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- Superficial Heat (acute) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016)
- Dry Needling (chronic) (Chou R, Deyo R, Friedly J, Skelly A, Hashimoto R, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S, Brodt E. 2016; Furlan AD, van Tulder MW, Cherkin D, Tsukayama H, Lao L, Koes BW, Berman BM. 2005)

Clinical Interventions Not Recommended (moderate to high level of evidence or lacks sufficient evidence (noted) to recommend)

- Traction (Beurskens, de Vet, Koke, et al., 1995; Fritz, Lindsay, Matheson, et al., 2007; Schimmel, de Kleuver, Horsting, Spruit, Jacobs, & van Limbeek, 2009; van der Heijden, Beurskens, Assendelft, de Vet, & Bouter, 1995; van Tulder, Koes, Assendelft, & Bouter, 1999; Wegner I, Widyahening IS, van Tulder MW, Blomberg SEI, de Vet HCW, Bronfort G, Bouter LM, van der Heijden GJ 2013; Delitto A, George SZ, Dillen LV, Whitman JM, Sowa G, Shekelle P, Denninger TR, Godges JJ 2012; Thackeray, Anne et al 2016)
- Therapeutic ultrasound (der Windt, van der Heijden, & Berg, 1999; Gam, & Johannsen, 1995; Ebadi S, Henschke N, Nakhostin Ansari N, Fallah E, van Tulder MW 2014)
- Electrotherapy modalities including TENS and electrical stimulation (Van der Heijden GJMG, Torenbeek M, van der Windt Hidding, Dekker, & Bouter 1999; van Tulder, Koes, Assendelft, & Bouter, 1999; Nnoaham KE, Kumbang J, 2008; Dubinsky RM and Miyasaki J, 2010)
- Laser modality (De Bie, Verhagen, Lenssen, de Vet, van de Wildenberg, Kootstra, & Knipschild, 1998; Gam, & Johannsen, 1995; Gam, Thorzen, & Lonnberg, 1993;
- Kinesiotaping (Vanti, C., Bertozzi, L., Gardenghi, I., Turoni, F., Guccione, A.A. and Pillastrini, P., 2014; Added, M.A.N., Costa, L.O.P., Freitas, D.G.D., Fukuda, T.Y., Monteiro, R.L., Salomão, E.C., Medeiros, F.C.D. and Costa, L.D.C.M., 2016)
- Phonophoresis (Durmus, D., Alayli, G., Goktepe, A.S. et al, 2013)
- Low Level Laser Therapy- insufficient evidence (Yousefi-Nooraie R, Schonstein E, Heidari K, Rashidian A, Pennick V, Akbari-Kamrani M, Irani S, Shakiba B, Mortaz Hejri S, Jonaidi AR, Mortaz-Hedjri S. 2008
- Pilates- insufficient evidence (Yamato TP, Maher CG, Saragiotto BT, Hancock MJ, Ostelo RWJG, Cabral CMN, Menezes Costa LC, Costa LOP 2015)
- Muscle Energy Technique- insufficient evidence (Franke H, Fryer G, Ostelo RWJG, Kamper SJ. 2015)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

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Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The importance of educating patients to understand that uncomplicated mechanical low back pain (LBP) has a natural course of recovery cannot be overemphasized. The patient can be taught to use medical equipment and administer self-care at his residence. General recommendations are to resume normal, or near normal, activity as soon as possible.

Home Medical Equipment

- Hot pack/cold pack

Self-Care Techniques

- Postural advice, instruction in proper body mechanics
- Flexibility exercises
- Lumbar stabilization exercises
- Aerobic conditioning, such as walking or swimming
- Heat applications, cold packs, if needed, to relieve discomfort/stiffness
- Proper Nutrition
- Stress management

Alternatives/Adjunct Management

- Osteopathic manipulation
- Chiropractic
- Physiatry
- Medication
- Yoga
- Pilates
- Cognitive Behavioral Therapy
- Acupuncture

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Orthopedic - Shoulder

Shoulder Adhesive Capsulitis	**477**
Shoulder Fractures (Non-surgical)	**487**
Shoulder Non-Specific Conditions	**496**
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Shoulder Adhesive Capsulitis

Diagnoses Included:

- Adhesive capsulitis
- Frozen Shoulder
- Shoulder periarthritis

Definition

Adhesive Capsulitis is a common cause of shoulder pain and stiffness. The pain and stiffness has been reported to last up to 2 or even 3 years. The early stages can often be very painful (Page et al 2014).

Other terms used as a descriptive diagnosis of the same cluster of presentation are "Frozen Shoulder" and "Periarthritis". Adhesive capsulitis generally occurs on a continuum characterized by progression of pain and reduced mobility of the shoulder through stages. Loss of mobility and function may be minimal or significant. Current theoretical evidence suggests the capsuloligamentous complex and musculotendinous structures surrounding the shoulder are involved. A general presentation would demonstrate loss of passive motion in multiple planes of motion of the shoulder, especially in external rotation and abduction. (Altman et al 2013)

Special Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect physical therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- Patients with diabetes mellitus and thyroid disorders are at risk.
- Greater prevalence in individuals 40-65 years of age
- More prevalent in female patients

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, rotator cuff tear, tendon rupture
Exertional, history of cardiac diagnosis	Cardiac pain can radiate to the shoulder
Constant, relieved/worse with meals, positional, associated with fatty meals	Gastrointestinal diseases including cholelithiasis
Pleuritic, shortness of breath, associated with cough	Pulmonary diseases
Multiple joint involvement, tophi	Rheumatology diseases (gout)
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Discoloration of hand, cold	Arterial occlusion

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Differential Diagnoses

- Subacrominal Impingement
- Pain referral due to cardiac or pulmonary conditions
- Pain referral due to cervical and brachial plexus conditions
- Metastatic disease: myeloma, sarcoma, lymphoma of adjacent tissues
- Complex Regional Pain Syndromes
- Traumatic injury such as fracture
- Fibromyalgia
- Rheumatoid Arthritis
- Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Hand and Shoulder score (DASH) OR QuickDASH with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)) OR The Shoulder Pain and Disability Index (SPADI) with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011)(Staples et al 2010))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)

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  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently
  - Discharge Criteria
- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Shoulder pain
- Progressive loss of range of motion of the shoulder especially in external rotation and abduction
- Patients may report progression in stages of pain first then progressive loss of motion
- Night pain
- Pain with movement, especially with rapid arm movements

(Walmsley et al 2014, Altman 2013)

Objective Findings

Clinicians should use functional outcome measures (see "Requirements for physical therapy"). These should be used before and after interventions in regards to restrictions associated with adhesive capsulitis. Strong evidence for recommendation, Grade A (Altman et al 2013)

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Specific Examination Considerations

A medical diagnosis of adhesive capsulitis may be helpful in describing tissues involved and pathological course, however it does not aid in treatment decision making for rehabilitation. Treatment based on impairment classification should guide rehabilitation. Additional consideration should be given to patient age, gender, comorbidities and risk factors associated with adhesive capsulitis. Level II-III (Altman et al 2013)

Primary and secondary adhesive capsulitis is mostly determined from the history and physical examination Level V (Altman et al 2013)

ROM loss of greater than 25% in at least two planes of movement and passive external ROM loss that is greater than 50% of the uninvolved shoulder or less than 30 degrees has been used to describe adhesive capsulitis. Level V (Altman et al 2013

Inspection

Clinical course

- It has been suggested that adhesive capsulitis has four stages of progression. (Hanhafin et al 2000). A patient may seek or be referred to physical therapy during any stage.
- Stage 1 – up to 3 months, sharp pain at end ROM, achy at rest and trouble with sleep
- Stage 2 – 3-9 months, knows as the “painful” or “freezing” stage. Presents with a progressive loss of motion in all directions due to pain
- Stage 3 – 9-15 months, knows as the frozen stage. Continued pain and loss of motion. Progressive fibrosis.
- Stage 4 – 15-24 months, known as the thawing stage. Pain begins to resolve. Stiffness may persist at first but generally reduces to mild limitation or no limitation. Recovery may be limited due to risk factors and comorbidities.

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Movement Testing

- Clinicians should measure active and passive shoulder ROM to assess key impairments. Expert Opinion Grade F (Altman et al 2013)
- Special Tests: The most current published and peer reviewed practice guideline for physical therapy of adhesive capsulitis (Altman et al 2013) does not provide direction as far as special tests specific to determining a diagnosis of adhesive capsulitis. There does not appear to be sufficient evidence to support the use of special tests to rule in or out the diagnosis. However, providers may utilize specific tests to help rule out other differential diagnoses or to determine a need for referral to other providers.
  - No single shoulder test can make a pathoanatomic diagnosis. Combinations of shoulder tests provide better accuracy but marginally so. Findings support a comprehensive history and clinical exam. Utility score represents expert opinion of the clinical use of a special test after gathering and clinically evaluating all of the literature regarding the test. The relevant literature studied looks at the test's discriminatory ability and reliability. The "utility score" scale is :
    - 1: Evidence strongly supports the use of this test.
    - 2: Evidence moderately supports the use of this test.
    - 3: Evidence minimally supports or does not support the use of this test.
    - 4: The test has not been researched sufficiently so it is unclear as to its value (Cook, Hegedus, 2013,Hegedus 2012).
- Special tests for Shoulder (Cook, Hegedus, 2008):
  - Highly recommended: Utility score: 1
    - Tests for Torn Labrum/Instability
    - Biceps Load Test II
  - Moderately recommended: Utility score: 2
    - Tests for torn rotator cuff/impingement
      - Rent Test
      - Lift off Test
      - External rotation lag sign
      - Internal rotation lag sign
      - Drop sign
      - Empty Can /Supraspinatus Test
      - Full Can/Supraspinatus Test
    - Tests for Impingement
      - Internal rotation Resisted Strength
      - Infraspinatus Test
      - Neer, Hawkins,Yocum, Likelihood ratio 3.6 (Cook, 2007; AAMG, 2003)
    - Tests for Torn Labrum/Instability
      - Crank Test
      - Kim Test
      - Jerk Test
      - Anterior Release Surprise Test
    - AC Jt. Pathology
      - AC Resisted Extension Test

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        - AC joint palpation
    - Recommended: (AAMG, 2003)
    - Biceps Tendon Lesions:
    - Neer, Hawkins and Yocum, 1.76 likelihood ratio
    - Speed test: 1.05 likelihood ratio

- Summary of Best Tests: (Cook, 2008)
    - Rotator cuff tears: Rent Test, Lift Off Test, Internal Rotation Lag Sign and External Rotation Lag Sign: Show promising results. Drop Sign: has value as a positive test for ruling in a supraspinatus tear
    - Supine Impingement Test: show promise as a screen where a negative test would rule out a rotator cuff tear
    - Impingement is a broad diagnosis including: subacromial bursitis, to partial rotator cuff tear, to a full thickness rotator cuff tear, making its value as a diagnostic label questionable. No test of diagnostic value in patients with impingement.
    - Detection of laxity/instability, only one test : Anterior release/Surprise Test :some promise: more research needed
    - Posterior inferior labral tears: Kim Test, Jerk Test: Show promise
    - Ac joint pathology: Pain with palpation is a good screen Resisted Extension Test: some use in diagnosing AC joint pathology, but need more research.

Management/Intervention

Conservative treatment of shoulder disorders generally includes rest, medication and specific rehabilitation approaches. (Desjardins-Charbonneau et al 2015) These may include exercise, manual therapy and various therapeutic modalities. Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence. The interventions should be designed to improve the movement and function of the patient and lessen or alleviate the activity limitations commonly reported by the patients who meet the diagnostic criteria of that pattern (Kelley et al, 2011)

- High Recommendation
    - Outcome Measures:
    - Strong evidence, Highly recommended Grade A (Altman et al 2013, Kelley, et al., 2011, 2013)
        - There are several outcome measures designed to assess patients with shoulder disorders. These tools can be classified as shoulder joint specific, shoulder disease specific or upper limb specific. Over 30 tools have been published. Validated functional outcome measures should be used before and after interventions intended to alleviate the impairments of body function and structure, activity limitations and participation restrictions.
        - Patient Education: Level I evidence, Grade B recommendation (Altman et al 2013

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Clinicians should utilize patient education that describes the natural course of adhesive capsulitis, promotes activity modification to allow pain-free ROM and function. Providers should also educate patients to match the intensity of stretching to their level of irritability.

- Moderate Recommendation
  - Therapeutic exercise (therapeutic ex.):
    - Stretching Exercises – Fair level of evidence II, Grade B (Altman et al 2013). Clinicians should instruct patients in stretching exercises. Intensity should be determined by the patient's irritability level.
  - Fair evidence Level II for non-specific shoulder pain
    - Often supplemented with joint mobs techniques: not proven to be superior to therapeutic ex alone for pain reduction, increase in ROM and function and decrease in disability (Brudvig, et al., 2011).
    - Exercise is effective for producing small improvement in ROM (van den Dolder, et al 2012).
    - Comparison of customized vs. standard exercise: equally effective in increasing strength, function and decreasing pain intensity (Wang et al 2006).
  - Manual Therapy:
  - Joint Mobilization – Fair to moderate evidence level II,IV Grade C (Altman et al 2013)
    - Utilization of joint mobilization mainly at the glenohumeral joint to reduce pain and increase motion and function. There is no evidence to suggest superiority compared to other interventions. There is no evidence to specify supervised care frequency. There is also evidence to suggest that joint mobilization along with a home program may be superior to joint mobilization alone (level II).
  - Manual Therapy combined with exercise – Moderate to low evidence. (Page et al 2014)
    - The best available data indicates that combination of manual therapy and exercise may not be as effective as steroid injection in the short term. After an injection, manual therapy and exercise may have similar effects to sham ultrasound; but it may provide greater patient reported outcomes.
    - Shoulder jt. mobs combined with hot pack active exercise stretching, soft tissue mobilization and education, may improve acute shoulder pain in the short term compared to combined treatments alone. Level I (AAMG, 2003).
    - Manipulative therapy in addition to usual medical care accelerates recovery of shoulder symptoms (Bergman et al 2004).
    - Joint mobs useful to reduce pain and increase ROM and function for adhesive capsulitis Grade C Level III/IV (weak evidence) (Albright et al, 2011).

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- Neutral Recommendation
  - Modalities:
  - High to weak evidence for recommendation: conflicting
    - Heating or electrical modalities can have positive benefit on pain, theoretically. The impact of modality use on the natural course of adhesive capsulitis has not been determined. Use of ultrasound, diatheramy or electrical stimulation may help to reduce pain and improve ROM. Level II-IV, Grade C (Altman et al 2013)
    - Ultrasound is commonly used in physiotherapy management of musculoskeletal pain in peripheral joints. Study demonstrated ultrasound has no clinical benefit beyond that of placebo ultrasound in physiotherapy treatment of shoulder pain. (Prospective double blind placebo controlled randomized trial, (Ainsworth et al 2007).
- Low Recommendation
  - Trigger Point Dry Needling
    - Very low quality to moderate quality evidence suggests that dry needling is more effective that no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes with compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017)
- Not Recommended
  - Transcutaneous electrical nerve stimulation (TENS):
    - Insufficient evidence to include or exclude for shoulder pain
    - Weak evidence Level III/IV for adhesive capsulitis combined with mobility and stretching (Kelley et al., 2013, 2011).
  - Kinesiotaping:
    - No Significant changes between taping and sham taping on pain or kinematics in individuals with shoulder pain (Aminaka N et at 2017)
    - Current evidence does not support the use of “Kinesio Taping” for shoulder pain (among other conditions) after systematic review. (Parreira PC et al 2014)

Home and Self-Care Techniques

Stretching Exercises – Fair level of evidence II, Grade B (Altman et al 2013). Clinicians should instruct patients in stretching exercises. Intensity should be determined by the patient’s irritability level.

Education on activity modification and keeping activity within the limits of pain and function (Hopman et al 2013)

The patient can be taught to use medical equipment and administer self care at his residence. The qualified health care provider should be able to educate the patient on a regular home exercise program. There does not appear to be a difference between exercise done at home or the clinic. (Littlewood et al 2015)

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Home Medical Equipment

- Hot packs/cold packs
- Pulleys for self assisted range of motion
- Theraband for therapeutic exercises

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- High Recommendation
  - Corticosteriod Injection – High level evidence I-II, Grade A
    - Intra-articular injections combined with shoulder mobility and stretching are more effective in providing short term pain relief (4-6 weeks) and improved function compared to manual therapy and exercise alone. (Altman et al 2013)
    - Combination of manual therapy and exercise may not be as effective as corticosteroid injection in the short term. (Page et al 2014)
- Neutral Recommendation for referral
  - Osteopathic manipulation
  - Chiropractic
  - Acupuncture - High to weak evidence for recommendation: conflicting: Level 1 systematic review. Comparison of the effectiveness of acupuncture compared to placebo ultrasound for shoulder pain and function. (AAMG, 2003)
  - Medication

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Shoulder Fractures (Non-surgical)

Diagnoses Included:

- Proximal Humeral Fracture
- Clavicular Fracture
- Glenoid Fracture

Definition

Upper limb fractures are a common injury affecting most age groups. The most common upper limb fracture occurs along the proximal third of the humerus. (Bruder et al 2011) Whereas the shoulder complex involves not only the proximal portion of the humerus, but the scapulae and the clavicle, fractures to any of these bones could impact function. It is also common for people with fractures affecting the shoulder to be referred to physical therapy to help restore lost function. Prior to attending physical therapy, some fractures may be surgically stabilized. For the purposes of this guideline section, only non-surgical shoulder fracture rehabilitation will be considered. Guidelines for post-surgical rehabilitation of shoulder fixation will be considered as part of the shoulder post-surgical guideline found in a separate section.

Special Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect physical therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.
- Patients with diabetes mellitus and thyroid disorders are at risk.
- Greater prevalence in individuals 40-65 years of age
- More prevalent in female patients
- Length of immobilization
- Other joints involved (elbow, wrist, neck)

Differential Diagnoses

- Standard for diagnosis of fracture is radiologic confirmation. This should help eliminate possibility for differential diagnoses. However, there may be possibility of a missed diagnosis or secondary diagnosis:
  - Complex or unstable fracture
  - Associated pathologic condition – Tumor or other cancer
  - Osteoporosis
  - Rotator Cuff Tear
  - Glenohumeral or Acromioclavicular dislocation
  - Avascular necrosis of the humeral head

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, rotator cuff tear, tendon rupture
Exertional, history of cardiac diagnosis	Cardiac pain can radiate to the shoulder
Constant, relieved/worse with meals, positional, associated with fatty meals	Gastrointestinal diseases including cholelithiasis
Pleuritic, shortness of breath, associated with cough	Pulmonary diseases
Multiple joint involvement, tophi	Rheumatology diseases (gout)
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Discoloration of hand, cold	Arterial occlusion

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Hand and Shoulder score (DASH) OR QuickDASH with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)) OR The Shoulder Pain and Disability Index (SPADI) with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011)(Staples et al 2010))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time

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- Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Shoulder pain
- Arm immobilized in sling, splint or swath
- Report of X-ray or other radiologic findings
- Pain with movement
- Reduce strength, especially if had prolonged casting or other immobilization

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Objective Findings

Clinicians should use functional outcome measures to assist in tracking outcomes as a result of skilled care (see "Requirements for physical therapy"). These should be used before and after interventions. Minimum clinical difference in common outcomes (DASH, Quick DASH, etc) have been reported for shoulder fracture (Handoll et al 2015).

Objective findings should be focused on impairments as a result of a fracture and tracked over time. These will likely guide treatment decisions:

- Affected daily abilities
- ROM limitations
- Pain ratings
- Radiologic reports

Specific Examination Considerations

Shoulder fractures are most common in the elderly and typically are the result of a fall. There may be osteoporosis present along with other comorbidities. Along with age, gender should be a consideration. Females are affected 2-3 times as often as men. (Ragan et al 2015).

Humeral fractures may be classified to assist in deciding the level of displacement and subsequent referral for surgical consultation. The most common classification system in use was reported by Neer back in 1970 for proximal humeral fractures. This classification should be done following radiographic findings; however knowledge of the fracture location may guide treatment.

Inspection

- Type of immobilization
- Swelling
- Muscle atrophy
- Circulation to distal parts of limb
- Skin quality and condition
- Redness or other erythema/discoloration

Movement Testing

- Clinicians should measure active and passive shoulder ROM to assess key impairments. Expert Opinion Grade F (Altman et al 2013)
  - AROM (extend, flex abduct, adduct, externally and internally rotate) can be measured visually or with goniometer or inclinometer.
  - PROM, accessory and restraints to movement, end feel

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Strength Testing

- Resisted Isometric Movements of shoulder and elbow (due to some of the muscle of shoulder also cross the elbow): extend, flex, abduct, adduct, internally and externally rotate. Elbow: flex, extend.

Special Tests

Whereas fractures are diagnosed as a result of imaging (X-ray, CT scan, MRI scan) special diagnostic tests are typically not used. There is no current high quality evidence to support the use of special tests in this type of injury. However, there may be times when a shoulder specific diagnostic test is used even with a primary diagnosis of fracture. For this reason, test information is included.

- No single shoulder test can make a pathoanatomic diagnosis. Combinations of shoulder tests provide better accuracy but marginally so. Findings support a comprehensive history and clinical exam. Utility score represents expert opinion of the clinical use of a special test after gathering and clinically evaluating all of the literature regarding the test. The relevant literature studied looks at the test's discriminatory ability and reliability. The "utility score" scale is :
  - 1: Evidence strongly supports the use of this test.
  - 2: Evidence moderately supports the use of this test.
  - 3: Evidence minimally supports or does not support the use of this test.
  - 4: The test has not been researched sufficiently so it is unclear as to its value (Cook, Hegedus, 2013, Hegedus 2012).
- Special tests for Shoulder (Cook, Hegedus, 2008):
  Highly recommended: Utility score: 1
  - Tests for Torn Labrum/Instability
  - Biceps Load Test II
- Moderately recommended: Utility score: 2
  - Tests for torn rotator cuff/impingement
    - Rent Test
    - Lift off Test
    - External rotation lag sign
    - Internal rotation lag sign
    - Drop sign
    - Empty Can /Supraspinatus Test
    - Full Can/Supraspinatus Test
  - Tests for Impingement
    - Internal rotation Resisted Strength
    - Infraspinatus Test
    - Neer, Hawkins,Yocum, Likelihood ratio 3.6 (Cook, 2007; AAMG, 2003)
  - Tests for Torn Labrum/Instability
    - Crank Test
    - Kim Test
    - Jerk Test
    - Anterior Release Surprise Test

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- AC Jt. Pathology
  - AC Resisted Extension Test
  - AC joint palpation
    - Recommended: (AAMG, 2003)
    - Biceps Tendon Lesions:
    - Neer, Hawkins and Yocum, 1.76 likelihood ratio
    - Speed test: 1.05 likelihood ratio

- Summary of Best Tests: (Cook, 2008)
  - Rotator cuff tears: Rent Test, Lift Off Test, Internal Rotation Lag Sign and External Rotation Lag Sign: Show promising results. Drop Sign: has value as a positive test for ruling in a supraspinatus tear
  - Supine Impingement Test: show promise as a screen where a negative test would rule out a rotator cuff tear
  - Impingement is a broad diagnosis including: subacromial bursitis, to partial rotator cuff tear, to a full thickness rotator cuff tear, making its value as a diagnostic label questionable. No test of diagnostic value in patients with impingement.
  - Detection of laxity/instability, only one test : Anterior release/Surprise Test :some promise: more research needed
  - Posterior inferior labral tears: Kim Test, Jerk Test: Show promise
  - AC joint pathology: Pain with palpation is a good screen.
  - Resisted Extension Test: some use in diagnosing AC joint pathology, but need more research.

Management/Intervention

There has been recent evidence to suggest that in patients with displaced proximal humeral fractures involving the surgical neck surgical intervention does not lead to better outcomes up to two years after the injury (Rangan et al 2015, Handoll et al 2015). When adhering to the ProFHER protocol, patients with non-surgical intervention were given a sling for a period of time followed by active rehabilitation within the National Health Service (United Kingdom). An informational pamphlet about self-care was used during the sling period. Basic physical therapy and promotion of a home program followed (Ragan et al 2015). More complex fractures may require surgical intervention. Evidence based recommendation of treatment is limited and will be combined with a shoulder post-surgical guideline.

However, there is evidence to suggest improved outcomes and fracture union for displaced clavicle fractures that are corrected surgically compared to non-surgically (Ahrens et al 2017). There may be more patients seeking non-surgical rehabilitation following displaced proximal humeral fractures than with displaced clavicle fractures.

The interventions should be designed to improve the movement and function of the patient and lessen or alleviate the activity limitations commonly reported by the patients who meet the diagnostic criteria of that pattern (Kelley et al, 2013).

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In a systematic review ranging from 1985 to 2004 the authors were not able to find research of high enough quality to assess the use of treatment modalities in proximal humeral fractures. All 66 studies identified were of too low quality to support a decision either way (Lanting et al 2007).

- High Recommendation
  - Outcome Measures:
  - Strong evidence, Highly recommended Grade A (Rangan et al 2015, Handoll et al 2015)
    - There are several outcome measures designed to assess patients with shoulder disorders. These tools can be classified as shoulder joint specific, shoulder disease specific or upper limb specific.
- Moderate Recommendation
  - Manual Therapy:
    - Early vs Delayed mobilization of proximal humeral fracture (minimally displaced): low quality evidence in favor of early mobilization. May result in fewer problems at one year, less overall sessions of physical therapy and better quality of life at 16 weeks. (Handoll et al 2015)
- Neutral Recommendation
  - Early Introduction of exercise for Proximal Humeral Fractures
    - Starting exercise earlier after conservatively managed fractures can reduce pain in the short term and increase activity. Three studies started with the first week following fracture compared to 3 weeks. After one year, early exercise group showed less disability. Multiple moderate to low quality studies(Bruder et al 2011)
- Low Recommendation
  - Supervised exercise vs home only for proximal humeral fractures
    - Upon review, there was preliminary evidence that adding supervised exercise to a home program may reduce upper limb activity and increase short term impairment. (Bruder et al 2011)
  - Supervised therapy plus a home program compared to home program alone for proximal humeral fractures.
    - There is no available evidence that adding supervised exercise to a home exercise program (compared to a home program alone) improves upper limb activity or reduces impairment (Bruder et al 2011)
- Not Recommended
  - Kinesiotaping:
    - No Significant changes between taping and sham taping on pain or kinematics in individuals with shoulder pain (Aminaka N et at 2017)
    - Current evidence does not support the use of “Kinesio Taping” for shoulder pain (among other conditions) after systematic review. (Parreira PC et al 2014)

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- Therapeutic Ultrasound:
  - The addition of ultrasound was not superior to placebo ultrasound when used as part of physical therapy in the short term for shoulder pain (Ainsworth et al 2007)

Home and Self-Care Techniques

Current evidence suggests that patients with proximal humeral fractures do not have any additional benefit and may have some short term reduced upper arm ability when additional exercise is given beyond a home program. (Bruder et al 2011) However early introduction to exercise and movement may help to reduce pain and increase arm use (Handoll 2015, Bruder 2011)

Home Medical Equipment

- Hot packs/cold packs
- Pulleys for self-assisted range of motion
- Theraband for therapeutic exercises

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Neutral Recommendation for referral
  - Acupuncture - High to weak evidence for recommendation: conflicting: Level 1 systematic review. Comparison of the effectiveness of acupuncture compared to placebo ultrasound for shoulder pain and function. (AAMG, 2003)
  - Orthopedic surgical consultation if not able to progress or has complications

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Shoulder Non-Specific Conditions

Diagnoses Included:

- Shoulder Pain and Dysfunction
- Shoulder Myofascial Pain
- Shoulder Dislocation
- Shoulder Sprain
- Acromioclavicular Sprain
- Glenohumeral Joint Degenerations
- Other shoulder conditions not associated with fracture, surgery, tendonopathy or capsular adhesions

Definition

For the purpose of these guidelines “shoulder” refers to the articulation of the scapula, clavicle and humerus together with the ligaments, tendons, muscles and other soft tissues with a functional relationship to these structures (AAMG, 2003). There is no universal definition of shoulder pain.Types of shoulder pain:

- “Acute shoulder pain” is defined as pain that has been present for less than three months. It does not refer to the severity or quality of the pain.
- “Chronic shoulder pain” is pain that has persisted for longer than 3 months. (AAMG, 2003)

Patient History

Many people with acute shoulder pain are likely to have conditions that resolve spontaneously regardless of treatment. 23% of all new episodes of shoulder pain resolve fully within one month and 44% resolve within three months of onset.

The results of studies on the natural history of shoulder pain vary considerably because of the range of definitions used to describe shoulder disorders (van der Heijden, 1999). The risk that uncomplicated shoulder pain will persist beyond the acute phase appears to be related to personality traits, coping style, and occupational factors (van der Heijden, 1999). Forty-one percent of the people had persistent symptoms after one year. Prevalence figures for shoulder disorders vary widely for point prevalence (7-26%), one month prevalence (19-31 %), one year (5-47%) and lifetime prevalence (7-66%) (Gillian, Robb, Aroll, & Reid 2009).

Special Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related and to what extent and nature of the event. Moderate evidence, grade B (Kelley et al 2011, Cook 2007, AAMG 2003)

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Differential Diagnoses

- Pain referral due to cardiac or pulmonary conditions
- Pain referral due to cervical and brachial plexus conditions
- Metastatic disease: myeloma, sarcoma, lymphoma of adjacent tissues
- Complex Regional Pain Syndromes
- Fibromyalgia
- Rheumatoid Arthritis
- Thoracic Outlet Syndrome

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, dislocation, rotator cuff tear
Exertional, history of cardiac disease	Cardiac pain can radiate to the shoulder
Constant, relieved/worse with meals, positional, associated with fatty meals	Gastrointestinal diseases including cholelithiasis and perforated ulcer
Pleuritic pain, shortness of breath, associated with cough	Pulmonary diseases
Multiple joint involvement	Rheumatology diseases
Fever, severe pain	Possible infection
Cancer history, night pain	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Unexplained weight loss	cancer or autoimmune dysfunction
Pain at rest or unrelated to activity	visceral source
History of smoking	lung cancer and referred pain from cancer
Other conditions referring to the shoulder	cervical radiculopathy

Requirements for Physical/Occupational Therapy Visits

Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:

- Functional Outcome Measurements showing significant functional limitations using the **Patient Specific Functional Scale (PSFS)**– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Hand and Shoulder Score (DASH) **OR QuickDASH** with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)) OR **The Shoulder Pain and Disability Index (SPADI)** with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011))
- ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Pain: limiting function and at least 3/10 for 50% of the time

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Treatment frequency and duration must be based on:

- Severity of objective clinical findings,
- Presence of and number of complicating factors and comorbidities,
- Natural history and chronicity of condition,
- Expectation for functional improvement with skilled intervention,
- Response to treatment provided

- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.

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- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings (Kelley 2013)

- Patient will present with shoulder pain
- Patient may present with limited shoulder movement, however shoulder mobility may be within functional limits
- The patient's condition may be related to a specific injury or the onset may be insidious.
- Often associated with functional weakness of the affected shoulder and arm
- Pain with daily activity and self-care
- Better with rest, but the patient may complain of trouble sleeping on the affected side

Specific Examination Considerations

The physical examination begins with an appropriate clinical history that provides the necessary information to guide the clinical examination. Most cases of acute shoulder pain are of "mechanical" origin and can be managed as acute regional pain (Level III evidence). Differential evaluation of clinical findings suggestive of musculoskeletal impairments of body functioning (ICF) and the associated tissue pathology/disease (ICD). Level 5, Grade F, Expert opinion: (Kelley et al, 2013, 2011) (AAMG, 2003; Magee, 1992; Butler, 1991).

Findings of shoulder examination must be interpreted cautiously in light of the evidence of limited utility. No clinical test is both reliable and valid for any specific diagnostic entity (Level III-2 evidence). Causes of shoulder pain cannot be diagnosed by clinical assessment. However, with the exception of serious conditions, satisfactory outcomes do not depend on precise identification of cause (Level III evidence). Despite limitations, physical exam is an opportunity to identify features of potentially serious conditions. Inspection

Palpation of shoulder, acromioclavicular (AC) joint, sternoclavicular (SC) joint, clavicle, scapula, cervical and thoracic spine and ribs: Tenderness is the main physical sign elicited by palpation. It may be focal or diffuse. Focal is more significant as it reproduces the patient's typical pain. (Hopman et al 2013)

Physical Impairment measures (ICF)

Measurement of impairment body function: mobility of a single joint. Grade E recommendation based on theoretical/foundational evidence.

- Movement Testing:
  - AROM (extend, flex abduct, adduct, externally and internally rotate) can be measured visually or with goniometer or inclinometer.
  - PROM, accessory and restraints to movement, end feel

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- Resisted Isometric Movements of shoulder and elbow (due to some of the muscle of shoulder also cross the elbow): extend, flex, abduct, adduct, internally and externally rotate. Elbow: flex, extend.

- Neurological Testing:
  - Upper limb Tissue Tension Tests (Wainner et al 2003)
  - Reflexes
  - Cutaneous distribution
- Tissue Irritability Levels:
  - High ≥7/10, medium 4-6/10, low≤3/10. Level 5
- Special Tests:
  - (Hegedus, 2012) No single shoulder test can make a pathoanatomic diagnosis. Combinations of shoulder tests provide better accuracy but marginally so. Findings support a comprehensive history and clinical exam. Utility score represents expert opinion of the clinical use of a special test after gathering and clinically evaluating all of the literature regarding the test. The relevant literature studied looks at the test's discriminatory ability and reliability. The "utility score" scale is :
    - 1: Evidence strongly supports the use of this test.
    - 2: Evidence moderately supports the use of this test.
    - 3: Evidence minimally supports or does not support the use of this test.
    - 4: The test has not been researched sufficiently so it is unclear as to its value (Cook, Hegedus, 2013).
- Special tests for Shoulder (Cook, Hegedus, 2008):
  - Highly recommended: Utility score: 1
    - Tests for Torn Labrum/Instability
    - Biceps Load Test II
  - Moderately recommended: Utility score: 2
    - Tests for torn rotator cuff/impingement
      - Rent Test
      - Lift off Test
      - External rotation lag sign
      - Internal rotation lag sign
      - Drop sign
      - Empty Can /Supraspinatus Test
      - Full Can/Supraspinatus Test
    - Tests for Impingement
      - Internal rotation Resisted Strength
      - Infraspinatus Test
      - Neer, Hawkins,Yocum, Likelihood ratio 3.6 (Cook, 2007; AAMG, 2003)
  - Tests for Torn Labrum/Instability
      - Crank Test
      - Kim Test
      - Jerk Test
      - Anterior Release Surprise Test

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- AC Jt. Pathology
  - AC Resisted Extension Test
  - AC joint palpation
  - Recommended: (AAMG, 2003)
- Biceps Tendon Lesions:
  - Neer, Hawkins and Yocum, 1.76 likelihood ratio
  - Speed test: 1.05 likelihood ratio

- Summary of Best Tests: (Cook, 2008)
  - Rotator cuff tears: Rent test, Lift off test, Internal rotation lag sign External rotation lag sign: Show promising results. Drop sign: value as a pos. test for ruling in a supraspinatus tear
  - Supine Impingement Test: show promise as a screen where a negative test would rule out a rotator cuff tear
  - Impingement is a broad diagnosis including: subacromial bursitis, to partial rotator cuff tear, to a full thickness rotator cuff tear, making its value as a diagnostic label questionable. No test of diagnostic value in patients with impingement.
  - Detection of laxity/instability, only one test : Anterior release/Surprise Test: some promise: more research needed
  - SLAP lesions: Biceps Load Test II: good diagnostic tool
  - Posterior inferior labral tears: Kim test Jerk test: Shows promise
  - AC joint pathology: Pain with palpation is a good screen.
  - Resisted Extension Test: some use in diagnosing AC joint pathology, but need more research.

Management/Intervention (evidence based)

Therapy must show significant functional change.

Referral Guidelines

Refer patient to their primary care provider for evaluation of alternative treatment options if:

- Improvement does not meet above guidelines, or improvement has reached a plateau
- Atrophy of upper extremity occurs

Management/Intervention (evidence based)

Shoulder pain is one of the most common reasons that people seek medical attention. Prospective studies in Europe have shown approximately 11 out of 1000 patients seen by a family practitioner have shoulder pain. Over 50% of patients diagnosed by a general practitioner to have shoulder tendonitis are referred to physical therapy (Albright, Allman, 2011).

There is a wide variety of treatment approaches, likely related to uncertainty about the efficacy of these multiple interventions. The interpretation of shoulder pain research is complicated by the broad inclusion criteria that allow mixed populations with different etiologies of shoulder pain.

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Differential evaluation of musculoskeletal findings is used to determine the most relevant physical impairments associated with the patient's reported activity limitations and medical diagnosis. Clusters of the clinical findings that commonly co-exist in patients are described as impairment patterns and are labeled according to the key impairments in body functions associated with that cluster. The impairment patterns drive the interventions which focus on normalizing the key impairments of body function. The interventions are designed to improve the movement and function of the patient and lessen or alleviate the activity limitations commonly reported by the patients who meet the diagnostic criteria of that pattern. Patients often fit more than one impairment pattern and the most relevant impairments and intervention may change during the course of their rehab. Thus, it is very important to continually re-evaluate (Kelley et al, 2011)

It is important to take prognostic risk factors into consideration and to intervene early to prevent progression to chronic pain (AAMG, 2003).

- High Recommendation
  - Outcome Measures:
  - Strong evidence, Highly recommended Grade A (Kelley, et al., 2011, 2013)
    - There are several outcome measures designed to assess patients with shoulder disorders. These tools can be classified as shoulder joint specific, shoulder disease specific or upper limb specific. Over 30 tools have been published. Validated functional outcome measures should be used before and after interventions intended to alleviate the impairments of body function and structure, activity limitations and participation restrictions.
- Moderate Recommendation
  - Therapeutic exercise (therapeutic ex.):
  - Moderate evidence with mod recommendation Grade B
  - Fair evidence Level II for non-specific shoulder pain
    - May improve shoulder pain compared to placebo in people with rotator cuff disease in both short and long term with improvement in function and abduction. (Level I) (Kelley et al, 2011; Albright et al., 2001; AAMG, 2003; Agency for Health Care Research and Quality National Guideline U. SDept. of Health and Human Resources, 2011)
    - Therapeutic ex.: an effective intervention for pts. with shoulder dysfunction.
    - Often supplemented with joint mobs techniques: not proven to be superior to therapeutic ex alone for pain reduction, increase in ROM and function and decrease in disability (Brudvig, et al., 2011).
    - Exercise is effective for producing small improvement in ROM (van den Dolder et al, 2012).
    - Comparison of customized vs. standard exercise: equally effective in increasing strength, function and decreasing pain intensity (Wang et al, 2006).
    - Home exercise program effective in improving symptoms and reduced disability (Ludewig, Borstad, 2003).

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- One hour of strength training/week effective in reducing neck and shoulder pain with fewer and longer sessions providing more gains than shorter more frequent (Anderson, Anderson et al, 2012).
- Specific exercise is effective in reducing pain, improving function and reduced need for surgery at 3 months (Holmgren et al, 2012).
- Graded exercise is more effective in restoring ADL's in chronic patients vs. usual care (Gereats et al, 2005).
- Core training should be considered in strengthening program for shoulder due to increased isometric peak torque of glenohumeral movements (Clinically significant) (Moghadum et al, 2011).
- Cross body stretch more effective than no stretch and more effective than sleeper stretch in improving int. rotation (McClure et al, 2007).
- Exercise, multiple physical modalities are all equally effective in restoring neuromuscular control short term (Ginn et al, 2005).
- Stretching exercises for adhesive capsulitis with intensity determined by tissue irritability. Moderate evidence Level I /II (Kelley et al, 2011, 2013).
- For chronic pain patients: A ctivity modification: reduce overhead activity, avoid painful arc 60-120 degrees, avoid heavy loading. Stretching and strengthening exercises should be done to relieve pain by improving overall shoulder function and provide short term recovery and long term results. (Burbank, Stevenson, Czarnecki et al, 2008).

- Manual Therapy:
  - Manual therapy may decrease pain in shoulder tendonopathy.It is unclear whether it can improve function. Level 1a. (Desjardins-Charbonneau A, Roy J, Dionne C et al 2015)
  - Shoulder jt. mobs combined with hot pack active exercise stretching, soft tissue mobilization and education, may improve acute shoulder pain in the short term compared to combined treatments alone. Level I (AAMG, 2003).
  - Manual therapy combined with home exercise: no short term effects but greater improvement noted at follow up (22 weeks) with shoulder function and strength suggest benefits with active treatment take longer to manifest. (Bennell et al, 2010).
  - Manual therapy added to an exercise protocol for shoulder impingement did not increase improvements compared to exercise alone. Level 1b. (Camargo et al 2015).
  - Combined manual therapy with multimodal or exercise therapy, Grade B (Brantingham et al, 2011).
  - Minor neurogenic shoulder pain and shoulder osteoarthritis respectively. Limited Level C and insufficient evidence (AAMG, 2003).
  - Manipulative therapy in addition to usual medical care accelerates recovery of shoulder symptoms (Bergman et al, 2004).
  - Clinically relevant: the number of muscles with active myofasical trigger points was significantly reduced (Bron et al, 2011).
  - Scapular mobs may be useful: small increase in ROM and decrease in pain (Surenkik et al, 2009).
  - STM with stretching can benefit shoulder posture and ms.

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- function J. (Bodyn et al, 2010).
- High grade mob technique more effective (by small amount) than low grade technique in improving jt. mobility and reducing disability. End range mobility for capsulitis was increased. poor study no control (Vermeulen et al, 2000).
- Manipulation more effective than exercise in treating more intense pain in shoulder and neck (Savoloinen et al, 2004).
- No data for calcific tendonitis, insufficient data for capsuliitis, bursitis, tendonitis non-specific pain (Albright et al, 2011).
- Joint mobs useful to reduce pain and increase ROM and function for adhesive capsulitis Grade C Level III/IV (weak evidence) (Albright et al, 2011).

- Neutral Recommendation
  - Therapeutic ultrasound:
  - High to weak evidence for recommendation: conflicting
    - Good evidence Level 1, RCT good recommendation. Grade A for pain and function. Clinically important benefit for short term relief of calcific shoulder tendonitis for 2 month period, no difference at end of 9 months (Albright et al.).
    - Grade C Level 1: for capsulitis bursitis and tendonitis, non-specific pain (Albright et al).
    - Pulsed ultrasound was not beneficial. (Nykanen, 1995).
    - Adhesive capsulitis some ROM increase, Level II (Kelley et al, 2011)
    - Ultrasound is commonly used in physiotherapy management of musculoskeletal pain in peripheral joints. Study demonstrated ultrasound has no clinical benefit beyond that of placebo ultrasound in physiotherapy treatment of shoulder pain. (Prospective double blind placebo controlled randomized trial, Ainsworth, et al, 2007).

- Low Recommendation
  - Theraputic Ultrasound when combined with other physical therapy interventions
    - Therapeutic ultrasound results in no improved benefit when combined with other treatments. This is due to low quality evidence. (Page et al 2016)
  - Activity limitations:
  - Grade F Level 5 Expert opinion:
    - (Kelley et al, 2011): utilize easily reproducible activities
    - The following measures can help to assess changes over time:
      - Pain during sleep
      - Pain and difficulty grooming and dressing
      - Pain and difficulty with reaching activities- to the shoulder level, behind back and overhead.
  - Iontophoresis:
    - No clinically important benefits of acetic acid use were observed. (Page et al 2016)
    - Low level of evidence: case studies: Symptoms of calcific tendonitis joint pain and tenderness soon disappear and range of motion is restored when acetic acid iontophoresis method is employed. (Psaki et al, 1958).

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        - Subdelotid bursitis clinical signs and symptoms improved with use of magnesium sulfate iontophoresis. (Weinstein et al, 1958).
    - Trigger Point Dry Needling
        - Very low quality to moderate quality evidence suggests that dry needling is more effective that no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes with compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017)
    - Expert opinion
        - Non Pharmacological interventions:
            - Simple interventions providing information, assurance and encouraging reasonable maintenance of activity may be used alone or in combination with other interventions for the successful management of acute musculoskeletal pain (AAMG, 2003).
- Not Recommended
    - Thermotherapy (heat, cold): Insufficient evidence
        - Thermotherapy (heat, cold): no data for calcific tendonitis, insufficient for capsulitis, tendonitis and bursitis, and non-specific pain. (AAMG, 2003)
        - Insufficient Level D for cryotherapy (Albright et al., 2001)
        - Ice reduced soreness after pitching. Controlled trial non-random (Yanglsowa et al, 2003)
        - Little evidence for use of modalites alone for chronic pain patients. (Burbank, et al., 2008).
    - Transcutaneous electrical nerve stimulation (TENS):
    - Insufficient evidence to include or exclude for shoulder pain
        - Uncertain whether TENS is superior to placebo and whethter any electrotherapy provides benefits over active interventions (Page et al 2016)
        - No data for calcific tendonitis and insufficient data for capsulitis, bursitis, tendonitis. Insufficient evidence: Level 1 Electrical stimulation, (Albright et al., 2001). Weak evidence Level III/IV for adhesive capsulitis combined with mobility and stretching (Kelley et al., 2011).
    - Kinesiotaping:
        - No Significant changes between taping and sham taping on pain or kinematics in individuals with should pain (Aminaka N et al, 2017)
        - Current evidence does not support the use of “Kinesio Taping” for should pain (among other conditions) after systematic review. (Parreira PC et al, 2014)
        - No effect on pain but changed the area in overall ROM where pain was felt (Lewis et al, 2005).
    - Massage:
        - No data for calcific tendonitis or insufficient data for capsulitis, bursitis, tendonitis (Albright et al., 2001)
        - Low quality of evidence for improving ROM or function. (van der Dolder, Rerreira, Refshauge, 2012)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

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- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Theraband for therapeutic exercises
- Overhead pulleys if limited in ROM

Self-Care Techniques

- Instruction in home exercise program for ROM and strengthening

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Chiropractic
- Acupuncture - **High to weak evidence for recommendation: conflicting:** Level 1 systematic review. Comparison of the effectiveness of acupuncture compared to placebo ultrasound for shoulder pain and function. (AAMG, 2003)
- Medication

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Shoulder Surgical Conditions

Diagnoses Included:

- Rotator Cuff Repair (open or closed, with or without clavicle resection or decompression)
- Shoulder Replacement (partial or total)
- Arthroscopic procedures (Capsular, labral, decompression, resection or chondral)
- Reduction and Fixation (open reduction internal fixation (ORIF), plating, pinning, etc. of fracture)

Definition

Rotator Cuff Repair

Pain, injury and pathology are common occurrences at the shoulder especially in regards to the muscles and tendons comprising the rotator cuff complex. These occur on a continuum of severity from tendinopathy to full-thickness tears of the muscle or tendon. Causes of the injury can range from acute to degenerative in nature. When conservative care for the underlying condition fails, surgical intervention may be utilized to repair the tendon attachment. It appears that approximately 95% of repairs to muscles/tendons of the rotator cuff are now done arthroscopically. (Thigpen et al 2016, Braun et al 2016, Fermont et al 2014).

Shoulder Replacement

Shoulder arthroplasty involves the replacement of one or both articulating portions of the glenohumeral joint. A partial replacement may just involve the humeral head or the glenoid, whereas a total replacement would involve replacing both surfaces with prosthetics. Shoulder replacement surgery is a standard intervention for those with signification loss of function of the shoulder due to previous failed care, trauma and degenerative changes. (Wilcox III et al 2005)

Arthroscopic Procedures

For the purposes of this guideline, additional arthroscopic procedures of the shoulder may be considered aside from rotator cuff repairs. There are several procedures that may be done in combination, alone or in combination with rotator cuff repairs.

Most often, these other arthroscopic procedures fall into two categories; surgical stabilization and/or decompression. Surgical stabilization may be indicated to resolve anatomical deficits to the capsulolabral complex causing instability (Gaunt et al 2010). Subacromial decompression via surgical intervention is common as a treatment option for shoulder pain that continues unresolved despite conservative care. (Brennan et al 2010) A primary goal is to correct impingement syndromes in an effort to prevent further injury or reoccurrence of injury such as in the case of rotator cuff tears.

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Reduction and Fixation

Fractures to any of the bony components of the shoulder complex can occur due to trauma or as a result of underlying pathologic conditions. To maintain function, joint congruency and optimal healing of the fractured bones surgical intervention may be needed to align and secure them from movement. Hardware can vary greatly based on the type of fracture and bone quality. The most common of these is the open reduction and internal fixation of a proximal humeral fracture. (Handoll et al 2015). Surgical fixation can certainly be utilized for fractures sustained to the clavicle or the scapula as well.

Patient History

Special Considerations

- Rule out Red Flags
- Identify surgical complications if applicable
- Familiarize with extent and success of surgery
- Immobilization – duration and position
- Age and health of patient
- Pain control
- Post-operative precautions from the surgeon

Rotator Cuff Repair

Certain consideration should be made with arthroscopic repair vs an open repair surgery. Arthroscopic repairs make up the majority of rotator cuff surgery. Patients presenting for care following an open procedure will often have more extensive incisions, more pain and less function. Age, past medical history, extent of tear, health of tissue prior to repair, duration of symptoms prior to repair, smoking and other health conditions should be considered prior to establishing a rehabilitation plan of care along with consultation from the surgeon (Thigpen et al 2016, Fermont et al 2014, Van Der Meijden et al 2012)

Shoulder Replacement

Even though this is becoming a common surgical procedure it is still a very invasive treatment option. It generally includes a significant amount of surgical work to several different tissues and structures including bone, muscle, tendon and capsule. Many of these structures are highly vascularized and neural. The surgery may be a result of trauma. Age, past and current medical history and potential for functional recovery are all important to consider (Wilcox III et al 2005)

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Arthroscopic Procedures

Presentation will vary depending on the extent of the injury and type of surgical procedure performed. There may have been a period of immobilization with a sling. There may have been surgical intervention to several parts of the glenohumeral complex including capsule, labrum, glenoid and distal clavicle. Various techniques are often combined. These may be secondary procedures along with a rotator cuff repair. Understanding the procedure is important (Gaunt et al 2010)

Arthroscopic stabilization is common in active adolescent populations that participate in sport activity. Even after surgery, the dislocation recurrence rate remains higher than in adults (Castagna et al, 2012).

Reduction and Fixation

Each fixation surgery will present with variations and differences based on the fracture, type of surgical hardware and technique used. Age and the health of the patient are often major factors, especially in those injured due to a fall. Surgery can be fairly invasive depending on the severity of the fracture (Handoll et al 2015)

Red Flags

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, rotator cuff tear
Exertional, history of cardiac diagnosis	Cardiac pain can radiate to the shoulder
Constant, relieved/worse with meals, positional, associated with fatty meals	Gastrointestinal diseases including cholelithiasis
Pleuritic, shortness of breath, associated with cough	Pulmonary diseases
Multiple joint involvement, tophi	Rheumatology diseases (gout)
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection

Differential Diagnoses

In general, this is not applicable as a patient will be referred to skilled care following a surgery and not due to a cluster of symptoms.

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Shoulder and Hand score (DASH) OR QuickDASH with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)) OR The Shoulder Pain and Disability Index (SPADI) with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Pain in shoulder area
- Pain with arm movement
- Swelling, edema and ecchymosis
- Patient may present with arm immobilized
- Loss of strength
- Pain referral may be present
- ROM reduction is typical and may be significant due to immobilization
- Difficulty with daily tasks and may require help with several daily tasks
- Difficulty sleeping
- Cervical pain or tightness
- Incisions may be covered or uncovered in various stages of healing. Itchiness at surgical site is common

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Objective Findings

- Clinicians should use patient rated functional outcome measures (see "Requirements for physical therapy") to comprehend a patient's response to treatment over time. These should be used before and after interventions (Thigpen et al 2016, Brennan et al 2010, Gaunt et al 2010,). There is some recommendation that patient rated functional outcomes should be assessed every 2-4 weeks to ensure symptoms and patient ability are improving as expected (Thigpen et al 2015)
- Pain utilizing a numeric pain scale (Brennan et al 2010)
- ROM – within post-operative restrictions of affected joints and contralateral joints as a basis for tracking progress.
- Visual inspection of surgical incision and surrounding area

Specific Examination Considerations (evidence based)

- Rotator Cuff Repair
  - Clinician rated impairments (strength, ROM, functional scales) are expected to improve every 1-2 weeks based on American Society of Shoulder and Elbow rehabilitation phases. (Thigpen et al 2016)
- Shoulder Replacement
  - Subscapularis dysfunction following TSA has been identified as a complication Aggressive external rotation or vigorous internal rotation should be avoided (Willcox III et al 2005).
- Arthroscopic Procedures
  - Active and passive ROM should be assessed with a goniometer or inclinometer. Scapular posture maybe assessed visually. Clinician rated impairments should be performed every 1-2 weeks (Gaunt et al 2010)

Movement Testing

- Clinicians should measure active and passive shoulder ROM to assess key impairments. (Thigpen et al 2016)
- AROM (extend, flex abduct, adduct, externally and internally rotate) can be measured visually or with goniometer or inclinometer.
- PROM, accessory and restraints to movement, end feel

Strength Testing

- Resisted Isometric Movements of shoulder and elbow (due to some of the muscle of shoulder also cross the elbow): extend, flex, abduct, adduct, internally and externally rotate. Elbow: flex, extend.

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Special Tests

Whereas surgical related diagnoses are a result of specific surgical technique to various body areas and tissue special diagnostic tests are typically not needed. The diagnosis will come from the surgeon. There is no current high quality evidence to support the use of special tests in this type of injury. However, special tests may be needed in the event of ruling out complication or failed surgical repairs.

- No single shoulder test can make a pathoanatomic diagnosis. Combinations of shoulder tests provide better accuracy but marginally so. Findings support a comprehensive history and clinical exam. Utility score represents expert opinion of the clinical use of a special test after gathering and clinically evaluating all of the literature regarding the test. The relevant literature studied looks at the test's discriminatory ability and reliability. The "utility score" scale is :
  - Evidence strongly supports the use of this test.
  - Evidence moderately supports the use of this test.
  - Evidence minimally supports or does not support the use of this test.
  - The test has not been researched sufficiently so it is unclear as to its value (Cook, Hegedus, 2013, Hegedus 2012).
- Special tests for Shoulder (Cook, Hegedus, 2008):
  - Highly recommended: Utility score: 1
    - Tests for Torn Labrum/Instability
    - Biceps Load Test II
  - Moderately recommended: Utility score: 2
    - Tests for torn rotator cuff/impingement
      - Rent Test
      - Lift off Test
      - External rotation lag sign
      - Internal rotation lag sign
      - Drop sign
      - Empty Can /Supraspinatus Test
      - Full Can/Supraspinatus Test
  - Tests for Impingement
    - Internal rotation Resisted Strength
    - Infraspinatus Test
    - Neer, Hawkins,Yocum, Likelihood ratio 3.6 (AAMG, 2003)
    - Likelihood ratio: A positive likelihood ratio (+ LR) identifies the strength of a test in determining the presence of a finding. The value of greater than 1 indicates an equivocal strength of diagnostic power: values that are higher suggest greater strength. A finding of less than 1 suggests the test provides "bogus" or little information. (Cook, 2007)
  - Tests for Torn Labrum/Instability
    - Crank Test
    - Kim Test
    - Jerk Test
    - Anterior Release Surprise Test
  - AC Jt. Pathology

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- AC Resisted Extension Test
- AC joint palpation
- Recommended: (AAMG, 2003)
- Biceps Tendon Lesions:
- Neer, Hawkins and Yocum, 1.76 likelihood ratio
- Speed test: 1.05 likelihood ratio

- Summary of Best Tests: (Cook, 2008)
  - Rotator cuff tears: Rent test, Lift off test, Internal rotation lag sign External rotation lag sign: Show promising results. Drop sign:v alue as a pos. test for ruling in a supraspinatus tear
  - Supine Impingement Test: show promise as a screen where a negative test would rule out a rotator cuff tear
  - Impingement is a broad diagnosis including: subacromial bursitis, to partial rotator cuff tear, to a full thickness rotator cuff tear, making its value as a diagnostic label questionable. No test of diagnostic value in patients with impingement.
  - Detection of laxity/instability, only one test : Anterior release/Surprise Test :some promise: more research needed
  - Posterior inferior labral tears: Kim test Jerk test: Shows promise
  - AC joint pathology: Pain with palpation is a good screen.
  - Resisted Extension Test: some use in diagnosing AC joint pathology, but need more research.

Management/Intervention (evidence based)

Rotator Cuff Repair

- Specific Protocol –
  - No benefit was found in favor of any one rehabilitation method from research reviewed. Recommendation to obtain surgeon approval for early ROM and may improve function early if small to moderate tear. If a large tear was present recommendation to immobilize 4-6 weeks. More conservative treatment may be needed for massive tears, open surgery and/or additional considerations such as advanced age and poor health status. Systematic Review, moderate –good quality evidence (Thompson et al 2016)
  - Little high-level evidence exists to support specific timing or protocol of repair rehabilitation. Protocols are based on opinion of clinical expert and their experience. Systematic Review (Van der Meijden et al 2012)
- Supervised Therapy vs Unsupervised therapy
  - No difference between groups. Level I and II research with limitations (Dickinson et al 2017)
  - Given the complexity of rehabilitation following surgery, supervised therapy is recommended despite evidence of successful recovery when compared one year out of surgery. Some evidence suggests compliance with a home program can be a problem. Expert Consensus for supervised therapy(Thigpen et al 2016)

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- Early Motion after surgery
  - early motion may improve ROM better than delayed however it increases the risk retearing. Level I-III Moderate Recommendation (Houck et al 2017)
  - Early ROM after surgery did not change the outcome or likelihood of tendon healing with small and medium tears. There were no differences in final function with early vs delayed ROM protocols. Level I (Keener et al 2014)
- Stretching/Manual Therapy
  - Aggressive stretching should be avoided. Increased rate of re-tear with aggressive manual stretching and unrestricted self-directed stretching. Level I. A gentle approach to rehab would be better for tendon healing and could avoid risk of re-tear. Level II (Keener et al 2014, Lee et al 2012)
- Frequency
  - Published research lists 12-28 visits. A survey of ASSET members indicated usual care at 1x a week during first 6 weeks then increasing based on need to 2 x a week for phases 2-4 as needed. 90% of members reported usual visits at <25 for uncomplicated postsurgical care (Thigpen et al 2016)
  - Range of visits for skilled care following rotator cuff repair with and without subacrominal decompression for both women and men was 14-25; with an average of 14-16. Level 2b (Brennan et al 2010)
- Transcutaneous Electrical Stimulation
  - Neuromuscular electrical stimulation has been shown to improve posterior rotator cuff function after surgery, however there is little consensus on dosing and time frame. Little power to ascertain level of recommendation. (Thigpen et al 2016)
- Cryotherapy
  - Favorable for use 4 to 23 hours postoperatively to decrease temperature. Level I-II recommendation (Dickinson et al 2017)
  - Decreased pain and improved sleep with cryotherapy in the first 24 hours after surgery. Cryotherapy treatment during the first 10 days after surgery has been shown to reduce opioid use, reduced swelling and less pain in therapy. Evidenced through several studies upon review, Moderate Recommendation (Thigpen et al 2016).

Shoulder Replacement

- Specific Protocol – Most rehabilitation programs are based on a protocol developed by Neer et al in 1975. However this protocol has little evidence or validation of functional outcomes. Additional published protocols are generally from expert opinion based on timelines and specific exercise. One program has not been shown to be more effective than another (Wilcox III et al 2005)
- Early Motion after surgery – Immediate ROM after TSA may improve a return to function more quickly than with delayed ROM. However, there is no evidence of long term differences. Immediate ROM may lower the healing rate when a lesser tuberosity osteotomy approach was used during surgery. Level I RCT (Denard et al 2016)

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- Supervised therapy vs Home program – A home based therapy program may provide adequate rehabilitation after TSA. Level III (Mulieri et al 2010)

Arthroscopic Procedures

- Specific Protocol
  - No difference in resultant function of groups receiving rehabilitation following standard care or The American Society of Shoulder and Elbow Therapists Rehabilitation Guideline for Arthroscopic Anterior Capsulolabral Repair of the Shoulder 2010. (Damkjaer et al 2015)
- Stretching/Manual therapy
  - Correct selection of technique and varying level of stress to the repair area are important for success. Gradual application of stress to stimulate healing but not damage tissue is important. Expert Opinion(Gaunt et al 2010)
  - Caution with submaximal tensioning during healing and remodeling phases could potentially harm immature cross-linking of repaired structures in stabilization procedures. Expert Opinion (Gaunt et al 2010)
- Early Motion after Surgery
  - Area of the repair will have reduced strength through first 12 weeks after surgery. Protection of the repair from undue and repetitive stress is recommended for anterior capsular repairs. Recommendation of absolute immobilization up to 4 weeks after repair and relative immobilization for 6 weeks with use of sling for comfort. Expert Opinion (Gaunt et al 2010)
- Frequency
  - Range of visits for skilled care following surgical repair for unidirectional instability: women was 14-23 and men was 10-16. Level 2b (Brennan et al 2010)
  - Range of visits for skilled care following subacrominal decompression for both women and men was 10-15. Level 2b (Brennan et al 2010)

Reduction and Fixation

- Early Motion after Surgery – There is limited evidence to recommend on timing of ROM following ORIF for proximal humeral fractures. Some evidence suggests outcomes are similar with early vs delayed mobilization. Level I (Handoll et al 2015)

Trigger Point Dry Needling

- Very low quality to moderate quality evidence suggests that dry needling is more effective than no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes when compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017)
- Including one session in the first week may assist with faster increases in function in individuals who have undergone proximal humeral ORIF or rotator cuff repair. 7/10 PEDro score (Arias-Buria et al 2015)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued

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growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care techniques

- Education on repair protection and carryover to a home program is crucial to protect the repair but allow for gradual progression. (Keener et al 2014, Lee et al 2012, Gaunt 2010)
- Swelling and edema management
- Cleanliness of incision areas
- Pain control
- Introduction of ROM, ADLs and strength as appropriate and over a gradual progression.

Home Medical Equipment

- Cold Packs
- Pulleys, cane, dowel for ROM
- Sling, swath, abduction pillow

Alternatives/Adjuncts Management

- A home based therapy program overseen by the physician may provide adequate rehabilitation after TSA. Level III (Mulieri et al 2010)

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Shoulder Tendinopathies

Diagnoses Included:

- Sub acromial Impingement
- Rotator Cuff Impingement
- Bicep Tendinosis/Tendinitis
- Shoulder Bursitis
- Rotator cuff tear (non-surgical)

Definition

For the purposes of this guideline, shoulder tendinopathies may encompass several broad diagnoses any of which involve the health and function of the musculotendonous structures of the shoulder complex (i.e. tendinitis, tendinosis). Affected areas could include muscle, tendon, bursa and other fascial layers involved in movement or stabilization of the glenohumeral, acromioclavicular and sternoclavicular joints.
This will most frequently refer to various rotator cuff tendinopathies. Specifically to this area, there is evidence to suggest that diagnoses such as shoulder impingement, RC tendonitis, tendinois and subacromial bursitis may be considered as the same entity. (Hanchard et al 2004)

Patient History

Diagnosis of rotator cuff syndrome requires a thorough history-taking which should include consideration of: age, occupation, sports participation, medical history, mechanism of injury, symptoms, weaknesses, loss of function and social situation. (Hopman K et al 2013)

Special Considerations

- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect physical therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- Pain referral due to cardiac or pulmonary conditions
- Pain referral due to cervical and brachial plexus conditions
- Metastatic disease: myeloma, sarcoma, lymphoma of adjacent tissues
- Complex Regional Pain Syndromes
- Fibromyalgia
- Rheumatoid Arthritis
- Thoracic Outlet Syndrome
- Infection

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, rotator cuff tear, tendon rupture

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Exertional, history of cardiac diagnosis	Cardiac pain can radiate to the shoulder
Constant, relieved/worse with meals, positional, associated with fatty meals	Gastrointestinal diseases including cholelithiasis
Pleuritic, shortness of breath, associated with cough	Pulmonary diseases
Multiple joint involvement, tophi	Rheumatology diseases (gout)
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Discoloration of hand, cold	Arterial occlusion

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Shoulder and Hand Score (DASH) OR QuickDASH with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)) OR The Shoulder Pain and Disability Index (SPADI) with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors and comorbidities,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimum Detectable Change or Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)

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- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional measures
- No objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Shoulder pain
- Pain with active abduction
- Loss of functional movement
- Loss of range of motion ROM
- Pain with overhead movements
- Pain with laying on affected side
- May present with decreased pain during use, increased pain after use
- May present with weakness during associated movements

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Specific Examination Considerations

Differential evaluation of clinical findings suggestive of musculoskeletal impairments of body functioning (ICF) and the associated tissue pathology/disease (ICD). Level 5, Grade F, Expert opinion: (Kelley et al.,2013, 2011) (AAMG, 2003; Magee, 1992; Butler, 1991).

The physical examination begins with an appropriate clinical history that provides the necessary information to guide the clinical examination. Most cases of acute shoulder pain are of "mechanical" origin and can be managed as acute regional pain (Level III evidence). (Kelley et al 2013,2011)

Inspection

Palpation of shoulder, acromioclavicular (AC) joint, sternoclavicular (SC) joint, clavicle, scapula, cervical and thoracic spine and ribs:T enderness is the main physical sign elicited by palpation. It may be focal or diffuse. Focal is more significant as it reproduces the patient's typical pain. (Hopman et al 2013)

- Movement Testing:
  - AROM (extend, flex abduct, adduct, externally and internally rotate) can be measured visually or with goniometer or inclinometer.
  - PROM, accessory and restraints to movement, end feel
  - Resisted Isometric Movements of shoulder and elbow (due to some of the muscle of shoulder also cross the elbow): extend, flex, abduct, adduct, internally and externally rotate. Elbow: flex, extend.
- Neurological Testing:
  - Upper limb Tissue Tension Tests (Wainner et al 2003)
  - Reflexes
  - Cutaneous distribution
- Tissue Irritability Levels:
  - High >7/10, medium 4-6/10, low<3/10. Level 5
- Special Tests:
  - No single shoulder test can make a pathoanatomic diagnosis. Combinations of shoulder tests provide better accuracy but marginally so. Findings support a comprehensive history and clinical exam. Utility score represents expert opinion of the clinical use of a special test after gathering and clinically evaluating all of the literature regarding the test. The relevant literature studied looks at the test's discriminatory ability and reliability. The "utility score" scale is :

    1. Evidence strongly supports the use of this test.
    2. Evidence moderately supports the use of this test.
    3. Evidence minimally supports or does not support the use of this test.
    4. The test has not been researched sufficiently so it is unclear as to its value (Cook, Hegedus, 2013, Hegedus 2012).

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- Special tests for Shoulder (Cook, Hegedus, 2008):
  - Highly recommended: Utility score: 1
    - Tests for Torn Labrum/Instability
    - Biceps Load Test II
  - Moderately recommended: Utility score: 2
    - Tests for torn rotator cuff/impingement
      - Rent Test
      - Lift off Test
      - External rotation lag sign
      - Internal rotation lag sign
      - Drop sign
      - Empty Can /Supraspinatus Test
      - Full Can/Supraspinatus Test
    - Tests for Impingement
      - Internal rotation Resisted Strength
      - Infraspinatus Test
      - Neer, Hawkins,Yocum, Likelihood ratio 3.6 (Cook, 2007; AAMG, 2003)
    - Tests for Torn Labrum/Instability
      - Crank Test
      - Kim Test
      - Jerk Test
      - Anterior Release Surprise Test
    - AC Jt. Pathology
      - AC Resisted Extension Test
      - AC joint palpation
      - Recommended: (AAMG, 2003)
      - Biceps Tendon Lesions:
      - Neer, Hawkins and Yocum, 1.76 likelihood ratio
      - Speed test: 1.05 likelihood ratio
- Summary of Best Tests: (Cook, 2008)
  - Rotator cuff tears: Rent test, Lift off test, Internal rotation lag sign External rotation lag sign: Show promising results. Drop sign:v alue as a pos. test for ruling in a supraspinatus tear
  - Supine Impingement Test: show promise as a screen where a negative test would rule out a rotator cuff tear

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- Impingement is a broad diagnosis including: subacromial bursitis, to partial rotator cuff tear, to a full thickness rotator cuff tear, making its value as a diagnostic label questionable. No test of diagnostic value in patients with impingement.
- Detection of laxity/instability, only one test : Anterior release/Surprise Test :some promise: more research needed
- SLAP lesions: Biceps Load Test II: good diagnostic tool
- Posterior inferior labral tears: Kim test Jerk test:S hows promise
- AC joint pathology:P ain with palpation is a good screen.
- Resisted Extension Test: some use in diagnosing AC joint pathology, but need more research.

Management/Intervention

Conservative treatment of shoulder tendinopathy generally includes rest, medication and specific rehabilitation approaches. (Desjardins-Charbonneau et al 2015) These may include exercise, manual therapy and various therapeutic modalities. Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence. The interventions should be designed to improve the movement and function of the patient and lessen or alleviate the activity limitations commonly reported by the patients who meet the diagnostic criteria of that pattern (Kelley et al, 2011)

- High Recommendation
  - Outcome Measures:
    - Strong evidence, Highly recommended Grade A (Kelley, et al., 2011,2013)
    - There are several outcome measures designed to assess patients with shoulder disorders. These tools can be classified as shoulder joint specific, shoulder disease specific or upper limb specific. Over 30 tools have been published. Validated functional outcome measures should be used before and after interventions intended to alleviate the impairments of body function and structure, activity limitations and participation restrictions.
- Moderate Recommendation
  - Therapeutic exercise (therapeutic ex.):
  - Moderate evidence with High recommendation Level 1b evidence for use in rotator cuff tendinopathy
    - Exercise programs can be designed by physical therapists with varying experience. There does not appear to be a difference between exercise done at home or the clinic. There should be some level of resistance and it appears higher repetition may have superior outcomes (Littlewood et al 2015)
    - Workers with rotor cuff tendinopathy should be initially treated with exercise prescribed and reviewed by qualified health care provider. Grade B (Hopman et al 2013)
  - Fair evidence Level II for non-specific shoulder pain
    - May improve shoulder pain compared to placebo in people with rotator cuff disease in both short and long term with improvement in function and abduction. (Level I) (Kelley et al, 2011; Albright et al., 2001; AAMG, 2003;

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Agency for Health Care Research and Quality National Guideline U. SDept. of Health and Human Resources, 2011)
    - Often supplemented with joint mobs techniques: not proven to be superior to therapeutic ex alone for pain reduction, increase in ROM and function and decrease in disability (Brudvig, et al., 2011).
    - Exercise is effective for producing small improvement in ROM (van den Dolder, et al 2012).
    - Comparison of customized vs. standard exercise: equally effective in increasing strength, function and decreasing pain intensity (Wang et al 2006).
    - One hour of strength training/week effective in reducing neck and shoulder pain with fewer and longer sessions providing more gains than shorter more frequent (Anderson et al 2012).
    - Specific exercise is effective in reducing pain, improving function and reduced need for surgery at 3 months (Holmgren et al 2012).
    - For chronic pain patients:A ctivity modification: reduce overhead activity, avoid painful arc 60-120 degrees, avoid heavy loading. Stretching and strengthening exercises should be done to relieve pain by improving overall shoulder function and provide short term recovery and long term results. (Burbank et al 2008).
- Manual Therapy:
    - Manual therapy may decrease pain in shoulder tendonopathy.It is unclear whether it can improve function. Level 1a. (Desjardins-Charbonneau A, Roy J, Dionne C et al 2015)
    - Manual therapy may be combined with exercise for additional benefit. Grade B (Hopman et al 2013)
    - Manual therapy added to an exercise protocol for shoulder impingement did not increase improvements compared to exercise alone. Level 1b. (Camargo et al 2015).
    - Shoulder jt. mobs combined with hot pack active exercise stretching, soft tissue mobilization and education, may improve acute shoulder pain in the short term compared to combined treatments alone. Level I (AAMG, 2003).
    - Combined manual therapy with multimodal or exercise therapy, Grade B (Brantingham et al 2011).
    - Manipulative therapy in addition to usual medical care accelerates recovery of shoulder symptoms (Bergman et al 2004).
    - No data for calcific tendonitis, insufficient data for capsuliitis, bursitis, tendonitis non-specific pain (Albright et al, 2011).
    - Joint mobs useful to reduce pain and increase ROM and function for adhesive capsulitis Grade C Level III/IV (weak evidence) (Albright et al, 2011).

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- Neutral Recommendation
  - Therapeutic ultrasound:
  - High to weak evidence for recommendation: conflicting
    - Good evidence Level 1, RCT good recommendation. Grade A for pain and function. Clinically important benefit for short term relief of calcific shoulder tendonitis for 2 month period, no difference at end of 9 months (Albright et al.).
    - Evidence suggests ultrasound does not enhance outcomes for therapy of rotator cuff tendinopathies compared to exercise alone. Using ultrasound for pain reduction or increased function should be avoided in workers with subacromial impingement syndrome. Grade C (Hopman et al 2013).
    - Grade C Level 1: for capsulitis bursitis and tendonitis, non-specific pain (Albright et al 2011).
    - Ultrasound is commonly used in physiotherapy management of musculoskeletal pain in peripheral joints. Study demomonstrated ultrasound has no clinical benefit beyond that of placebo ultrasound in physiotherapy treatment of shoulder pain. (Prospective double blind placebo controlled randomized trial, (Ainsworth et al 2007).
- Low Recommendation
  - Theraputic Ultrasound when combined with other physical therapy interventions – Therapeutic ultrasound results in no improved benefit when combined with other treatments. This is due to low quality evidence. Grade C (Page et al 2016) (Hopman et al 2013)
  - Activity limitations- Grade F Level 5 Expert opinion (Kelley et al, 2013, 2011):
    - Utilize easily reproducible activities
    - The following measures can help to assess changes over time:
      - Pain during sleep
      - Pain and difficulty grooming and dressing
      - Pain and difficulty with reaching activities- to the shoulder level, behind back and overhead.
  - Iontophoresis
    - No clinically important benefits of acetic acid use were observed. (Page et al 2016)
    - Low level of evidence: case studies: Symptoms of calcific tendonitis joint pain and tenderness soon disappear and range of motion is restored when acetic acid iontophoresis method is employed. (Psaki, Caroll, 1958).
  - Trigger Point Dry Needling
    - Very low quality to moderate quality evidence suggests that dry needling is more effective that no treatment, sham and other treatments for reducing pain. Low quality evidence suggests superior outcomes for function when compared to no treatment. There is no difference in functional outcomes with compared to other therapy treatments. Any long term benefit evidence is lacking. Level 1a. (Gattie et al 2017)

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- Expert opinion
  - Non Pharmacological interventions:
    - Simple interventions providing information, assurance and encouraging reasonable maintenance of activity may be used alone or in combination with other interventions for the successful management of acute musculoskeletal pain (AAMG, 2003).
- Not Recommended
  - Thermotherapy (heat, cold): Insufficient evidence
    - Thermotherapy (heat, cold): no data for calcific tendonitis, insufficient for capsulitis, tendonitis and bursitis, and non-specific pain. (AAMG, 2003)
    - Insufficient Level D for cryotherapy (Albright et al., 2001)
    - Ice reduced soreness after pitching. Controlled trial non-random (Yanglsowa, Miyanaga, Shiralki, Shinojo, Mokai, 2003)
    - Little evidence for use of modalites alone for chronic pain patients. (Burbank, et al., 2008).
  - Transcutaneous electrical nerve stimulation (TENS):
  - Insufficient evidence to include or exclude for shoulder pain
    - Uncertain whether TENS is superior to placebo and whethter any electrotherapy provides benefits over active interventions (Page et al 2016)
    - No data for calcific tendonitis and insufficient data for capsulitis, bursitis, tendonitis. Insufficient evidence: Level 1 Electrical stimulation, (Albright et al., 2001). Weak evidence Level III/IV for adhesive capsulitis combined with mobility and stretching (Kelley et al., 2013, 2011).
  - Kinesiotaping:
    - No Significant changes between taping and sham taping on pain or kinematics in individuals with shoulder pain (Aminaka N et at 2017)
    - Current evidence does not support the use of “Kinesio Taping” for shoulder pain (among other conditions) after systematic review. (Parreira PC et al 2014)
    - No effect on pain but changed the area in overall ROM where pain was felt (Lewis, Wright, Green, 2005).
  - Massage:
    - No data for calcific tendonitis or insufficient data for capsulitis, bursitis, tendonitis (Albright et al., 2001)
    - Low quality of evidence for improving ROM or function. (van der Dolder, Rerreira, Refshauge, 2012)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued

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growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self care at his residence. The qualified health care provider should be able to educate the patient on a regular home exercise program. There does not appear to be a difference between exercise done at home or the clinic. (Littlewood et al 2015)

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises

Self-Care Techniques

- Home ROM exercises, home self joint mobilization techniques
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort
- Education on activity modification and keeping activity within the limits of pain and function (Hopman et al 2013)

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Acupuncture - High to weak evidence for recommendation: conflicting: Level 1 systematic review. Comparison of the effectiveness of acupuncture compared to placebo ultrasound for shoulder pain and function. (AAMG, 2003)
- Medication

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Orthopedic – Upper Extremity

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Elbow Collateral Ligament Reconstruction

Tommy John Surgery Definition

The ulnar collateral ligament (UCL) is the strongest and stiffest of the collateral ligaments of the elbow. The three most common causes of UCL injury are dislocation, chronic attenuation in athletes and acute valgus injury. Reconstruction of the collateral ligament is one of the most common surgeries performed on a throwing athlete. The detached ulnar collateral ligament is reattached and any posterior olecranon osteophytes may be removed. The ulnar nerve is typically mobilized and transposed during the procedure. There are several different surgical approaches to manage a torn collateral ligament at the elbow including the Jobe technique, the docking technique, Endobutton, and interference screw techniques (Watson JN et al, 2014). Excellent results can be achieved with ligament reconstruction (Dines et al, 2017). However, a small percentage of reconstructions re-tear and need to have a revision which leads to slower rate of return to athletics. (Dines et al, 2017).

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

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Differential Diagnoses

- Proximal ulnar nerve impingement secondary to transposition

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture/ligament rupture
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic, primary or paraneoplastic), potential complications of chemotherapy
Unilateral edema	Upper extremity deep vein thrombosis
Loss of distal pulse	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion

Subjective Findings

- Symptoms of UCL injury:
  - Medial elbow pain in athletes who throw is the most common symptom. Pain may be especially prominent during the acceleration phase of the overhead throw.
  - Pain is often chronic or recurrent and may lead to a slow erosion of throwing ability.
  - Athletes may report similar pain in previous seasons.
  - Rest generally helps relieve pain.
  - Occasionally, athletes may experience acute pain over the medial elbow, sometimes associated with a popping sensation, during a single throw that causes them to stop throwing immediately.
  - Loss of elbow range of motion (ROM) is occasionally observed.
  - With acute rupture, ecchymosis may be observed over the medial elbow.
  - Pain may be reproduced on making a clenched fist.
  - UCL tenderness may occasionally be difficult to differentiate from flexor pronator tendonitis, but the pain of flexor pronator tendinitis is aggravated by resisting forearm pronation.

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- Symptoms following UCL Repair:
  - Patient often presents to therapy in a supportive brace or sling
  - Impaired functional ability
  - Edema in affected upper extremity
  - Pain in affected upper extremity
  - Restricted movement of upper extremity
  - Decreased strength
  - Distal numbness

Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for upper extremity conditions. There is high level of documentation for objective evaluations for the upper extremity (Saunders, 2015). When treating post operative UCL repair/reconstruction, it is important to know the type of surgical procedure that was done on the elbow as this may affect the treatment plan (Ellenbecker TS et al, 2009). The evaluation may include:

- Inspection
  - Swelling
  - Surgical Wound
- Palpation of bony and soft tissue
  - Pain medial elbow
  - Popping sensation
  - Temperature
- Range of motion, active and passive (assess after brace is removed) movements of ipsilateral and contralateral joints
  - Elbow (flexion, extension, supination, pronation)
  - Wrist (flexion, extension)
- Manual muscle testing of ipsilateral joints per post-surgical protocol, also test contralateral joints:
  - Elbow (flexion, extension, supination, pronation)
  - Wrist (flexion, extension)
- Orthopedic and neurologic testing (test after brace is removed)
  - Joint-play movements of the ulnohumeral joint, radioulnar joint, and radiohumeral joint
  - Joint and ligamentous tests:
- Valgus stress test
- Varus stress test
- Neurological test
- Tinel's Test
- Deep tendon reflexes
- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire)(Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn et al, 2012)

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Management/Intervention

There is high level of documentation regarding elbow UCL surgical procedures. No specific functional outcome studies were found regarding therapy interventions/protocols. There is a lack of evidence based practice particularly randomized controlled trials and cohort case series information in the literature regarding elbow rehabilitation. (Blackmore and Michlovitz, 2006)

Therapy protocols following UCL reconstruction, based on expert opinion, agree on the need for gradual and protected return of ROM and a resistive exercise program for the entire upper extremity kinetic chain. The rehabilitation program should be based on the specific surgical procedure performed (ie, docking technique versus traditional figure of 8 technique). Advances in surgical technique preserve the origin of the wrist flexors and forearm pronators which allow earlier progression of the rehabilitation program. Resistive exercises aimed at providing dynamic stability to the scapulothoracic, glenohumeral, and ulnohumeral joints are an important part of the comprehensive rehabilitation following reconstruction of the elbow UCL. (Ellenbecker TS et al, 2009)

The commonalities between the protocols include initial protection of healing tissues (the elbow is immobilized in a posterior splint with elbow held at 90 degrees and wrist free for 7-10 days) and gentle ROM. In the next phase of treatment, motion is gradually increased and a hinged elbow brace is worn. Isotonics for the shoulder are added. In the third phase of treatment, strength and endurance is increased without exacerbating pain. With athletes, throwing exercise is the final phase of treatment. (Fry, Sherry) (Brigham and Women's hospital) (Wilk et al, 2012)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

- There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

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Attention/Task Completion

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- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
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Growth/Maturation

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Overuse/Sport

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Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

- Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.
- Patients should be educated in proper protection techniques to be utilized during all activities.
- Retraining for proper positioning to avoid re-injury and other factors in occupationally related overuse syndromes, is an important component of the overall therapy consult.

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Home Medical Equipment

- Cold packs
- Resistance bands
- Therapeutic Putty
- Orthosis, as needed

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises
- Progression to therapeutic exercise—strengthening exercises
- Cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication

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Elbow Fracture Post-ORIF

Diagnoses included:

- Distal Humerus Open Reduction Internal Fixation (ORIF)
- Coronoid ORIF
- Radial Head ORIF
- Olecranon ORIF

Definition

- A fracture is essentially a structural failure of bone. The nature of the fracture is determined by inherent properties of the bone, its structure, and type of forces applied to it.
  - Forces of tension, compression, bending, and torsion can load bone beyond its structural strength.
  - External forces may render a fracture displaced or undisplaced, with two or more fragments.
  - Displaced fragments may be overriding one another, lateral to each other, extremely distracted from one another, angulated, or rotated out of alignment.
  - Displaced fractures may be open fractures with a fragment breaking through skin, exposing the fracture site to external environment and increases risk of infection.
  - In addition to bony involvement, fractures frequently result in associated injury of soft tissues attached to, or adjacent to, the bone.
  - Radial head can also be dislocated mimicking/complicating an elbow fracture.
  - Fractures may be treated by immobilization with casts, sling/immobilizer, ORIF, percutaneous pinning, or joint replacement.
  - The mechanism for most elbow fractures is direct elbow trauma or a fall onto an outstretched hand.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

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Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

Not applicable

Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Compartment syndrome
Diabetes	Neuropathy
Multiple joint involvement, large tophus	Rheumatologic diseases, gout
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:

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- Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
- The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
- Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion

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Subjective Findings

- Patient often presents to therapy in a supportive brace or sling
- Impaired functional ability
- Edema in affected upper extremity
- Pain in affected upper extremity
- Restricted movement of upper extremity
- Surgical scar/wound
- Decreased strength

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for upper extremity conditions. There is high level of documentation for objective evaluations for the upper extremity. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).
- The evaluation may include:
  - AROM and PROM elbow/forearm: flexion, extension, supination, pronation (ipsilateral and contralateral joints)
  - AROM and PROM wrist and hand (ipsilateral and contralateral joints)
  - AROM and PROM shoulder (ipsilateral and contralateral joints) for capsular tightness
  - Neurologic Testing (if neurologic signs are present)
  - Test integrity of Ulnar nerve (abduction & adduction of digits) and Median nerve (opposition of thumb)
  - Sensation-palmer aspect of 1st-5th digits
  - Temperature changes
  - Pain level
  - Inspection of wound/scar including color and circulatory changes
  - Edema measurements of elbow, wrist and hand
  - Tinel's Sign
  - Joint-play movements of the humeroulnar joint, radioulnar joint, and humeroradial joint
  - As the wounds heal and edema decreases, manual muscle testing of wrist, elbow and forearm (ipsilateral and contralateral joints) along with grip/pinch strength testing may be indicated.
- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
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Management/Intervention

Initial therapy interventions are focused on decreasing inflammation, normalizing pain, managing scars, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of the affected upper extremity. There are widely used therapy protocols following elbow fractures treated with ORIF. However, there is no strong evidence supporting any specific protocol. The following treatment techniques have been studied and reported in the literature.

Splint use with posttraumatic elbow stiffness

High level of evidence

Stiffness is common after elbow injuries and motion is difficult to recover. Avoiding elbow stiffness with early motion is preferable to trying to deal with it after a contracture has occurred. One randomized controlled study showed good results in range of motion with splinting and exercise for posttraumatic elbow stiffness. This study found that static progressive elbow splints and dynamic elbow splints had no difference in the end results and the choice of splinting method should be based on clinician's professional judgment. (Lindenhovius et al, 2012) Another systemic search found evidence that supports static progressive splinting 3x/day for 30 minutes in each direction was most effective for patients with post traumatic and post surgical elbow stiffness. (Muller AM et al, 2013)

Passive exercise

Moderate level of evidence

Passive range of motion is an effective way to increase ROM after a fracture, joint injury or period of immobilization (Michlovitz SL et al, 2004)

Specific Rehabilitation Intervention

Insufficient evidence

There are widely accepted therapy treatments following ORIF's. However, there is not enough evidence available to determine the best form of rehabilitation. There is also not enough evidence available to determine if results are better when interventions are started during immobilization period versus post immobilization. (Handoll HHG et al, 2015)

Early motion following elbow surgical treatment

Lacks sufficient evidence

Specific to elbow fractures, there lacks robust evidence on the timing of mobilization, specifically early mobilization, after non-surgical or surgical treatment for adults with elbow fractures. There is a need for high quality, well-reported, randomized controlled trials comparing early versus delayed mobilization with commonly-occurring elbow fractures, treated with or without surgery (Harding et al, 2011)

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Some studies found beginning mobilization early in the postop rehabilitation process leads to less pain and edema. It also results in earlier return to work, less stiffness and better preserved range of motion. Mobilization should begin as soon as bone and joint stability are established**. (Amini D, 2011), (**Roll SC, Hardison ME, 2016)

One study found heterotopic ossification following elbow surgery is more common when surgery is delayed or when there is a longer period of immobilization following surgery. (Bauer AS et al, 2012)

Use of silicone gel sheeting to manage postop scars

Low level and Conflicting level of evidence

Some studies report low level of evidence to support silicone gel use in preventing hypertrophic scaring in newly healed post surgical wounds. (O'Brien L et al, 2006) Other studies report silicone is effective, safe and is the gold standard of treatment to prevent hypertrophic scaring in clinical studies that have been done. (Monstrey S et al, 2014). More randomized, controlled trials are needed in this area to determine sound evidence for the use of silicone gel in prevention of keloids following surgery.

Strength training of nonaffected upper extremity during period of immobilization.

Low Level of Evidence

There is low quality evidence of clinically marginal benefits for cross education involving strength training of the nonfractured upper extremity during period of immobilization with or without surgical repair. (Handoll HHG et al, 2015**)**

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There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

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  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

It is necessary for patients to understand the importance of early motion while protecting the surgical repair. The home program for postop elbow ORIF conditions should include edema control techniques, use of orthosis, pain control techniques, range of motion and activities of daily living (ADL's). The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

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Home Medical Equipment

- Cold packs
- Compression ace wrap/tubigrip for edema control
- Orthosis
- Resistance band(s) for therapeutic exercises
- Heat packs

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Home exercise program for edema control
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected upper extremity

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Massage

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Elbow Nonspecific

Diagnoses included:

- Olecranon Bursitis
- Elbow Sprain/Strain
- Elbow Dislocation
- Elbow Pain

Definition

Made up of three articulating surfaces within a common capsule, the elbow is a complex joint. Lateral stability is provided by the lateral collateral ligament over the radiohumeral joint, and the annular ligament that supports the superior radioulnar joint. Medial stability is provided by the fan shaped medial collateral ligament extending from the medial epicondyle to the olecranon and coronoid processes.

Three main functional muscle groups cross the joint; muscle groups originating proximal to the elbow control flexion and supination (brachialis and biceps), and elbow extension (triceps). In addition the medial and lateral epicondyles are the origin of the common wrist flexor and extensor groups. Flexor group also provides wrist ulnar deviation and forearm pronation. Extensor group controls wrist radial deviation and supination, in addition to wrist extension.

Sprains and strains of the elbow are commonly produced by valgus stresses, hyperextension or traction. Sprains and strains may be graded from microtrauma to partial tears of muscle or ligaments, to complete tears or avulsion. Dislocations can occur, some of which may reduce prior to medical attention, however, dislocations may leave patients with derangement of the joint structures. The most common elbow dislocation occurs when the radius or ulna moves posterior to the humerus, generally with considerable force, and possibly with associated fractures. This is usually the result of falling on an outstretched hand (FOOSH). Anterior and lateral dislocations also can occur, usually from a direct posterior blow to a flexed elbow. In children the most common elbow dislocation is subluxation of the radial head distally through the annular ligament. This most often occurs when the arm is pulled.

The olecranon bursa lies between the superior olecranon and the skin. It may become inflamed because of trauma, inflammatory disease such as gout, or most often prolonged pressure. Usually the elbow joint is not involved as the bursa and the joint do not communicate unless rheumatoid arthritis is present.

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Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine nature and extent of traumatic event.

Differential Diagnoses

- Gout
- Osteoarthritis
- Trauma
- Cervical radiculopathy
- Proximal nerve impingement
- Epicondylitis
- Cubital tunnel syndrome

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture/ligament rupture, neural damage
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic, primary or paraneoplastic), potential complications of chemotherapy
Unilateral edema	Upper extremity deep vein thrombosis
Loss of distal pulse	Arterial occlusion
Immune-compromised state	Infection
Cold Intolerance, fatigue, constipation	Hypothyroidism
Multiple joint involvement, unusual skin rashes, other vascular involvement	Rheumatologic diseases (e.g., Rheumatoid arthritis, Sjogren's Syndrome, Systemic Lupus Erythematosis, Polyarteritis nodosa)
Stocking-glove neurological involvement	Diabetes, alcoholism, B12 deficiency
Auto repair occupation, battery exposure	Lead poisoning
Hand/skull disproportionately large	Acromegaly

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion

Subjective Findings

- With olecranon bursitis:
  - The classic finding is posterior elbow swelling that is very clearly demarcated, appearing as a goose egg over the olecranon process.
  - Bursitis may be the result of a direct blow to the bursa or lifestyle (leaning on elbow for extended time such as at a desk)
  - The affected site may be tender to palpation.
  - The area may be warm and red, particularly with infection.
  - Skin inspection may reveal abrasion or contusion if there was recent trauma.
  - Vital signs may reveal fever, but generally only with advanced infection.
  - Elbow range of motion (ROM) usually is normal, but occasionally the end range of elbow flexion may be slightly limited due to pain.
  - Patients with systemic inflammatory processes (e.g., rheumatoid arthritis) or crystal deposition disease (eg, gout, pseudogout) may reveal evidence of focal inflammation at other sites.

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- Patients with rheumatoid arthritis may, upon inspection of the elbow, have rheumatoid nodules.
- Symptoms should gradually resolve
- Elbow pain during active or passive ROM may increase the clinician's suspicion of fracture of the olecranon process if there is a history of trauma.

- With elbow dislocations:
  - Complaints of recurrent painful clicking, snapping, clunking, or locking of the elbow are common.
  - Swelling
  - Painful motion
  - Decreased motion especially elbow extension
  - Altered sensation in ulnar or median nerve distribution depending on severity
  - Impaired functional ability
  - Weakness in elbow and hand
- With elbow sprains/strains:
  - Pain around the elbow, medially, and/or laterally
  - May have history of swelling
  - History of trauma
  - Restricted elbow range of motion
  - Altered sensation in ulnar or median nerve distribution depending on severity
  - Impaired functional ability
  - Varus and/or valgus stress testing is painful
  - Resisted wrist flexion and/or pronation may be painful
  - Symptoms should gradually resolve

Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for upper extremity conditions. There is high level of documentation for objective evaluations for the upper extremity. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).

- The evaluation may include:
  - AROM and PROM elbow/forearm: flexion, extension, supination, pronation (ipsilateral and contralateral joints)
  - AROM and PROM wrist and hand (ipsilateral and contralateral joints)
  - AROM and PROM shoulder (ipsilateral and contralateral joints) for capsular tightness
  - Neurologic Testing (if neurologic signs are present)
  - Test integrity of Ulnar nerve (abduction & adduction of digits) and Median nerve (opposition of thumb)
  - Sensation-palmer aspect of 1st-5th digits
  - Temperature changes
  - Skin color, may have wound
  - Pain level and location of pain
  - Edema measurements of elbow, wrist and hand
  - Palpation for distal pulse (Brachial artery)

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- Tinel's Sign
- Joint-play movements of the humeroulnar joint, radioulnar joint, and humeroradial joint
- Valgus stress test
- Varus stress test
- Deep tendon reflexes
- Manual Muscle Testing (as condition allows) of ipsilateral and contralateral joints:
  - Elbow (flexion, extension, supination, and pronation)
  - Wrist (flexion, extension,radial deviation, ulnar deviation)
  - Shoulder movements

- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn et al, 2012)

Management/Intervention

Initial therapy interventions are focused on decreasing inflammation, normalizing pain, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of the affected upper extremity. There are widely used therapy protocols following elbow injuries. However, there is no strong evidence supporting any specific protocol. The following treatment techniques have been studied and reported in the literature.

Splint use with posttraumatic elbow stiffness

High level of evidence

Stiffness is common after elbow injuries and motion is difficult to recover. Avoiding elbow stiffness with early motion is preferable to trying to deal with it after a contracture has occurred. One randomized controlled study showed good results in range of motion with splinting and exercise for posttraumatic elbow stiffness. This study found that static progressive elbow splints and dynamic elbow splints had no difference in the end results and the choice of splinting method should be based on clinician's professional judgment. (Lindenhovius et al, 2012) Another systemic search found evidence that supports static progressive splinting 3x/day for 30 minutes in each direction was most effective for patients with post traumatic and post surgical elbow stiffness. (Muller AM et al, 2013)

Passive exercise

Moderate level of evidence

Passive range of motion is an effective way to increase ROM after a fracture, joint injury or period of immobilization (Michlovitz SL,et al, 2004)

Incorporate ADL activities in the treatment of hand injuries

Moderate level of evidence

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One randomized, controlled study found high level of evidence supporting therapeutic that mimic Activities of Daily Living (ADL's) improve the functions of the hand more effectively than just therapeutic activities such as range of motion, strength and modalities. This study suggests adding ADL simulated activities to treatment following hand injuries. (Guzelkucuk U et al, 2007)

Early Mobilization with elbow dislocations

Insufficient evidence

There is no clear evidence available on early mobilization with elbow injuries. However, most of the relevant literature reports clinical outcomes decrease with increased time of elbow immobilization after trauma. The early mobilization programs need to allow for controlled movements without putting strain on the injured structures. (Carsten et al, 2013)

Some studies have found stiffness and heterotopic ossifications after elbow dislocation are common occurrences. It is felt that elbow dislocations should be treated by controlled early mobilization in braces with limited range of motion to decrease stiffness and HO. (Carsten et al, 2013)

One trial compared early mobilization of the elbow with immobilization for three weeks in a plaster cast following elbow dislocation. This trial found no firm evidence of differences between the two interventions in the recovery of elbow range of motion or pain at one year. None of the trial participants had an unstable elbow or had suffered another dislocation (Taylor et al, 2012)

Range of motion with the arm overhead improves elbow stability following an elbow LCL injury. Initiating early motion in this "safe position" may decrease elbow stiffness and allow optimal ligament healing. If exercises are done in a dependent position, active motion with forearm pronation should be encouraged as this helps stabilize an elbow with a LCL injury. Varus positioning should be avoided as this worsens instability. (Manocha, 2016)

Nonsurgical treatment of elbow instability versus immobilization treatment. (No evidence showing that surgical technique is superior to nonsurgical)

This study compared surgical treatment to nonsurgical casting for 3 weeks with elbow instability. At 1 year, there were no significant differences in mobility, stability, or elbow and grip strength between the two groups. (Rinkel et al, 2014)

Exercises and heterotopic ossification

Lacking evidence

Some have thought that passive ROM in elbow injuries can lead to heterotopic ossification (HO). There is no solid evidence in literature that shows PROM causes or exacerbates HO. Therefore, passive motion is an accepted treatment for elbow injuries. (Casavant AM, Hastings H, 2006)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

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- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. With elbow injuries, it is important to include joint protection education in the home program as well as range of motion exercises and progressive exercises.

Home Medical Equipment

- Cold packs
- Orthotics as needed
- Resistance bands for progressive exercise

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises
- Progression to therapeutic exercise—strengthening exercises
- Cold packs, if needed, to relieve discomfort
- Education for proper positioning to avoid re-injury
- Orthotic use as needed

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Aspiration or surgical removal of bursa in cases of chronic olecranon bursitis

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Elbow Neuropathy

Diagnoses Included:

- Cubital Tunnel Syndrome with and without release
- Ulnar Nerve Transposition
- Ulnar Nerve Compression
- Radial Nerve Entrapment
- Radial Tunnel Syndrome (RTS)
- Posterior interosseous nerve syndrome (PINS)
- Cubital Tunnel, Ulnar Nerve Entrapment

Definition

Entrapment neuropathies of the upper extremity are common problems. What has traditionally been attributed to features of normal aging (eg, weakness, loss of function or sensation) has been subsequently recognized in younger patients whose vocations require repetitive motion to complete work-related tasks. Repetitive motion, force, posture, and vibratory influences on the peripheral nerves of the upper extremity are poorly understood but are blamed as contributing factors to the development of neuropathic symptoms.

The ulnar nerve can be compressed or entrapped at a number of locations, including the cubital tunnel and in the medial intermuscular septum. Due to the superficial location of the ulnar nerve, repetitive motion may initiate a cycle of inflammation and edema that inhibits the normal gliding of the nerve. Additional injury occurs when traction forces caused by elbow flexion produce an additional compressive force on the internal architecture of the nerve. The severity of the nerve injury will be dependent on the magnitude, duration, and character of the applied forces. Ulnar nerve transposition is accomplished by creating a new tunnel using the flexor muscles of the forearm. The ulnar nerve is then moved (transposed) out of the cubital tunnel and placed in the new tunnel.

Radial tunnel syndrome involves compression of the deep branch of the radial nerve. Compression of the nerve occurs during elbow extension, forearm pronation, and wrist flexion which cause the Extensor Carpii Radialis Brevis (ECRB) and the fibrous edge of the superficial part of the supinator to tighten around the nerve. The superficial branch of the radial nerve can also become entrapped where it pierces the fascia between the brachioradialis and extensor carpi radialis longus tendons. This is known as superficial radial nerve palsy.

- The posterior interosseous nerve has various potential sites of compression as it traverses through the radial tunnel:
  - Fibrous bands connecting the brachialis to the brachioradialis.
  - Vascular leash of Henry, a fan of blood vessels that cross the nerve at level of radial neck.
  - Medial proximal portion (leading edge) of ECRB.
  - Between fibrous bands at proximal and distal edge of the supinator; proximal border is referred to as Arcade of Fröhse.

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- PINS involves loss of motor function of some, or all of the muscles innervated by the posterior interosseous nerve, and is characterized by weakness.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician). See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- Cervical radiculopathy
- Proximal nerve impingement
- Pregnancy
- HIV
- Olecranon bursitis
- Medial epicondylitis
- Radiculopathy
- Thoracic outlet syndrome
- Guyon's canal syndrome
- Lateral epicondylitis
- De Quervain disease

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Red Flag	Possible Consequence or Cause
Severe trauma	Fracture/ligament rupture
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic, primary or paraneoplastic), potential complications of chemotherapy
Unilateral edema	Upper extremity deep vein thrombosis
Loss of distal pulse, severe pain 12-24 hours after trauma	Compartment syndrome
Immune-compromised state	Infection
Cold Intolerance, fatigue, constipation	Hypothyroidism
Multiple joint involvement, unusual skin rashes, other vascular involvement, tophi	Rheumatologic diseases (e.g., rheumatoid arthritis, Sjogren's syndrome, systemic lupus erythematosis, polyarteritis nodosa), gout
Stocking-glove neurological involvement	Diabetes, alcoholism, B12 deficiency
Auto repair occupation, battery exposure	Lead poisoning
Hand/skull disproportionately large	Acromegaly

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold

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- The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
- Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures.
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

- Non operative ulnar nerve compression:
  - Activity related pain and paresthesias distal to the elbow through the ulnar nerve distribution, most often of the small finger and ulnar side of the ring finger
  - Pain and tenderness about the medial aspect of the elbow
  - Decreased sensation in the ulnar distribution of the hand
  - Weakness of grip power and dexterity
  - Progressive inability to separate the fingers
  - Symptoms may be aggravated by resting the flexed elbow on a firm surface
  - May have recurrent subluxation of the nerve over the epicondyle
  - Clawing contracture of the ring and little fingers (late sign)
  - In chronic cases, pain may be referred into the scapular region
- Post operative ulnar nerve transposition:
  - Wound/scar at elbow
  - May complain of hypesthesia in ulnar nerve distribution
  - Elbow pain
  - Swelling at the elbow
  - Decreased elbow ROM
  - Decreased grip and pinch
  - Muscle weakness
  - Numbness and/or sensory changes
  - Impaired upper extremity function
- Radial nerve entrapment:
  - Pain, poorly localized over the radial aspect of the proximal forearm
  - Maximal tenderness over the radial tunnel
  - Weakness of wrist and finger extensors
  - Pain may be reproduced by resisted middle finger extension
  - Abnormal sensation on the dorsum of the hand
  - Symptoms mimic those of tennis elbow:
    - tenderness over the lateral aspect of the elbow
    - pain on passive stretching of the extensor muscle
    - pain on resisted extension of the wrist and fingers.
    - More prevalent in women age 30-50
- PINS (posterior interosseous nerve syndrome)
  - Symptoms look like DeQuervain's disease with shooting or burning pain along posterior-radial forearm, wrist, and thumb associated with wrist flexion and ulnar deviation
  - loss of motor function of some, or all of the muscles innervated by the posterior interosseous nerve
  - Weakness
  - Impaired fine motor control

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Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for upper extremity conditions. There is high level of documentation for objective evaluations for the upper extremity. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).

- The evaluation may include:
  - Inspection
    - Skin changes
    - Hand deformities (ie, clawing with ulnar nerve involvement)
    - Muscle atrophy
    - Posture
    - Surgical wound/scar if postoperative
  - Palpation of bony and soft tissue
    - Tenderness around elbow/forearm, scapular
    - Palpate forearm for pain
    - Temperature changes
  - Range of motion, active and passive, of ipsilateral and contralateral joints
    - Fingers, thumb, wrist, elbow, shoulder, cervical spine
  - Provocation tests
    - The Elbow Flexion Test
    - The Pressure Provocative Test
    - Tinel's Sign
  - Orthopedic and neurologic testing
    - Accessory joint movements at elbow, wrist, fingers
    - Tinel's sign (provocative test)
    - Elbow flexion test (elbow flexed past 90 degrees, supinated, wrist extended) (provocative test)
    - Froment's sign with key pinch
    - Wartenburg sign (clawing or abduction of small finger with extension)
    - 2-point discrimination
    - Vibratory perception and light touch
    - Test sensation C7-T1
    - Deep tendon reflexes (C5-C7)
    - Joint-play movements of the humeroulnar joint and humeroradial joint
  - Manual Muscle Testing of ipsilateral and contralateral joints:
    - Fingers, thumb
    - Wrist
    - Elbow
    - Shoulder
    - Cervical spine
    - Grip and pinch test
- Patient's specific presentation will depend on the severity, duration and location of the nerve compression.

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- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn, 2012)

Management/Intervention

Typical management strategies used when treating neuropathies include explanation and education, postural and ergonomic advice, joint mobilization, orthotics, soft tissue techniques, neural mobilization and exercise. Due to the lack of high level evidence, no specific treatment protocols or strong recommendations can be made. The following interventions have been studied and reported in literature.

Home program alone with ulnar nerve compression

Insufficient Evidence

Evidence from one small RCT of conservative treatment showed that in mild cases, patients who were given information on movements or positions to avoid had the same beneficial effects in improving work activities and reducing night pain as those patients who were using splints or doing exercises. (Caliandro P et al, 2016)

Tendon and nerve gliding with neuropathies

Insufficient evidence

One MRI study showed that gentle nerve gliding did not aggravate the inflammatory process but rather decreased intraneural edema. Nerve and tendon gliding in a carpal tunnel study showed an immediate decrease in carpal tunnel pressure in patients with carpal tunnel syndrome (Schmid AB et al, 2013)

Treatment with elbow splint, nerve glides, home program (Evidence does not support any one treatment over another with cubital tunnel syndrome)

At a 6 month follow-up, no significant differences were found in performance, satisfaction, pain, strength or neurophysicological parameters between those treated with just splinting, those treated with just nerve glides and those treated with just education. (Rinkel WD et al, 2013)

Splinting (with and without steroid injections) to treat cubital tunnel (No evidence to support any greater effect with steroids in addition to splinting)

At 6 month follow-up, no significant differences were found in symptoms and nerve conduction studies between patients using an elbow splint and those using a splint and receiving an injection. (Rinkel WD et al, 2013)

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Exercise therapy with peripheral neuropathy

Insufficient evidence

Inadequate evidence from randomized controlled trials was found when trying to determine if exercises affected levels of disability in patients with peripheral neuropathy. There was evidence, however, that strengthening exercises moderately improve muscle strength in people with peripheral neuropathy. (White et al, 2004)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. Home programs with elbow nueropathies may include education in rest/reduction of strenuous activities, identification of causative factors and correction of faulty techniques

Home Medical Equipment

- Cold packs
- Resistance bands
- Therapeutic Putty
- Splint, if necessary
- Elbow pads

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises
- Progression to therapeutic exercise—strengthening exercises
- Cold packs, if needed, to relieve discomfort
- Instruction in splint use, if necessary

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Cortisone injection
- Chiropractic
- Surgery

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Elbow Tendinopathies

Diagnoses Included:

- Lateral epicondylitis
- Medial epicondylitis
- Tennis elbow
- Golfer's elbow
- Epitrochlear bursitis
- Epicondylosis
- Peritendonitis
- Epicondylalgia

Definition

Lateral epicondylitis is a pathologic condition of the common extensor muscles at their origin on the lateral humeral epicondyle. It specifically involves the tendons of the muscles that control wrist extension and radial deviation resulting in pain on the lateral side of the elbow with contraction of these muscles. It most commonly involves the extensor carpi radialis brevis tendon. This injury is typically caused by activities that involve wrist extension/grasp as the wrist extensors contract during grasping activities to provide stability to the wrist. There may be a partial tear of the tendon fibers at, or near their point of insertion on the humerus. Risk factors are forceful repetitive wrist or forearm movement. In 10% of cases, conservative measures have failed and a fascial release may be performed.

Medial epicondylitis is a pathologic condition of the flexor muscles at their origin on the medial humeral epicondyle. It specifically involves the tendons of the muscles that control wrist flexion and ulnar deviation resulting in pain on the medial side of the elbow with contraction of these muscles. It commonly involves the flexor carpi radialis brevis and pronator teres tendons. This injury is typically caused by activities that involve wrist flexion/grasp and pronation as the wrist flexors contract during grasping activities to provide stability to the wrist. There may be a partial tear of the tendon fibers at, or near their point of insertion on the humerus. Risk factors are forceful repetitive wrist or forearm movement.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

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Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below.).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- C6 or C7 cervical nerve root compression
- Posterior Interosseous Nerve Syndrome (PINS) entrapment of nerve as it travels through the radial tunnel/ulnar nerve entrapment
- Radial head arthritis
- Posterolateral plica
- Posterolateral rotatory instability
- Olecranon bursitis
- Crystalline deposition such as gout and pseudogout (Chonrocalcinosis)
- Occult fractures of the radial head or lateral humeral epicondyle
- Tendonitis of the long head of the biceps/tendonitis of triceps

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, severe pain	Possible infection
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of hand/fingers	Vascular occlusion, shunt emboli (dialysis patients)
Multiple joint involvement, tophi	Rheumatolgical diseases; gout
Exertional symptoms, history of cardiac disease	Anginal equivalent

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.

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- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Symptoms are typically unilateral and tend to involve the dominant arm.
- Aching pain generally increases with activity and may be present at night
- May have a weakened grip on the affected side.
- Elbow range of motion is typically normal.
- Onset is often between 35 and 50 years of age (mean 45)
- Condition is more common in men than women
- Specific to Lateral epicondylitis:
- Localized tenderness just distal and anterior to the lateral epicondyle
- Pain increases with resisted wrist extension, especially with the elbow in extension
- Specific to Medial epicondylitis:
- Complaints of pain over the flexor-pronator origin slightly distal and anterior to the medial epicondyle.
- Pain is made worse by gripping, resisted wrist flexion and pronation, and passive wrist extension and supination

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Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for elbow conditions. There is high level of documentation for objective evaluations for the elbow. (Hunter, 2002) (Saunders, 2015), (Wyss J, 2012)

- The evaluation may include:
  - AROM and PROM of elbow and wrist (ipsilateral and contralateral joints) Manual muscle testing of elbow, wrist and shoulder (ipsilateral and contralateral joints)
  - Grip strength testing
  - Pain level
  - Edema measurements of elbow
  - Joint and ligamentous test:
  - Elbow valgus test
  - Elbow varus test
  - Neurological Test:
  - Tinel's Test
  - Deep Tendon Reflexes
  - Joint-play movements of the humeroulnar joint, radioulnar joint, and humeroradial joint
- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - PRTEE (patient rated tennis elbow evaluation) (Poltawski,2011) (Rompe, 2007)
  - Patient Specific Functional Scale (Horn, 2012)
- There are widely accepted provocative tests done for tendinitis. However, the validity (specifically the sensitivity and specificity) of these clinical tests has not yet been determined. (Saroja G,2014) Some of the frequently used tests are as follows:
  - Maudsley's Test
  - Mill's Test
  - Cozen's Test
  - Dynomometer testing (Grip strength generally decreases when elbow is extended and increases when elbow is flexed in a patient with lateral epicondylitis) (Dorf ER, 2007)

Management/Intervention

Clinical Interventions with moderate level of evidence

- Stretching and eccentric strengthening interventions for epicondylitis are recommended to help with the recovery. Most studies show that eccentric strengthening is more effective than concentric exercises. (Moderate evidence) (Hoogvliet,P 2016) (Wilson)
- Exercise is an effective way to manage tendonitis. Exercise has been shown to lead to greater and faster decrease in pain, less sick leave, fewer medical consultations,

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and increased work ability. However, there are no specific guidelines on the intensity, duration, or frequency of exercise. General guidelines recommend gradually increasing resistance (Moderate evidence), (Coombes, 2015)

- The ulnar-humeral lateral glide and radial head posteroanterior glide are techniques that can be used following the Mulligan mobilization. The patient performs the pain-producing movement in conjunction with sustained mobilization. These glides have been helpful in decreasing pain and increasing grip strength.(Moderate evidence) (Coombes, 2015)
- Cryotherapy provides acute relief of tendinopathies. The most effective use of cold is melting ice water through a wet towel for 10 minutes (moderate evidence) (Wilson)
- Manipulating the cervical and thoracic spine in addition to stretching, plus mobilization of the wrist and forearm provides short term and mid term relief of symptoms. Moderate evidence. (Hoogvliet,P)
- Manual therapy techniques targeting the cervical and thoracic regions provide additional clinical benefits beyond local elbow treatment alone (Moderate evidence) (Coombes, 2015)
- Extracorporeal shock wave therapy is a noninvasive, relatively safe and effective treatment of pain relief with chronic tendinopathy. (Moderate evidence) (Wilson)

Clinical Interventions lacking sufficient evidence or with conflicting evidence.

- When treating lateral epicondylitis Modalities may be considered to help with pain. However, there is little research that supports or refutes modalities (including ultrasound, iontophoresis, phonophoresis and low level laser treatment). (Andres, et al, 2008) (Wilson)
- Low level laser treatment is emerging as a safe and effective alternative to corticosteroid injections and Non-Steroidal Anti-Inflammatory Drugs . It appears that low level laser treatment works well when added to exercises and stretching programs. There is need for more studies comparing treatment with low level laser therapy to other pain treatments for elbow tendonitis. (Bjordal et al, 2008)
- Literature does not provide conclusive evidence that there is one preferred treatment modality over another modality. (Sims et al, 2014)
- Cross friction massage may help with healing however, there is not sufficient evidence on this treatment method and its effect on pain, grip strength and functional status. (Hoogvliet, 2013) (Coombes.et al, 2015), (Loew, 2014)
- Elbow straps or sleeves can be helpful in reducing pain with gripping. (Jafarian FS, 2009) (Johnson, 2007). There is no conclusive evidence supporting the use of orthotics with elbow tendinopathy (Wilson)

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Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

- Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

- There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
- Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

- Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

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- Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
- Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

- Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

- Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The importance of educating patients to understand that epicondylitis is a self limiting condition that often resolves gradually in 12-18 months is crucial. Instruct patient on avoiding pain provoking activities. The patient can be taught self stretching, use of counter force brace, and progressive strengthening. It is also important to educate patients in proper ergonomics such as minimizing forceful exertions and repetition in addition to keeping wrist and forearm in neutral positons.

Home Medical Equipment

- Hot packs/cold packs
- Resistance bands/ Therapeutic Putty for therapeutic exercises
- Counterforce bracing
- Wrist splint

Self-Care Techniques

- In acute phase, r, reduce strenuous activities.
- Home ROM exercises, stretching wrist extensor/flexor musculature
- Progress strengthening exercises as tolerated
- Hot packs/cold packs, if needed, to relieve discomfort
- Proper work station set up, proper body mechanics

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Yoga
- Injection
- Acupuncture (Trinh KV, et al. 2004)

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Hand Fractures post ORIF

Diagnoses included:

- ORIF Phalanges
- ORIF Metacarpals

Definition

- A fracture is essentially a structural failure of bone. The nature of the fracture is determined by inherent properties of the bone, its structure, and type of forces applied to it.
  - Forces of tension, compression, bending, and torsion can load bone beyond its structural strength.
  - External forces may render a fracture displaced or nondisplaced, with two or more fragments.
    - Displaced fragments may be overriding one another, lateral to each other, extremely distracted from one another, angulated, or rotated out of alignment.
    - Displaced fractures may be open fractures with a fragment breaking through skin, exposing the fracture site to external environment and increases risk of infection.
  - In addition to bony involvement, fractures frequently result in associated injury of soft tissues attached to, or adjacent to, the bone.
  - Fractures may be treated by immobilization with casts, sling/immobilizer, ORIF, percutaneous pinning, or joint replacement.
  - Fractures and dislocations of the phalanges occur from a variety of mechanisms. In younger patients, these injuries are more likely to be sports related, while older patients are likely to be injured by machinery or by falls. Crush injuries are common at the distal phalanx, while the PIPJ is usually damaged by an axial blow to the finger

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

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Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnosis

Not applicable.

Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Infection, arterial occlusion
Diabetes, parathesias	Neuropathy, other metabolic disorders, (e.g. B12 deficiency, hypothyroidism)
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimum detectable change 15 points (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or
- periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

- Impaired functional ability
- Pain
- Swelling
- Decreased flexibility of hand
- Muscle atrophy

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for hand conditions. There is high level of documentation for objective evaluations for the hand. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).
- The evaluation may include:
  - AROM and PROM of DIP joints, PIP joints, MCP joints, and wrist (ipsilateral and contralateral joints)
  - Neurological testing (test dermatome C6,C7,C8,T1)
  - Sensation (may include Semmes Weinstein, static 2 point)
  - Temperature changes
  - Inspection of wound/scar including color and circulatory changes
  - Edema measurements of digits and hand
  - As the wounds heal and edema decreases, manual muscle testing of digits and wrist (ipsilateral and contralateral joints) along with grip/pinch strength testing may be indicated.
  - Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn et al, 2012)
  - Hand Assessment Tool (Sanjiv HN, 2009)

Management/Intervention

Initial therapy interventions are focused on decreasing inflammation, normalizing pain, managing scars, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of hand. There are widely used protocols following hand fractures treated with ORIF. One evidence based protocol for the treatment of metacarpal fractures has been established by Angela Toemen and Robyn Midgley.

Early motion following surgical treatment (Moderate level of Evidence with high level of documentation)

Beginning mobilization early in the postop rehabilitation process leads to less pain and edema. It also results in earlier return to work, less stiffness and better preserved range of motion. Mobilization should begin as soon as bone and joint stability are established. **(Amini D, 2011)** (Roll SC, Hardison ME, 2016)

Incorporate ADL activities in the treatment of hand injuries (Moderate level of evidence)

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One randomized, controlled study found high level of evidence supporting therapeutic activities that mimic ADL's improve the functions of the hand more effectively than just therapeutic activities such as range of motion, strength and modalities. This study suggests adding ADL simulated activities to treatment following hand injuries. (Guzelkucuk U et al, 2007)

Splint use (moderate evidence)
Appropriate splinting can help increase ROM and reduce contractures after a joint injury (Michlovitz SL et al, 2004)

Passive exercise (Moderate level of evidence)
Passive range of motion is an effective way to increase ROM after a fracture, joint injury or period of immobilization (Michlovitz SL et al, 2004)

Metacarpal fractures and home programs (moderate level of evidence)
One study with level II evidence reports that postoperative metacarpal fractures treated with a home program do just as well as those treated with traditional therapy. (Gulke, 2017)

Use of silicone gel sheeting to manage postop scars (Low level and Conflicting level of evidence)
Some studies report low level of evidence to support silicone gel use in preventing hypertrophic scaring in newly healed post surgical wounds. (O'Brien L, et al, 2006) Other studies report silicone is effective, safe and is the gold standard of treatment to prevent hypertrophic scaring in clinical studies that have been done.(Monstrey, S et al. 2014) More randomized, controlled trials are needed in this area to determine sound evidence for the use of silicone gel in prevention of keloids following surgery.

Contrast baths to manage edema (Conflicting level of evidence)
Contrast baths may increase skin temperature and blood flow but the evidence on its effect of edema is conflicting. In addition, there is no clear determination of the relationship between the physiological effects of contrast baths and hand function (Breger Stanton DE et al, 2009)

Specific Rehabilitation Intervention (Insufficient evidence)
There are widely accepted therapy treatments following ORIF's. However, there is not enough evidence available to determine the best form of rehabilitation and what interventions should be used to optimize functional recovery. There is also not enough good quality evidence available to determine if results are better when interventions are started during immobilization period versus post immobilization. In addition, no determination has been made on how frequent or how long care should be provided (Handoll HHG et al, 2015)

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Strength training of nonaffected hand/wrist during period of immobilization. (Low Level of Evidence)

There is low quality evidence of clinically marginal benefits for cross education involving strength training of the nonfractured hand during period of immobilization with or without surgical repair. (Handoll HHG et al, 2015)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

- Activity of Daily Living
  - Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.
- Attention/Task Completion
  - There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
  - Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
  - There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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- Growth/Maturation
  - Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
  - Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
  - Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.
- Overuse/Sport
  - Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).
- Hypermobility
  - Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
  - Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
    - Focus on return to function with management of pain rather than resolution of pain.
    - Provide a more targeted approach with importance on self-management.
    - Selection of activity that does not exacerbate symptoms.
    - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

It is necessary for patients to understand the importance of early motion while protecting the surgical repair. The home program for postop hand ORIF conditions should include edema control techniques, use of protective orthosis, pain control techniques, range of motion and ADL's. The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Home Medical Equipment

- Cold packs
- Theraband for therapeutic exercises
- Heat packs
- Theraputty
- Orthosis
- Compression glove/Coban

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Home exercise program for edema control
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected hand

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication

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Hand Fractures – Nonsurgical

Diagnoses included:

- Phalange Fractures
- Metacarpal Fractures
- Broken fingers
- Broken hand

Definition

A fracture is essentially a structural failure of bone. The nature of the fracture is determined by inherent properties of the bone, its structure, and type of forces applied to it.

- Forces of tension, compression, bending, and torsion can load bone beyond its structural strength.
- External forces may render a fracture displaced or nondisplaced, with two or more fragments.
- Displaced fragments may be overriding one another, lateral to each other, extremely distracted from one another, angulated, or rotated out of alignment.
- Displaced fractures may be open fractures with a fragment breaking through skin, exposing the fracture site to external environment and increases risk of infection.
- In addition to bony involvement, fractures frequently result in associated injury of soft tissues attached to, or adjacent to, the bone.
- Fractures may be treated by immobilization with casts, sling/immobilizer, ORIF, percutaneous pinning, or joint replacement.
- Fractures and dislocations of the phalanges occur from a variety of mechanisms. In younger patients, these injuries are more likely to be sports related, while older patients are likely to be injured by machinery or by falls. Crush injuries are common at the distal phalanx, while the PIPJ is usually damaged by an axial blow to the finger.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

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- Determine if trauma-related; determine nature and extent of traumatic event

Differential Diagnosis

Not applicable.

Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Infection, arterial occlusion
Diabetes, paresthesia	Neuropathy, other metabolic disorders, (e.g. B12 deficiency, hypothyroidism)
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand	Arterial occlusion
Immune-compromised state	Infection

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- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
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  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
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Subjective Findings

- Impaired functional ability
- Pain
- Swelling
- Decreased flexibility and range of motion of hand and wrist
- Muscle atrophy

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for hand conditions. There is high level of documentation for objective evaluations for the hand. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).
- The evaluation may include:
  - AROM and PROM of DIP joints, PIP joints, MCP joints, and wrist (ipsilateral and contralateral joints)
  - Neurological testing
  - Test dermatome C6, C7, C8, T1
  - Sensation
  - Temperature changes
  - Edema measurements of digits and hand
  - Strength testing when fracture healing allows

Management/Intervention

Initial therapy interventions are focused on decreasing inflammation, normalizing pain, , restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of hand. There are widely used therapy protocols following hand fractures. One evidence based protocol for the treatment of metacarpal fractures has been established by Angela Toemen and Robyn Midgley.

Incorporate ADL activities in the treatment of hand injuries (Moderate level of evidence)

One randomized, controlled study found high level of evidence supporting therapeutic activities that mimic ADL's improve the functions of the hand more effectively than just therapeutic activities such as range of motion, strength and modalities. This study suggests adding ADL simulated activities to treatment following hand injuries. (Guzelkucuk U et al, 2007)

Splint use (moderate evidence)

Appropriate splinting can help increase ROM and reduce contractures after a joint injury (Michlovitz SL et al, 2004)

Passive exercise (Moderate level of evidence)

Passive range of motion is an effective way to increase ROM after a fracture, joint injury or period of immobilization (Michlovitz SL et al, 2004)

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Splint use versus early motion in MC neck fracture (moderate level of evidence)

Two options for conservative management of boxer's fracture (metacarpal neck fracture of small digit) have good results. One option is to splint the CMC joint, MP joint and IP joint to immobilize digit. The other option is taping the digit and applying a CMC orthosis which does not limit motion. Neither one of these non-operative treatment regimen for fracture of the neck of the fifth metacarpal can be recommended as superior to the other. (Poolman et al, 2005)

Early motion with extra-articular hand fractures: (Insufficient evidence)

Evidence does not support or refute beginning early motion in joints surrounding an extraarticular hand fracture. There is little evidence on the effects of healing and functional outcomes with early motion. (Feehan, 2004)

Ultrasound (Insufficient Evidence)

While a potential benefit of ultrasound in the treatment of acute fractures in adults cannot be ruled out, the currently available evidence is insufficient to support the routine use of this treatment. (Griffin et al, 2014)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

- Activity of Daily Living
  - Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.
- Attention/Task Completion
  - There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
  - Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

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- There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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- Overuse/Sport
  - Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

- Hypermobility
  - Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
  - Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

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- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. It is necessary for patients to understand the importance of following through with edema control, orthoses, pain control, range of motion and using upper extremity with ADL's to maximize return of functional use of their hand.

Home Medical Equipment

- Cold packs
- Compression glove/coban
- Theraband/theraputty for therapeutic exercises
- Heat packs
- Orthosis

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Home exercise program for edema control
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected hand

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic

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Hand- Post Dupuytren's Release

Diagnoses Included

- Viking disease
- Palmar fasciitis

Definition

Dupuytren's contracture is characterized by the proliferation of fibroblasts and production of collagen starting in the fibrofatty tissue of the hand. Initially this presents as nodules with puckering of the skin in the palmar and digital fascia along longitudinal tension lines. In the advanced stage, the nodules progress to form cords on the fascia. Fibrous tissue adheres to overlying skin and may also involve the tendon sheath of the long flexors of the finger. Flexion contracture develops at the MCP and PIP. Ultimately, the joint capsule contracts and permanent changes at the articular surfaces of the bones occur. When the disease has progressed so that the MCP joint contracts to 30 degrees and the deformity becomes a functional problem there are several options for treatment. Collagenase injection was approved by the FDA in 2010. It is a conservative treatment which may be done in the physician's office. The affected cord is injected and the next day the treated joint is manipulated to attempt cord rupture. Minimal hand therapy is usually needed following this procedure.

Percutaneous needle fasciotomy is a minimally invasive treatment that is usually performed under local anesthesia. It involves multiple punctures of the cord using the bevel of a needle. It may be performed as an initial intervention or for recurrent disease.

A more invasive Dupuytren's release (fasciotomy) may be performed. This surgery involves making an incision in the palm of the hand to remove inflamed and contracted connective tissue. The extent of the operation is dependent upon whether the contracture affects one or several fingers. Timing of the operation is based on the rate of progression of the disease and, consequently, may be performed in stages.

Because of some genetic predisposition to Dupuytren's disease and contractures, symptoms may recur or progress after treatment. Between 50-80% of individuals treated surgically have good return of hand function and decreased pain for 10 years.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

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Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- Osteoarthritis
- Tenosynovitis
- Spastic contracture in hemiplegia
- Ulnar nerve paralysis
- Scleroderma
- Rheumatoid nodules
- Trigger finger
- Articular cartilage pathology including neoplastic pathology
- Osteonecrosis

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear
Fever, severe pain	Infection
Diabetes, paresthesia	Neuropathy, other metabolic conditions (e.g. B12 deficiency, hypothyroidism)
Multiple joint involvement, tophi	Rheumatologic diseases, gout
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of arm or hand	Arterial occlusion; vascular insufficiency
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Shoulder and Hand score (DASH) OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations

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- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.

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- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- A patient typically presents with a history of progressive loss of range of motion (extension) of the affected finger(s) which led to patient having surgical release.
- The fourth digit most commonly is involved. The fifth, third, and second fingers are involved in decreasing order of frequency. Specifically, there is a decreased ability to extend the MCP joint(s) fully, and sometimes a decreased ability to extend the PIP joint(s) fully is noted.
- The history may refer to an isolated nodule in this area, initially somewhat tender, which may have hardened and then progressed to cording. .
- Asking about functional disabilities may elicit a history of certain tasks that the individual can no longer perform, such as grasping objects and typing.
- Postoperative pain may be present and often times resolves completely over time. Prior to surgery, Dupuytren's is usually a painless condition
- Postoperative swelling in digits and hand is typical
- No sensory deficits are reported, unless there is some other concomitant pathology. Sensory impairments may be present following surgery depending on the extent of the surgery.
- Prior to surgery, strength is usually normal. Postoperatively, patient will have less strength which increases as healing progresses.
- Postoperatively, patient will present with wound/scar at surgical site
- Dupuytren's is more common in men than women and is most prevalent in people of European descent

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for hand conditions. There is high level of documentation for objective evaluations for the hand. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).
- The evaluation may include:
  - AROM and PROM of PIP joints, MP joints, and wrist (ipsilateral and contralateral joints)
  - Inspection of wound/scar including color and circulatory changes
  - Edema measurements of digits and hand
  - As the wounds heal and edema decreases, manual muscle testing of digits and wrist (ipsilateral and contralateral joints) along with grip/pinch strength testing may be indicated.
  - Outcome measures (Very good documentation and very good level of evidence)

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- DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
- Quick DASH (Franchignoi F, MD, 2014)
- Patient Specific Functional Scale (Horn, 2012)
- Hand Assessment Tool (Sanjiv HN, 2009)

Management/Intervention

Hand therapy following Dupuytren's release is a common practice. Various protocols have been found in the literature reviewed. Commonalities in protocols include initial splinting, edema control, wound management and gentle ROM to control the inflammatory response. This is followed by gradual increase of ROM and scar management. Some protocols include strengthening while others do not. If strength is an issue, this is never done in the early stages of rehab. As there is no specific protocol with high evidence based results, the therapist needs to use clinical reasoning and adapt the treatment protocols as appropriate. (Skirven T et al, 2011) (Engstrand, 2009) (Cannon, 2001)

- High Level of evidence for no need for splinting preoperatively
  - There is high level of evidence supporting no benefit of treatment with splints and stretches for nonoperative Dupuytren's contracture. There is high level of evidence showing that stretching for less than 7 months has no clinically important effects on joint mobility when treating a contracture. (The studies did not follow patients for greater than 7 months). There is also moderate to high level of evidence showing that treating a contracture with stretching/splinting, does not provide any change in quality of life or level of pain. (Harvey LA, et al 2017) Some clinicians feel one therapy visit prior to surgery is beneficial to assess preoperative ROM, intrinsic muscle strength, and sensation. The severity of the condition preoperatively is a good predictor of the post op rehabilitation process. The therapy visit can be used to educate and prepare patients for the rehabilitation expectations following surgery. There is no level of evidence to support the benefits of a preoperative therapy visit.
- Moderate level of evidence:
  - There is controversy on whether or not all post op patients need to be splinted. There is moderate level of evidence supporting therapy alone is as effective in regaining motion as therapy plus splinting. It is suggested that splints should only be used postoperatively when there is a loss of active extension. (Collis J et al, 2013) Jerosch-Herold C et al, 2011)
  - There are other studies with moderate evidence to support low tension splinting versus splinting with mechanical stretch following Dupuytren's release. When the hand is splinted with little tension on the surgical site, there have been fewer complications with wound healing and less postoperative flare ups. Improvements in ROM are not affected over the long run in splinting with low tension versus splinting with stretch provided. (Rivlin M et al, 2014) (Evans RB et al, 2002)

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Use of silicone gel sheeting to manage postop scars (Low level and Conflicting level of evidence)

Some studies report low level of evidence to support silicone gel use in preventing hypertrophic scaring in newly healed post-surgical wounds. (O'Brien L, et al, 2006) Other studies report silicone is effective, safe and is the gold standard of treatment to prevent hypertrophic scaring in clinical studies that have been done. (Monstrey, S et al. 2014) More randomized, controlled trials are needed in this area to determine sound evidence for the use of silicone gel in prevention of keloids following surgery.

Contrast baths to manage edema (Conflicting level of evidence)

Contrast baths may increase skin temperature and blood flow but the evidence on its effect of edema is conflicting. In addition, there is no clear determination of the relationship between the physiological effects of contrast baths and hand function (Breger Stanton DE et al, 2009)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

- Activity of Daily Living
  - Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.
- Attention/Task Completion
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- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
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  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
  - Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
  - More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. Specific to Dupuytren's release, patients need to understand the importance of controlling initial postop inflammation and allowing the wounds to heal with progression of range of motion and return of functional use of hand. Patients also need to understand the diagnosis of Dupuytren's and the chance of the condition returning.

Home Medical Equipment

- Cold packs
- Splint
- Compression glove
- Coban
- Cica gel

Self-Care Techniques

- Instruction in active and passive range of motion
- Edema control techniques
- Scar management techniques
- Progressive strengthening exercises if needed
- Education in use of splint

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication

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Hand Tendinopathies

Diagnoses Included:

- Trigger finger
- Trigger digit
- Stenosing tenosynovitis

Definition

Trigger finger (TF) is one of the most common causes of hand pain and disability. The diagnosis is made when a finger is "locked" or attempts to lock in a position of flexion. If the flexor tendon cannot re-enter the canal at the A1 pulley, it assumes a flexed or "locked" position. This is usually due to the formation of a nodule in the flexor digitorum superficialis (FDS) tendon, where it glides under the A1 pulley in the region of the metacarpal head.

The condition begins as discomfort in the palm during movements of the involved digit(s). Gradually, or, in some cases acutely, the flexor tendon causes painful popping or snapping as the patient flexes and extends the digit.

Injection therapy is generally the first line of management. Surgery is considered for those in whom injections have failed or in whom other pathology, particularly RA, is the probable cause of the symptoms.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and or referral to physician). See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event

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Differential Diagnoses

- Crystalline deposition such as gout and pseudogout (Chondrocalcinosis)
- Collateral ligaments of the metacarpophalangeal (MCP) joint catch on a bony prominence on the side of the metatarsal head (osteophyte)
- Localized swelling in the flexor digitorum profundus (FDP) gets entrapped at the decussation of the FDS
- Partially lacerated flexor tendon catches against the A1 pulley or the FDS decussation
- Nodule in the FDS catches against the A3 pulley
- Locking is simulated by abnormal sesamoids
- Loose body is present in the MCP joint
- Snapping or subluxating extensor digitorum communis (EPC)

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture
Fever, severe pain	Possible infection
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of hand/fingers	Vascular occlusion, shunt emboli (dialysis patients)
Exertional symptoms, history of cardiac disease	Anginal equivalent

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the Disability of the Arm, Shoulder and Hand score (DASH) OR QuickDASH with a score of 11 or higher (Minimal Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of the time
  - Neurological signs: altered reflexes and/or sensations
  - Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition, and
  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures.
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

For nonoperative conditions, there is often a tender nodule that can be palpated overlying the metacarpophalangeal (MCP) joint

For postoperative conditions, there will be a wound/scar at the A1 pulley

- Pain in the affected area
- Swelling
- Reports of decreased strength
- Hypersensitivity may be present at scar
- Limited range of motion or fixed deformity
- Snapping or popping sensation
- In patients with diabetes, trigger fingers are more common and are less likely to respond to treatment

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for hand conditions. There is high level of documentation for objective evaluations for the hand. (Hunter,2002)
- The evaluation may include:
  - AROM and PROM of IP's and MCP's. (ipsilateral and contralateral joints)
  - Manual muscle testing of wrist and digits (ipsilateral and contralateral joints)
  - Grip strength testing
  - Pinch strength testing
  - Edema measurements of digits and hand
- Outcome measures (Very good documentation and very good level of evidence)
  - Patient Specific Functional Scale (Horn, 2012)
  - DASH(Disability of the arm, shoulder ,and hand questionnaire)
  - (Franchignoi F, 2014)
- Quick DASH (Franchignoi F, 2014)
  - Hand Assessment Tool (Sanjiv HN, 2009)

Management/Intervention

Surgical intervention (High Level of Evidence with high level of documentation)

There is strong evidence supporting surgical release of trigger fingers. Surgery is often considered when injections have been unsuccessful or the digit is in a locked position. Also, surgery has been more effective with patients who are diabetic. (Amirfeyz, R)

Surgical release of the first annular (A1) pulley is most effective overall in both diabetics and nondiabetics alike. (Lambert MA)

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Steroid Injections (Moderate Level of Evidence)

Local steroid injection is safe and effective in short term treatment and is therefore recommended as the first level of treatment. However, when compared with surgery, there is a higher level of recurrent symptoms after 6 months. Some physicians use splints in addition to injection. Research shows that injections are not as successful in diabetic patients. (Amirfeyz R)

Cryotherapy (Moderate level of evidence)

Cryotherapy provides acute relief of tendonopathies. The most effective use of cold is melting ice water through a wet towel for 10 minutes (Wilson)

Manual therapies (Low Level of evidence) – there is insufficient evidence to support or refute the use of manual therapy for trigger fingerOrthotics

There is no definitive evidence supporting the benefits of splinting trigger fingers. There is a good documentation on the topic with multiple studies. The studies lack high level of evidence, however, it is agreed that splinting is a good option for those who wish to avoid invasive treatment and for those with mild to moderate symptoms of triggering.

Managing nonsurgical trigger fingers with splints has been effective with patients who have had symptoms of triggering for less than 6 months. The most common splint fabricated holds the MCP joint in 10-15 degrees of flexion and allows the PIP and DIP joint movement. Patients who have been splinted have demonstrated decreased pain, decreased triggering and perceived overall improvement. (Colburn J)

Use of orthoses reduces patient's pain and stage of stenosing tenosynovitis in triggering fingers. (Valdes K)

If a single digit is triggering, some recommend immobilizing PIP joint and allowing movement at MP and DIP joint. If multiple fingers are involved, it is recommended to immobilize MP joints in 10-15 degrees of flexion. And as with all orthotics, proper fit and compliance of patient affects the success rate. (Akhtar,S).

Modalities

There is weak evidence to support the use of modalities including ultrasound and iontophoresis with trigger fingers. (R Amirfeyz). Ultrasound, iontophoresis and phonophoresis are of uncertain benefits with tendinopathies. (Wilson)

Graston Technique

There is weak evidence supporting the benefits of Graston technique or cross friction massage with trigger fingers. Only one study was found which supports the Graston technique. (Howitt S). More studies need to be done in this area.

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Exercises

There is insufficient evidence to support exercises with trigger fingers. It may be that exercises and therapy are most beneficial in patients with mild triggering. (Salim, N)

The need for formal physical/occupational therapy postoperatively lacks sufficient evidence. Often times patients progress well with just a home program. Patients may need therapy to regain motion if there was a fixed contracture or limited motion prior to surgery. (Salim, N)

In children younger than 3 years of age, conservative treatment including passive range of motion is effective for trigger thumbs in stage 2. Surgical release is thought to be indicated for stage 3 to avoid flexion deformity. (**Archives of Orthopaedic and Trauma Surgery**)

Pediatric and Adolescent Considerations– Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

- Activity of Daily Living
  - Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.
- Attention/Task Completion
  - There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)
  - Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
  - There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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- Growth/Maturation
  - Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)
  - Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.
  - Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.
- Overuse/Sport
  - Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).
- Hypermobility
  - Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.
  - Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
    - Focus on return to function with management of pain rather than resolution of pain.
    - Provide a more targeted approach with importance on self-management.
    - Selection of activity that does not exacerbate symptoms.
    - Home programs be continuous, progressive and part of daily routine.

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- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

It is important to educate patients on the need to monitor their symptoms with conservative treatment such as the use of splints, ice, activity modification and rest. If symptoms do not improve after 2-4 weeks, it may be necessary to go back to the physician for an injection or progress to surgery. If patient is postoperative, it is crucial for them to understand the need to resume normal use of the hand as soon as possible to prevent range of motion limitations.

Home Medical Equipment

- Hot packs/cold packs
- Theraputty as triggering resolves
- Splint
- Compression glove/coban to manage postop edema as needed

Self-Care Techniques

- Splinting to decrease synovitis around the A1 pulley
- Rest, reduce strenuous activities
- Home ROM exercises, stretching wrist extensor musculature
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Injection
- Acupuncture

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Proximal Humerus Fracture Post- Open Reduction, Internal Fixation (ORIF)

Diagnoses included:

- Proximal humerus ORIF
- Shoulder ORIF
- Proximal Humeral Fracture, Open, Post-ORIF

Definition

The most common fracture of the humerus, and involves the proximal third of the humerus as a result of a direct blow to the anterior, lateral, or posterolateral aspect of the humerus, or from a fall on an outstretched hand (FOOSH injury. Operative repair of humeral fracture is indicated when fracture is: open, associated with a nerve or vascular injury, multiple trauma, pathologic fracture or failure to maintain acceptable alignment by non-operative means. This condition is typically treated conservatively with an emphasis on controlling distal edema and stiffness and early motion at the shoulder to prevent development of arthrofibrosis secondary to prolonged immobilization.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Obtain a detailed history of the mechanism of injury and associated metabolic morbidity (i.e., whether the injury was the result of a direct impact to the lateral shoulder or the result of an indirect mechanism, as in a fall onto the outstretched hand). Indirect causes of proximal humerus fractures result in greater degrees of fracture displacement. Determine whether seizure or electrical shock was involved, as these indirect mechanisms are associated with posterior dislocations.

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

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- Infection
- Rotator cuff pathology
- Glenohumeral arthritis

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament/tendon rupture
Sensory loss along lateral deltoid	Axillary nerve injury
Fever, severe pain	Possible infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand	Arterial occlusion
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH" to "the Disability of the Arm, Should and Hand Score (DASH) OR QuickDASH with a score of 11 or higher (Minimum detectable change 15 points (Franchignoni, F.,2014)) OR The Shoulder Pain and Disability Index (SPADI) with a score of 20 or higher (minimum clinical important difference of 8-13 points (Angst, F., 2011))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 for 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Reduction in complicating factors (such as positive neurological signs)

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- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion

Subjective Findings

- Patient may present with arm immobilized in a sling, immobilizer or a sling with an accompanying swathe Shoulder pain
- Surgical scar/wound
- Swelling and ecchymosis
- Pain with motion
- Loss of ROM
- Loss of strength

Specific Examination Considerations

- Therapy evaluations need to include appropriate clinical histories along with objective findings for upper extremity conditions. There is high level of

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documentation for objective evaluations for the upper extremity. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).

- The evaluation may include:
  - Range of motion, active and passive of ipsilateral joints (as allowed by surgical protocol), and contralateral joints:
    - Gleno-humeral joint
    - Scapulo-thoracic joint
    - Sterno-clavicular joint
    - Acrimio-clavicular joint
    - Cervical spine
    - Elbow
  - AROM and PROM elbow/forearm: flexion, extension, supination, pronation (ipsilateral and contralateral joints)
  - Test peripheral pulses (vascular compromise)
  - Neurologic Testing (if neurologic signs are present)
    - Test for axillary nerve damage-Deltoid muscle/sensation
    - Test for Brachial plexus injury (C5-C8), Dermatomes and Myotomes
  - Temperature changes
  - Pain level
  - Inspection of wound/scar including color and circulatory changes
  - Edema measurements of elbow, wrist and hand
  - Orthopedic Testing
    - Joint play movements of the Gleno-humeral joint
  - Manual Muscle Testing of ipsilateral joints (as allowed by surgical protocol), and contralateral joints:
    - Gleno-humeral joint
    - Scapulo-thoracic joint
    - Sterno-clavicular joint
    - Acrimio-clavicular joint
    - Cervical spine
    - Elbow

Outcome measures (Very good documentation and very good level of evidence)

- DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
- Quick DASH (Franchignoi F, MD, 2014)
- Patient Specific Functional Scale (Horn et al, 2012)
- Shoulder Pain and Disability Index (SPADI) (Angst,2011)

Management/Intervention

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Initial therapy interventions are focused on decreasing inflammation, normalizing pain, managing scar, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of the affected upper extremity. There are widely used therapy protocols following proximal humeral ORIF. However, there is no strong evidence supporting any specific protocol. The following treatment techniques have been studied and reported in the literature.

- **Physical Therapy with pediatric humeral Fractures (surgical and nonsurgical) (High level of** evidence)
  - One study found no benefit to a formal physical therapy program for children between 5 and 12 years of age with closed treatment of a supracondylar humeral fracture, regardless of the degree of displacement of the fracture or whether or not the fracture was treated surgically. The average length of immobilization in these pediatric cases was 3 weeks and the return of function and motion was the same in both the groups treated with therapy and without therapy.(Schmale et al, 2014)
- Surgical care vs Nonsurgical care of displaced proximal humeral fracture (Moderate level of evidence)
  - Among patients with displaced proximal humeral fractures involving the surgical neck, there was no significant difference between surgical treatment and nonsurgical treatment in patient-reported clinical outcomes over 2 years following initial injury. (Rangan et al, 2015) (Handoll et al, 2015)
- Specific Rehabilitation Intervention (Insufficient evidence)
  - There are widely accepted therapy treatments following ORIF's. However, there is not enough evidence available to determine the best form of rehabilitation. There is also not enough evidence available to determine if results are better when interventions are started during immobilization period versus post immobilization. (**Handoll HH, Elliott 2015)**
- Early Mobilization (Insufficient evidence)
  - There is insufficient evidence to say when to start mobilization after surgical fixation of a proximal humeral fracture (Handoll et al, 2015)
  - There is limited evidence suggesting outcomes are similar with early mobilization versus delayed mobilization after either a surgical fixation of a humeral fracture or a hemiarthroplasty.(Handoll, Brorson,2015)
  - In one trial involving surgically managed proximal humeral fractures, starting exercise at 2 weeks post op did not improve shoulder activity more than starting exercises at 6 weeks after immobilization.(Bruder et al, 2011)

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- Use of silicone gel sheeting to manage postop scars (Low level and Conflicting level of evidence)
  - Some studies report low level of evidence to support silicone gel use in preventing hypertrophic scaring in newly healed post-surgical wounds. (O'Brien L, et al, 2006) Other studies report silicone is effective, safe and is the gold standard of treatment to prevent hypertrophic scaring in clinical studies that have been done. (Monstrey, S et al. 2014). More randomized, controlled trials are needed in this area to determine sound evidence for the use of silicone gel in prevention of keloids following surgery.

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physeal injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).

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- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

It is necessary for patients to understand the importance of motion while protecting the surgical repair. The home program for postop proximal humeral ORIF conditions should include edema control techniques, pain control techniques, range of motion and ADL's. The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Home Medical Equipment

- Cold packs
- Theraband for therapeutic exercises
- Heat packs
- Home electrical stimulation unit

Self-Care Techniques

- Instruction in home exercise program for ROM exercises
- Progression to therapeutic exercise-strengthening
- Cold packs, if needed, to relieve discomfort
- Heat packs
- Resumption of ADL's with affected extremity

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Acupuncture

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Thoracic Outlet Syndrome

Synonyms
None

Definition
The thoracic outlet is the anatomic space bordered by the 1st thoracic rib, the clavicle, and the superior border of the scapula through which the great vessels and nerves of the upper extremity pass. It is further defined by the interscalene interval, a triangle with its apex directed superiorly. This triangle is bordered anteriorly by the anterior scalene muscle, posteriorly by the middle scalene muscle, and inferiorly by the first rib.

Thoracic outlet syndrome (TOS) is a clinical syndrome characterized by symptoms attributable to compression of the neural or vascular anatomic structures that pass through the thoracic outlet: the brachial plexus, the subclavian artery, vein, or both.

Patient History
Patient History may include:

Patient Data
The onset of TOS has been attributed to multiple causes. An insidious onset is not uncommon. Frequently the symptoms are attributed to trauma or described as a repetitive use syndrome. Overhead arm use has been identified as an aggravating factor. Many sources believe that anatomical compression due to postural changes of the shoulder girdle is a primary cause. Soft tissue fibers compress the neurovascular structures as they change in relationship to skeletal changes. Vascular occlusions or space occupying lesions such as tumors or callus formation may also play a role.

Specific Considerations
- Rule out red flags (require medical management).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear, tendon rupture
Fever, severe pain	Possible infection
Unilateral edema	Upper extremity deep vein thrombosis
Immune-compromised state	Infection
Cancer history	Cause of symptoms (metastatic or primary)
Discoloration of hand/fingers	Vascular occlusion, shunt emboli (dialysis patients)
Exertional symptoms, history of cardiac disease	Anginal equivalent

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Presentation

Pain, numbness and/or tingling, and heaviness of the involved upper extremity are common complaints reported. Neck pain and headaches are reported concomitantly. Autonomic phenomena (e.g., cold hands, blanching, swelling) also may be reported.

Subjective Findings

Patient presents with neurological type symptoms of the upper extremity. Pain, paresthesias, heaviness and temperature changes are common complaints. The neck is also frequently involved. Autonomic symptoms are sometimes present. Postural changes may be obvious, including the forward shoulders, forward head, excessive spinal curves, or significant leg length differences. Middle aged women are most frequently affected.

Scope of Examination

Examine the musculoskeletal system for possible causes, or contributing factors to the complaint.

Specific Examination Considerations

All of the following objective tests may not be appropriate on admission to therapy, but should be assessed as the member's condition allows during the course of care.

- Inspection of spine, thorax, shoulder girdles and upper extremities
  - Posture
  - Swelling of hand
- Palpation of bony and soft tissue
  - Pain between clavicle and 1st rib
  - Range of motion, active and passive movements of ipsilateral and contralateral joints:
  - Gleno-humeral joint-Flexion, extension, abduction, Horizontal adduction, internal and external rotation
  - Shoulder Girdle-Protraction, retraction, elevation, circumduction and depression
- Orthopedic and neurologic testing
  - Joint
  - Play movements
  - Glenohumeral joint
  - Cervical spine
  - Thoracic spine
  - Scapulothoracic mechanism
  - Sensation
  - Special tests
    - Adson Manuever
    - Wright test
    - Roos/EAST test
    - Costoclavicular Bracing test

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- Manual Muscle Testing of ipsilateral and contralateral joints:
  - Test shoulder girdle and glenohumeral joint
- Functional assessment - The following standardized test may be used to assess functional limitations:
  - Disabilities of the Arm, Shoulder and Hand (DASH)

Findings of Thoracic Outlet Syndrome

Many tests have been developed to assess the patient with TOS. They may be helpful in determining the cause and location of the compression, thus, assisting in proper therapy treatment.

Due to the high false positive rate for TOS tests, perform at least 3 tests to reduce this possibility.

Adson maneuver	Performed in the sitting or standing position with the examiner palpating the radial pulse in the patient's abducted and extended arm. The examiner extends and externally rotates the arm as the patient rotates his or her head toward the examiner and takes a deep breath. A diminished or absent radial pulse suggests compression of the subclavian artery by the scalene muscles.
Allen test	Test the involved side by having the patient make a fist and elevate their hand above their head for 30 seconds. Occlude the Ulnar and Radial arteries by placing direct pressure over each artery at the wrist. Ask the patient to open their hand (it should appear blanched). Return their hand to waist level and release the pressure on the Ulnar artery. Watch for color to return. Repeat procedure, this time release pressure on the Radial artery. Watch for color to return.
Roos test/EAST test (elevated arm stress test)	Patient holds both arms in the 90/90 position of the Allen test and then rapidly opens and closes the fingers for 3 minutes. Inability to maintain the test position, diminished motor function of the hands, or decreased sensation or paresthesia is suggestive of TOS secondary to neurovascular compromise. In one study, over 80% of patients with carpal tunnel syndrome (CTS) presenting to an electrodiagnostic medicine laboratory had a positive EAST.
Wright test	Arm is hyperabducted so that the hand is brought over the head with the elbow and arm in the coronal plane. Wright advocated performing the test in the sitting and then supine positions. Taking a breath or rotating or extending the head and neck may have an additional effect. The pulse is palpated for differences. This test is used to detect compression in the costoclavicular space.
Costoclavicular syndrome test or military brace	Accomplished by palpating the radial pulse and drawing the patient's shoulder down and back. A positive test is indicated by the absence of the pulse.

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Provocation elevation test	Patient elevates both arms above the horizontal and rapidly opens and closes the hands 15 times. If fatigue, cramping, or tingling occurs, the test is positive for vascular insufficiency and TOS.
Shoulder girdle passive elevation test	Patient crosses one arm on the chest. The examiner stands behind the patient and passively elevates the shoulder girdle upward and forward (passive shoulder shrug). The position is held for 30 seconds. A positive test is reported if the pulse becomes stronger, skin color improves, or hand temperature increases. The patient also my report a "relief phenomenon," which can range from numbness, pins and needles, or pain as the ischemia to the nerve is released.
Halstead maneuver	Radial pulse is palpated and the examiner applies a downward traction on the arm while the patient's neck is hyperextended and the head is rotated to the opposite side. Absence or decrease pulse indicates a positive test for TOS.

Differential Diagnoses

- Cervical myelopathy
- Cervical radiculopathy
- Double crush syndrome (thoracic outlet syndrome and compression at another distal or proximal site)
- Paget-von Schroetter syndrome, effort syndrome (spontaneous venous thrombosis, primary deep venous thrombosis of the upper extremity)
- Pancoast (apical lung) tumor
- Shoulder tendonitis, bursitis, impingement
- Shoulder (glenohumeral) instability
- Raynaud syndrome
- Ulnar neuropathy (cubital tunnel syndrome, Guyon canal syndrome)
- Fibromyalgia
- Infection

Physical/Occupational Therapy Management

Therapy must show measurable functional progress.

Care Classifications

- Therapeutic Care
  - Therapeutic care is care provided to relieve the functional loss associated with an injury or condition and is necessary to return the patient to the functioning level required to perform their daily needs and work activities. Therapeutic care generally occurs within a reasonable period of time and is guided by evidence based practice of physical therapy.

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- Acute Care
  - Acute care is care of an injury or condition characterized by short and relatively severe symptom complex, generally up to the first month following onset of injury. The condition may be induced by either traumatic or non-traumatic factors and may consist of a new condition or an exacerbation of an existing one. Need for care is proportional to the severity of the signs and symptoms of the particular case, modified by the status of healing tissues. The therapeutic goals of acute care are patient education in the recovery/healing process, reduction of symptoms and minimization of functional loss, in preparation for resolution of the injury or condition. Means and methods include a combination of direct care and a home management program to progress towards recovery of function.
- Subacute Care
  - Subacute care is care of an injury or condition characterized by a less severe symptom complex and intermediate course. Typically, it follows an acute injury or exacerbation, and can extend up to three months from onset. Subacute care is characterized by a combination of direct care and home management consisting of exercise, symptom management, patient education, and an emphasis on compliance. The therapeutic goal of this phase is to improve functional status by increasing existing range of motion and muscle strength and reducing signs and symptoms associated with the condition or injury. Means and methods include progression of exercise, instruction in self-care, and monitoring patient compliance and motivation. Intensity of care is guided by the condition of healing tissue structures, generally including therapy visits supplemented by a home management program.
- Corrective or Rehabilitative Care
  - Corrective or rehabilitative care is the stage of ongoing care beyond the sub-acute phase. This phase of care may last up to 6 month from onset. It may also refer to treatment of conditions that are chronic in nature and do not occur in conjunction with an acute or subacute phase. The therapeutic goals of this phase are reduction and management of symptoms with a goal of maximizing function over time. Means and methods include progression of exercise, continued patient education, and transition to self-management. Intensity of care is guided by functional status, focusing on home management, supplemented by therapy visits.
- Skilled Maintenance Care
  - Maintenance care is defined as services required to maintain the member's current condition or to prevent or slow deterioration of the member's condition. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)
- Skilled maintenance care for Medicare and Medicaid enrollees is covered if the specialized skill, knowledge and judgment of a qualified therapist are required:
  - To establish or design a maintenance program appropriate to the capacity and tolerance of the member
  - To educate/instruct the member or appropriate caregiver regarding the maintenance program

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- For periodic re-evaluations of the maintenance program
- When skilled services are required in order to provide reasonable and necessary care to prevent or slow further deterioration, coverage will not be denied based on the absence of potential for improvement or restoration as long as skilled care is required.

- Skilled Maintenance Programs in an Outpatient and Home Health setting will not be covered if furnished by a Physical Therapist Assistant. (Chapter 15, Section 220.2 Subsection D of the Medicare Benefit Policy Manual)
  - Condition Severity Classifications
    - Severity is classified as mild, moderate and severe conditions. Mild conditions result from a variety of conditions, may or may not require treatment, symptoms are low-grade and generally do not affect activity of daily living tasks. Moderate conditions also result from a variety of causes; pain is usually mid-range (5-6/10), may have work restrictions and may affect performance of activities of daily living. Severe conditions mostly result from accidents or injuries, symptoms are intense, may result in loss of work, and will have a pronounced decrease in the ability to perform activities of daily living.

Conditions Severity Criteria Table

Criteria	Mild Condition	Moderate Condition	Severe Condition
Mode of Onset	Variable	Variable	Severe
Anticipated duration of care	1-6 weeks	6-10 weeks	10 or more weeks
Loss of work days	No loss of work days	0-4 days of work lost	5 or more days of work lost
Work restriction	None	Possible, depends on occupation; 0-2 weeks	Restriction, depending on occupation; 2 or more weeks
Functional deficits: ◆ Range of motion	Mild/no loss	Mild to moderate loss	Considerable loss
◆ Muscle Strength	Mild/no loss	Mild to moderate loss	Considerable loss
◆ Neurologic findings	None	May be present	May be present
◆ BADL (Basic daily function such as walking in the home, bathing, dressing, grooming, feeding, positioning, and elimination)	Mild/no loss	Mild to moderate	Moderate to severe

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Significant Functional Limitations (i.e. Activities of daily living, vocational activities) - Practitioners are strongly encouraged to utilize peer reviewed, standardized tools to quantify Functional Limitations.
  - Strength: <4/good (5 = normal; 4 = good; 3 = fair; 2 = poor; 1 = trace)
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of clinical findings,
  - Presence of complicating factors,
  - Natural history of condition, and
  - Expectation for functional improvement

Physician specific protocols will be considered in the context of the plan's definition of medical necessity.

Treatment Methods

- Therapy program goals are to:
  - Reduce pain and inflammation,
  - Aid stretching and strengthening, and
  - Assist in gradual return to activity.
- Treatment methods used:
  - Modalities to reduce pain and inflammation
  - Correction of postural abnormalities of the neck and shoulder girdle,
  - Strengthening of the scapular suspensory muscles,
  - Stretching of the scapulothoracic muscles, and
  - Mobilization of the whole shoulder complex and the first and second ribs
  - Home program, individually prescribed, is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.
  - Emphasis should be placed on a program of self-management for exercise, instruction in activities of daily living modifications and the reduction of aggravating factors.

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Referral Guidelines

Refer patient to their primary care provider for evaluation of alternative treatment options if:

- Improvement does not meet above guidelines, or improvement has reached a plateau
- Atrophy of the extremity occurs
- Neurological deficits appear/progress
- Disability/loss of functional ability of the upper extremity

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Management/Intervention

Use of modalities and/or passive treatments should be limited. The goal is to transition the patient as quickly as possible to active care, self-management and functional independence.

The following table lists the procedures for ***Acute Phase, Subacute Phase and Corrective, Rehabilitative Phase*** presentation.

- Acute Phase
  - Acute care is characterized by a short and relatively severe course. Need for care is proportional to the severity of the signs or symptoms of the particular case. Frequency of therapeutic visits is gradually reduced over a short period of time, generally 1-4 weeks.
- Subacute Phase
  - Subacute care is characterized by an intermediate and less severe course. It is a combination of direct care and with an emphasis on home management consisting of patient motivation and compliance. Intensity of care is guided by the condition of healing tissue structures, and generally includes less frequent therapeutic visits gradually tapering over a short period of time.
- Corrective/Rehabilitative Phase
  - Corrective or rehabilitative care is the stage of ongoing care, and may also refer to conditions that are chronic in nature. Treatment is directed toward further symptom reduction and the achievement of optimal structural and functional restoration. In most cases, this type of care is largely active and is typically directed by the provider and performed by the patient as a home program.

Expected Outcome	Procedures/Modalities Such As
Resolution of acute inflammation and pain	➢ Superficial heat, Ultrasound, Interferential current, TENS, spray and stretch
Improve range of motion	➢ Active range of motion of shoulder and cervical spine ➢ Stretch scapulothoracic muscles ➢ Stretch shoulder muscles ➢ Joint mobilization to shoulder, vertebral segments and 1st and 2nd rib
Improve postural control	➢ Postural awareness of upper trunk and shoulder girdle ➢ Scapular stabilization
Improve strength	➢ Begin with isometric strengthening exercises ➢ Gradually add isotonic exercises, resisted exercises and isokinetic exercises
Patient education and self-management and joint protection	➢ Self-management of symptoms-application of ice or heat, self-mobilization techniques, stretching and strengthening exercises ➢ Avoid activity that exacerbates pain ➢ Avoid overhead activities, activities requiring outstretched arms, heavy lifting and carrying
Progressive return to normal function	➢ Gradual resumption of activities relating to community, leisure and sports ➢ Functional training activities ➢ Work simplification/back protection

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Note: Not all of the above modalities are appropriate for each individual case; they require the skill and judgment of persons properly trained and licensed for safe use. Use of diathermies, including microwave, shortwave, and ultrasound, is controversial and is contraindicated in the presence of metals, and prior to neurological, and/or orthopedic maturity. Landmark recommends following all manufacturer and educational guidelines in the use of electrotherapeutic modalities.

Home and Self-Care Techniques

The patient can be taught to use medical equipment and administer self-care at his residence.

Home Medical Equipment

- Hot packs/cold packs
- Theraband for therapeutic exercises
- Use of cervical pillow while sleeping may be helpful
- Gymball
- Home electrical stimulation unit

Self-Care Techniques

- Rest, reduce strenuous activities
- Home ROM exercises, neurotension stretches
- Progression to therapeutic exercise—strengthening exercises
- Hot packs/cold packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Psychotherapy

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Wrist Fracture Nonsurgical

Diagnoses included:

- Carpal Fracture
- Distal radius fracture
- Colles fracture
- Scaphoid fracture
- Lunate fracture

Definition

A fracture is essentially a structural failure of bone. The nature of the fracture is determined by inherent properties of the bone, its structure, and type of forces applied to it.

- Forces of tension, compression, bending, and torsion can load bone beyond its structural strength.
- External forces may render a fracture displaced or non-displaced, with two or more fragments.
- Displaced fragments may be overriding one another, lateral to each other, extremely distracted from one another, angulated, or rotated out of alignment.
- Displaced fractures may be open fractures with a fragment breaking through skin, exposing the fracture site to external environment and increases risk of infection.
- In addition to bony involvement, fractures frequently result in associated injury of soft tissues attached to, or adjacent to, the bone.
- Fractures may be treated by immobilization with casts, sling/immobilizer, ORIF, percutaneous pinning, or joint replacement.
- Fracture of the distal radius is the most common wrist injury.

The scaphoid is the most commonly fractured carpal bone. There is a high incidence of delayed healing, or non-union of scaphoid fractures, and are they are inherently unstable.
Distal radius, scaphoid, and lunate fractures usually are the result of a fall on an outstretched hand. Wrist fractures may be also be caused by hyper flexion mechanisms and by direct blows to the wrist.

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Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- Forearm fractures
- Hand fractures
- Tendonitis
- Tenosynovitis

Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Compartment syndrome
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand; delayed capillary refill	Arterial occlusion; arterial insufficiency
Immune-compromised state	Infection

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Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn KK, 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition.
- Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Pain and tenderness:
  - With scaphoid fractures, the point of maximal tenderness lies in the anatomic snuffbox. Radial deviation of the wrist or axial loading of the first metacarpal may increase pain.
  - Axial loading of the third metacarpal may increase pain with a lunate injury. In addition, lunate fractures may be associated with point tenderness over the lunate fossa (located distal to the radius at the base of the long finger metacarpal).
  - With triquetrum fractures, the point of maximal tenderness is localized to the triquetrum with ulnar sided wrist pain.
  - The classic finding in a Colles fracture is the so-called dinner fork deformity, which is produced by dorsal displacement of the distal fracture fragments. A Smith fracture may show an obvious volar displacement of the wrist relative to the forearm, known as a garden spade deformity.

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- Impaired functional ability
- Wrist and finger stiffness, and possibly elbow stiffness
- Decreased grip and pinch
- Open wound/break in skin
- Ecchymosis and swelling
- Impaired circulation
- Atrophy of forearm muscles
- Extent of residual malalignment

Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for hand and wrist conditions. There is high level of documentation for objective evaluations for the hand and wrist. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).

- The evaluation may include:
  - Active Range of Motion (AROM) and Passive Range of Motion (PROM) wrist and elbow/forearm (ipsilateral and contralateral joints)
  - AROM and PROM of digits (ipsilateral and contralateral joints)
  - AROM and PROM shoulder (ipsilateral and contralateral joints) for capsular tightness
  - Joint play movements of the wrist and hand
  - Neurological testing (may include Phalen's test or Tinel's sign)
  - Sensation (May include Semmes-Weinstein Monofilament test)
  - Sensation along C6-C7
  - Temperature changes
  - Pain level
  - Edema measurements of wrist and hand
  - When the fracture is stable and edema decreases, manual muscle testing of digits, wrist and forearm (ipsilateral and contralateral joints) along with grip/pinch strength testing may be indicated.
- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn, 2012)
  - HAT (Hand Assessment Tool) (Sanjiv HN, 2009)
  - PRWE (Patient Related Wrist Evaluation) (Sorensen et al, 2013) (Walenkamp, 2015)

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Management/Intervention

Initial therapy interventions are focused on decreasing inflammation, normalizing pain, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of the affected upper extremity. There are widely used therapy protocols following wrist fractures. However, there is no strong evidence supporting any specific protocol. The following treatment techniques have been studied and reported in the literature.

Specific Rehabilitation Intervention (Insufficient evidence)

There are widely accepted therapy treatments following wrist fractures. However, there is not enough evidence available to determine the best form of rehabilitation and what interventions should be used to optimize functional recovery. There is also not enough good quality evidence available to determine if results are better when interventions are started during immobilization period versus post immobilization. Nor is there enough good quality evidence supporting therapy vs home program in the long term outcomes of functional use of the upper extremity. In addition, no determination has been made on how frequent or how long care should be provided. (Handoll HHG et al, 2015)
One observational study found that exercise and advice were the most frequently administered treatment following distal radius fractures. Further research is needed to provide high quality evidence that these interventions improve outcomes following distal radius fractures. (Bruder AM et al, 2013)

Edema Management (High level of evidence)

One randomized clinical control study compared the effect of traditional edema control techniques (elevation, compression, coban wrap, isotoner gloves, functional activity) versus a modified manual edema mobilization technique (MEM) (deep breathing, terminus stimulation, axillary stimulation starting in the uninvolved side, MEM to trunk region and then stimulation of involved side). Neither method was superior in terms of edema reduction. However, the modified MEM group needed fewer sessions to decrease edema vs the traditional edema control group. (Knygsand-Rosehoej K, Maribo T, 2011)

Incorporate ADL activities in the treatment of hand injuries (Moderate level of evidence)

One randomized, controlled study found high level of evidence supporting therapeutic activities that mimic Activities of Daily Living (ADL's) improve the functions of the hand more effectively than just therapeutic activities such as range of motion, strength and modalities. This study suggests adding ADL simulated activities to treatment following hand injuries. (Guzelkucuk U et al, 2007)

Joint Mobilization (Moderate level of evidence)

Joint mobilization techniques at the wrist in patients with limited range of motion following a distal radius fracture has been found to be an effective treatment technique (Roll, Hardison, 2017)

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Regular supervised therapy from a hand therapist versus home program with regular monitoring (Moderate evidence)
There were no statistically significant differences between the final scores of the PRWHE (patient rated wrist and hand evaluation), range of motion, pain, or grip strength between patients receiving regular therapy and those with a home program which was monitored. (Valdes, 2015). It is suggested that clinic-based therapy may be preferable for patients with complications after a distal radius fracture with volar plate fixation. Patients with decreased finger motion and various comorbidities may also benefit more from therapy provided in a clinic versus just a home program.
There is no evidence to support adding supervised exercises to a monitored home program after distal radius fracture is beneficial. There have been no statistically significant differences in any impairment or activity outcome measures between those with therapy versus those with a monitored home program. (Bruder et al, 2016)

Beginning therapy during immobilization leads to better short term results (Moderate level of evidence)
When therapy is started during the immobilization period, there are greater improvements in grip, pinch and ROM in the short term. There is no evidence of differences in these areas in the long term. (Roll SC, Hardison ME, 2017)

Contrast baths to manage edema (Conflicting level of evidence)
Contrast baths may increase skin temperature and blood flow but the evidence on its effect of edema is conflicting. In addition, there is no clear determination of the relationship between the physiological effects of contrast baths and hand function (Breger Stanton DE et al, 2009)

Strength training of non-affected upper extremity during period of immobilization. (Low Level of Evidence)
There is low quality evidence of clinically marginal benefits for cross education involving strength training of the non-fractured upper extremity during period of immobilization with or without surgical repair. (Handoll HHG et al, 2015) One moderate quality randomized controlled trial found contralateral strengthening beginning during period of immobilization led to faster recovery of grip in the affected hand. (Magnus et al, 2013)

Ultrasound (Insufficient Evidence)
While a potential benefit of ultrasound in the treatment of acute fractures in adults cannot be ruled out, the currently available evidence is insufficient to support the routine use of this treatment. (Griffin et al, 2014)

Mirror Therapy (lacks evidence)
In one pilot randomized study of distal radius fractures,, the use of mirror therapy along with conventional hand therapy versus hand therapy alone did not have any difference in patient pain level or their level of disability. (Bayon-Calatayud M, 2016) One moderate quality RCT found conventional therapy plus the use of mirror therapy along with a mirror therapy home program resulted in significantly improved range of motion and functional scores versus no mirror therapy. (Roll, Hardison, 2017).

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Exercise and home program versus no intervention (Insufficient evidence):

There is preliminary evidence from a single trial that exercise combined with home program education improves upper limb activity and reduces pain in the short term after distal radius fracture. A single session of exercise and instruction compared to no intervention found improvements in upper limb activity and decreased pain at 3 and 6 weeks after cast removal. There were no statistically significant differences for range of motion or grip strength at the 3 and 6 week time. (Bruder, 2011)

Dynamic Splinting (No Evidence)

For contractures which develop after a distal radius fracture, there is no evidence to support dynamic splinting as superior to standard care in improving range of motion or occupational performance. (Roll, Hardison, 2017).

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

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Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017;Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physical injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).

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- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. It is necessary for patients to understand the importance of controlling edema, orthotic use, range of motion, use of upper extremity with ADL's and progression of exercises to be able to achieve the best possible functional outcome.

Home Medical Equipment

- Cold packs/heat packs
- Resistance band/putty for therapeutic exercises
- Orthosis
- Compression glove/sleeve for edema control

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Home exercise program for edema control
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected hand

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication

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Wrist Fracture Post-Open Reduction Internal Fixation

Diagnoses included:

- Distal radius ORIF
- Distal ulna ORIF
- Both forearm bone ORIF
- Scaphoid ORIF

Definition

- A fracture is essentially a structural failure of bone. The nature of the fracture is determined by inherent properties of the bone, its structure, and type of forces applied to it.
  - Forces of tension, compression, bending, and torsion can load bone beyond its structural strength.
  - External forces may render a fracture displaced or no displaced, with two or more fragments.
  - Displaced fragments may be overriding one another, lateral to each other, extremely distracted from one another, angulated, or rotated out of alignment.
  - Displaced fractures may be open fractures with a fragment breaking through skin, exposing the fracture site to external environment and increases risk of infection.
  - In addition to bony involvement, fractures frequently result in associated injury of soft tissues attached to, or adjacent to, the bone.
  - Fractures may be treated by immobilization with casts, sling/immobilizer, ORIF, percutaneous pinning, or joint replacement.
  - Fracture of the distal radius is the most common wrist injury.
- The scaphoid is the most commonly fractured carpal bone. There is a high incidence of delayed healing, or non-union of scaphoid fractures, and are they are inherently unstable.
- Distal radius, scaphoid, and lunate fractures usually are the result of a fall on an outstretched hand. Wrist fractures may be also be caused by hyper flexion mechanisms and by direct blows to the wrist.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

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Special Considerations

- Rule out red flags (require medical management and/or referral to physician) See Table below.
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

Not applicable

Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Compartment syndrome
Diabetes; paresthesias in stocking-glove distribution	Neuropathy; B12 deficiency, hypothyroidism, lead poisoning
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided

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- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

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Subjective Findings

- Impaired functional ability
- Wrist and finger stiffness, and possibly elbow stiffness
- Wrist and hand pain
- Decreased grip and pinch
- Wrist and finger swelling
- Surgical scar/wound

Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for hand and wrist conditions. There is high level of documentation for objective evaluations for the hand and wrist. (Hunter, 2002) (Saunders, 2015) (Wyss J, 2012).

- The evaluation may include:
  - Active Range of Motion (AROM) and Passive Range of Motion (PROM) wrist and elbow/forearm (ipsilateral and contralateral joints)
  - AROM and PROM of digits (ipsilateral and contralateral joints)
  - AROM and PROM shoulder (ipsilateral and contralateral joints) for capsular tightness
  - Joint play movements of the wrist and hand
  - Neurological testing (may include Phalen's test or Tinel's sign)
  - Sensation (May include Semmes-Weinstein Monofilament test)
  - Sensation along C6-C7
  - Temperature changes
  - Pain level
  - Inspection of wound/scar including color and circulatory changes
  - Edema measurements of wrist and hand
  - As the wounds heal and edema decreases, manual muscle testing of digits, wrist and forearm (ipsilateral and contralateral joints) along with grip/pinch strength testing may be indicated.

Outcome measures (Very good documentation and very good level of evidence)

- DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
- Quick DASH (Franchignoi F, MD, 2014)
- Patient Specific Functional Scale (Horn, 2012)
- HAT (Hand Assessment Too)l (Sanjiv HN, 2009)
- PRWE (Patient Related Wrist Evaluation) (Sorensen et al, 2013) (Walenkamp, Monique et al, 2015)

Management/Intervention

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Initial therapy interventions are focused on decreasing inflammation, normalizing pain, managing scar, restoring motion and patient education. Proprioception needs to be maintained with eventual progression of exercises to return to maximal functional use of the affected upper extremity. There are widely used therapy protocols following wrist fractures treated with ORIF. However, there is no strong evidence supporting any specific protocol. The following treatment techniques have been studied and reported in the literature.

Specific Rehabilitation Intervention (Insufficient evidence)
There are widely accepted therapy treatments following wrist ORIF's. However, there is not enough evidence available to determine the best form of rehabilitation and what interventions should be used to optimize functional recovery. There is also not enough good quality evidence available to determine if results are better when interventions are started during immobilization period versus post immobilization. Nor is there enough good quality evidence supporting therapy vs home program in the long term outcomes of functional use of the upper extremity. In addition, no determination has been made on how frequent or how long care should be provided. (Handoll HHG et al, 2015)

Edema Management (High level of evidence)
One randomized clinical control study compared the effect of traditional edema control techniques (elevation, compression, coban wrap, isotoner gloves, functional activity) versus a modified manual edema mobilization technique (MEM) (deep breathing, terminus stimulation, axillary stimulation starting in the uninvolved side, MEM to trunk region and then stimulation of involved side). Neither method was superior in terms of edema reduction however, the modified MEM group needed fewer sessions to decrease edema vs the traditional edema control group. (Knygsand-Rosehoej K, Maribo T,2011)

Early motion following surgical treatment (Moderate level of Evidence)
Beginning mobilization early in the postop rehabilitation process leads to less pain and edema. It also results in earlier return to work, less stiffness and better preserved range of motion. Mobilization should begin as soon as bone and joint stability are established. (Amini D, 2011) **(**Roll SC, Hardison ME,2016)

Incorporate ADL activities in the treatment of hand injuries (Moderate level of evidence)
One randomized, controlled study found high level of evidence supporting therapeutic activities that mimic ADL's improve the functions of the hand more effectively than just therapeutic activities such as range of motion, strength and modalities. This study suggests adding ADL simulated activities to treatment following hand injuries. (Guzelkucuk U et al, 2007)

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Joint mobilization (Moderate level of evidence)
Joint mobilization techniques at the wrist in patients with limited range of motion following a distal radius fracture has been found to be an effective treatment technique (Roll, Hardison, 2017)

Splint use (Moderate level of evidence)
Appropriate splinting can help increase ROM and reduce contractures after a joint injury (Michlovitz SL,et al, 2004)

Passive exercise (Moderate level of evidence)
Passive range of motion is an effective way to increase ROM after a fracture, joint injury or period of immobilization (Michlovitz SL,et al, 2004)

Use of silicone gel sheeting to manage postop scars (Conflicting level of evidence)
Some studies report low level of evidence to support silicone gel use in preventing hypertrophic scaring in newly healed post-surgical wounds. (O'Brien L, et al, 2006) Other studies report silicone is effective, safe and is the gold standard of treatment to prevent hypertrophic scaring in clinical studies that have been done. (Monstrey, S et al. 2014). More randomized, controlled trials are needed in this area to determine sound evidence for the use of silicone gel in prevention of keloids following surgery.

Contrast baths to manage edema (Conflicting level of evidence)

Contrast baths may increase skin temperature and blood flow but the evidence on its effect of edema is conflicting. In addition, there is no clear determination of the relationship between the physiological effects of contrast baths and hand function (Breger Stanton DE et al, 2009)Therapy vs home program (Insufficient evidence)
The effect of formal therapy following ORIF with volar plate fixation of the distal radius is uncertain. The average motion and disability was not significantly different with formal therapy vs surgeon directed independent exercises. (Souer JS et al, 2011)

Strength training of non-affected upper extremity during period of immobilization. (Low level of evidence)
There is low quality evidence of clinically marginal benefits for cross education involving strength training of the non-fractured upper extremity during period of immobilization with or without surgical repair. (Handoll HHG et al, 2015)

Mirror Therapy (lacks evidence)
In one pilot randomized study of distal radius fractures, the use of mirror therapy along with conventional hand therapy versus hand therapy alone did not have any difference in patient pain level or their level of disability. (Bayon-Calatayud M, 2016) One moderate quality RCT found conventional therapy plus the use of mirror therapy along with a mirror therapy home program resulted in significantly improved range of motion and functional scores versus no mirror therapy. (Roll, Hardison, 2017).

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Dynamic Splinting (No Evidence)

For contractures which develop after a distal radius fracture, there is no evidence to support dynamic splinting as superior to standard care in improving range of motion or occupational performance. (Roll, Hardison, 2017).

Home and Self-Care Techniques

It is necessary for patients to understand the importance of early motion while protecting the surgical repair. The home program for postop wrist ORIF conditions should include edema control techniques, use of protective orthosis, pain control techniques, range of motion and ADL's. The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition.

Home Medical Equipment

- Cold packs
- Compression glove/sleeve for edema control
- Orthosis
- Resistance band/putty for therapeutic exercises
- Heat packs

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Home exercise program for edema control
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected hand

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Osteopathic manipulation
- Chiropractic
- Medication
- Massage

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Wrist Nonspecific

Diagnoses included:

- Extensor Carpi Ulnaris (ECU) injury
- Triangular fibrocartilage complex (TFCC) injury
- Ulnar impaction

Definition

Extensor Carpi Ulnaris (ECU) injury:
The extensor carpi ulnaris function depends on the position of the wrist. In supination, the tendon lies dorsal to the center of rotation of the wrist and contributes to extension. The tension on the ECU is greatest during activity involving supination and holding the wrist in flexion and/or ulnar deviation. When in pronation, the tendon lies more palmar and ulnar to the center of rotation and contributes less to wrist extension. ECU pathology is more common in wrists with negative ulnar variance. Ulnar sided wrist pain can be the result of an unstable ECU which is usually caused by an acute event or a tendinopathy which is usually a more insidious onset. (Pang et al, 2017)

TFCC/DRUJ:
The TFCC is responsible for stability across the distal radioulnar joint (DRUJ). The TFCC has rich blood supply at the outer articular disc and very poor blood supply in the disc lying between the ulnar head, lunate and triquetrum. Therefore, injury to the central and radial portion of the TFCC has significant limited ability to heal following an injury. Surgical intervention for a TFCC injury that does not respond to conservative treatment depends on where the lesion is located. If it is in the highly vascularized area it is often repaired and if it is in the poorly vascularized area it is most often debrided (Watanabe et al, 2010)

In the case of TFCC and DRUJ pathology, there may be a specific traumatic injury (usually affecting the peripheral disc) or in chronic cases of ulnar sided wrist pain, there may be degenerative injuries(usually affecting the central disc). Pain is generally localized to ulnar wrist and increases with activities that load the wrist or with pronation/supination motion.

Ulnar impaction:
This condition results from impaction between the ulnar carpal bones and the ulnar head. The condition tends to occur where there is a positive ulnar variance and degenerative/osteoarthritic conditions in the wrist. (Watanabe et al, 2010). Symptoms are more pronounced in pronation (Altman, 2016)

Acute traumatic injury usually results from a notable traumatic event. Most injuries involve hyperextension and ulnar deviation, although ulnar sided lesions may also be

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caused by direct blows and flexion injuries. Patient may report hearing a pop with immediate swelling and pain.

Chronic overuse injuries can be the result of repetitive ulnar loading and may present with vague ulnar sided pain without a specific injury. Professions including mechanics and plumbers may be more likely to have a chronic injury with ulnar sided wrist pain

Chronic degenerative problems can be secondary to prior traumatic events including previous injuries that have altered the anatomy of the wrist (ie, malunioned distal radius fracture or radial shortening following a radial head fracture)

Patient History

- General demographics
- Occupation/employment/leisure
- Living environment
- History of current conditions (mechanism of injury, location, and duration of symptoms)
- Functional status and activity level
- General health, comorbidities, medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior hand surgery and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician. See Table below).
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine nature and extent of traumatic event.

Differential Diagnoses (Shin et al, 2004)

Nonunion or malunion of hamate, pisiform, triquetrum, ulnar styloid process, distal ulna or radius, or base of the 5th mectacarpal

- Bone cysts
- Complex regional pain syndrome
- Guyon's tunnel syndrome
- Ligament injuries (lunotriquetral, capitohamate, ulnolunate, triquetrocapitate, triquetrohamate)

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Red Flag	Possible Consequence or Cause
Severe trauma	Ligament tear
Fever, severe pain	Infection
Loss of distal pulse	Compartment syndrome
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases
Unilateral edema	Deep vein thrombosis
Cancer	Cause of symptoms (metastatic or primary)
Discoloration of wrist or hand; delayed capillary refill	Arterial occlusion; arterial insufficiency
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

- Two or more of the following findings must be present to establish medical necessity. At least one of the findings must address functional limitation. Degree of abnormality should be specified at initiation of therapy, and periodically, to establish an objective response to therapy:
  - Functional Outcome Measurements showing significant functional limitations using the Patient Specific Functional Scale (PSFS)– with combined average score of 7/10 or less for 3 items (Minimum detectable change (90%CI) for average score = 2 points (Horn, K. K., 2012)) OR the DASH OR QuickDASH with a score of 11 or higher (Minimally Clinically Important Difference of 10 and 15 points respectively (Franchignoni, F.,2014))
  - ROM: < than functional motion (refer to **Maximal Complex Motion Necessary for Functional Activities**)
  - Pain: limiting function and at least 3/10 50% of time
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
  - Natural history and chronicity of condition,
  - Expectation for functional improvement with skilled intervention,
  - And response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time
  - Range of Motion remains below what is required for personal care or essential employment requirements (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Reduction in complicating factors (such as positive neurological signs)
  - The patient is unable to maintain progress independently

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Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care.
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Ulnar sided wrist pain
- Pain with ulnar deviation and loading of the wrist
- Pain with hyperextension of the wrist
- Patient may report clicking or catching in the wrist
- Pain with pronated ulnar deviation and grip (ulnar impaction)
- Pain with supination/pronation

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Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for wrist conditions. (Shin et al, 2004) Wrist pain is a common problem seen in hand therapy clinics and because it can be an ambiguous complaint, it can be a challenge to evaluate and treat. Using a systemic approach to the evaluation helps clinicians recognize pathology and estimate the potential efficacy of therapy and the eventual prognosis. (Porretto-Loehrke A et al, 2016))

- Inspection
  - Look for previous surgical scars
  - Prominence of ulna (may indicate some degree of instability of DRUJ)
  - Decreased turgor in the volar digital pads suggest vascular insufficiency
  - Skin color, temperature and hair growth compared to contralateral side
- Passive Range of Motion (PROM) /Active Range of Motion (AROM)
  - AROM and PROM ipsilateral and contralateral sides (wrist flexion, extension, radial deviation, ulnar deviation, pronation, supination)
  - End feel of ipsilateral and contralateral sides
- Resisted testing with isometric resistance to wrist, forearm and elbow in static position
- Pain Level
- Specific Provocative Tests:
  - Piano key test
  - Ulnocarpal stress test
  - Pisiform boost test
  - DRUJ ballottement (ballottement of ulna)
  - Dynamic examination of the ulnar head with active pro/sup
  - ECU subluxation test
  - LT (lunotriquetral) ballottement
  - Fovea Sign
  - Press Test
  - Palpation (this is the final aspect of an evaluation as palpating the painful structure before performing the evaluation may increase overall pain and skew the results. Also, palpation is the least reliable part of a wrist evaluation).
  - Tenderness over anatomic structures (ie, TFCC, pisotriquetral joint, DRUJ, ECU)
- Outcome measures (Very good documentation and very good level of evidence)
  - DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2014)
  - Quick DASH (Franchignoi F, MD, 2014)
  - Patient Specific Functional Scale (Horn, 2012)
  - PRWE (Patient Related Wrist Evaluation) (Sorensen et al, 2013) (Walenkamp, 2015)

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Management/interventions

No specific research was found with moderate to high levels of evidence to help determine specifics for treatment of patients with ulnar sided wrist pain. In addition, no research was found on the level of functional improvements with therapy.

Literature reports the common conservative approach with patients having ulnar sided wrist pain include initial treatment of rest/splint to painful wrist. (Time of immobilization varies from 4-8 weeks). Following immobilization, therapy progresses with ROM, pain control, edema control and then eventual progression to strengthening and finally to resumption of sports if patient is an athlete. No specific timelines have been found for the progression of therapy. The clinician must use their professional skills to modify progression as indicated. If non-operative treatment does not relieve the symptoms, surgery may need to be considered.

ECU Splint

Conservative management for ECU subluxation consists of splinting to restrict supination and ulnar deviation as these motions are what lead to subluxation in the injured ECU. (Altman, 2014) In one case study of a female college athlete with ECU subluxation, a short arm cast for 4 weeks was not effective in stabilizing the ECU. However, a long arm cast with the wrist in slight extension, radial deviation and pronation for 4 weeks followed by splinting and rehab, was effective in stabilizing the ECU and resolving symptoms. (Patterson et al, 2011)

DRUJ instability Splint

Circumferential bracing that attempt to maintain the relationship between the distal radius and ulna with forearm rotation can be effective for people with chronic DRUJ instability without arthrosis. (Altman, 2014)

TFCC splint

Preventing forearm pronation/supination and wrist motion with splinting may help with TFCC injuries. (Altman, 2014)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

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Activity of Daily Living (ADL)

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010)

Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).

There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004)

Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010)

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

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Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014) This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physical injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):

- Focus on return to function with management of pain rather than resolution of pain.
- Provide a more targeted approach with importance on self-management.
- Selection of activity that does not exacerbate symptoms.
- Home programs be continuous, progressive and part of daily routine.
- Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).
- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

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Home and Self-Care Techniques

The home program is central to the care of all patients. The teaching for this program should be started on the first day of therapy and continue throughout the formal therapy program with a planned transition. It is crucial for patients to understand the need for initial rest/immobilization with slow progression back to functional use of wrist and hand.

Home Medical Equipment

- Cold packs/heat packs
- Orthosis
- Theraband/theraputty for therapeutic exercises

Self-Care Techniques

- Instruction in proper fit/purpose of any orthosis
- Cold pack/hot pack, if needed, to relieve discomfort
- ROM exercises
- Progression to therapeutic exercise - strengthening exercises
- Resumption of ADL's with affected hand

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Medication
- Injection
- Surgery

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Wrist Tenosynovitis

Diagnoses Included:

- DeQuervain's Tenosynovitis
- DeQuervain's Tendonosis
- Wrist Tenosynovitis
- Radial Styloid Tenosynovitis
- Tenovaginitis
- Nicknamed "blackberry thumb" or "texting thumb"

Definition

Tenosynovitis is inflammation of the synovial sheath surrounding the tendon. It gives rise to pain that is aggravated by active movements of the tendon or by passive stretching. In de Quervain's disease, the tendons of the abductor pollicis longus and the extensor pollicis brevis at the styloid of the radius pass through a thick tendon sheath that frequently becomes stenosed and inflamed and produces symptoms. It is a relatively common, uncomplicated, and noncontroversial musculoskeletal disorder of the wrist.

Patient History

- General demographics
- Occupation/employment
- Living environment
- History of current conditions
- Functional status and activity level
- Medications
- Other tests and measurements (laboratory and diagnostic tests)
- Past history (including history of prior therapy and response to prior treatment)

Special Considerations

- Rule out red flags (require medical management and/or referral to physician).See Table below
- Identify co-morbidities requiring medical management, and those that affect therapy management.
- Determine if trauma-related; determine nature and extent of traumatic event.

Differential Diagnoses

- Articular cartilage pathology including neoplastic pathology
- Carpal Tunnel Syndrome
- Cellulitis
- Compartment Syndrome Extremity
- Gout and Pseudogout
- Infection
- Intersection syndrome
- Osteoarthritis
- Osteonecrosis

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- Reiter Syndrome
- Rheumatic Fever
- Spastic contracture in hemiplegia
- Trigger finger
- Ulnar nerve paralysis

Red Flag	Possible Consequence or Cause
Severe trauma	Fracture, ligament tear
Fever, severe pain	Infection
Diabetes	Neuropathy
Multiple joint involvement	Rheumatologic diseases, gout
Cancer	Cause of symptoms (metastatic or primary)
Unilateral edema	Upper extremity deep vein thrombosis
Discoloration of arm or hand	Arterial occlusion
Immune-compromised state	Infection

Requirements for Physical/Occupational Therapy Visits

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  - ROM: < than functional motion (refer to Maximal Complex Motion Necessary for Functional Activities)
  - Pain: limiting function and at least 3/10
  - Neurological signs: altered reflexes and/or sensations
- Treatment frequency and duration must be based on:
  - Severity of objective clinical findings,
  - Presence of and number of complicating factors,
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  - Expectation for functional improvement with skilled intervention,
  - Response to treatment provided
- A request for continued services may be considered reasonable and necessary when 1 or more of these conditions are met:
  - Minimally Clinical Important Difference has been met in the Functional Outcome Measure and the score meets medically necessary threshold
  - The Numeric Pain Rating Scale is reduced by 2 or more points but remains above 3/10 for 50% of the time

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- Range of Motion remains below what is required for personal care or essential employment requirements (refer to Maximal Complex Motion Necessary for Functional Activities)
- Reduction in complicating factors (such as positive neurological signs)
- The patient is unable to maintain progress independently

Discharge Criteria

- The patient is discharged when the patient/care-giver can continue management of symptoms with an independent home program.
- Discharge occurs when reasonable functional goals and expected outcomes have been achieved.
- Therapy is discontinued when the patient is unable to progress towards outcomes because of medical complications, psychosocial factors or other personal circumstances.
- Repetitive exercise for range of motion, flexibility, or strengthening does not generally require the skills of a therapist beyond establishing the program and/or periodic reassessment related to significant change in the patient's condition. Therapy is discontinued when services become routine or repetitive in nature, indicating they are not of a skilled nature.
- Therapy is discontinued when the patient is no longer objectively demonstrating benefit from therapy including but not limited to, lack of meeting Minimally Clinical Important Differences in pain and functional outcome measures
- No minimal objective clinical improvement has been made after 6 weeks of direct care
- If the member has been non-compliant with therapy as is evidenced by the clinical documentation, and/or the lack of demonstrated progress, therapy will be deemed to be not medically necessary and the member should be discharged from therapy.
- Therapy services are not considered medically necessary for pain mediation alone. The goals of therapy are for improvement in restoration of function, motor ability, and range of motion.

Subjective Findings

- Complains of loss of function
- Localized tenderness at the radial styloid
- Proximal radiating symptoms may be present
- Pain may radiate distally along the thumb
- Women (particularly postpartum) are more likely affected than men.
- There may be palpable thickening of the sheath present, with crepitation on movement.

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Specific Examination Considerations

Therapy evaluations need to include appropriate clinical histories along with objective findings for wrist conditions. There is high level of documentation for objective wrist evaluations. (Hunter, 2002)

The evaluation may include:

- AROM and PROM of wrist, thumb and elbow (ipsilateral and contralateral joints)
- Manual muscle testing of wrist, thumb and elbow (ipsilateral and contralateral joints)
- Grip strength testing
- Pinch strength testing
- Edema measurements of wrist
- Sensitivity testing of wrist and hand

Finkelstein's Test is used to diagnosis DeQuervain's with high level of documentation and good level of evidence. (Batteson, R)

Outcome measures (Very good documentation and very good level of evidence)

- DASH (Disability of the arm, shoulder, and hand questionnaire) (Franchignoi F, MD, 2013)
- Quick DASH (Franchignoi F, MD, 2013)
- Patient Specific Functional Scale (Hefford, 2012)
- Hand Assessment Tool (Sanjiv HN, 2009)

Management/Intervention

Treatment with moderate level of evidence:

- Splinting: moderate level of evidence and documentation to support the use of orthosis to manage tenosynovitis. Most recommended splint is one that immobilizes wrist in neutral, 30 degrees of CMC joint flexion and 30 degrees of thumb abduction with thumb IP free. (Ilyas AM, 2007) (Ritu G)
- Splinting for pain control: There is moderate level of evidence that splints help control the pain associated with tenosynovitis however, there is no definitive evidence on whether or not the splint should be used full time, at night only, or only with painful activity. (Ilyas,2009)
- Cortisone injection: Moderate evidence supports cortisone injection as a treatment of choice for DeQuervains. (Peters-Veluthamaningal) (Richie CA)
- Cryotherapy provides acute relief of tendonopathies. The most effective use of cold is melting ice water through a wet towel for 10 minutes (moderate evidence) (Wilson

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Clinical Interventions lacking sufficient evidence

There is no gold standard on the treatment of DeQuervain's. Research is lacking in the study of specific treatments and the results of such treatments. Some of the commonly used and widely accepted treatments include: Ultrasound, icing, splinting, stretches, eccentric strengthening, friction massage, and activity modification.
One study found that kinesiotaping was more effective than physical therapy treatment of paraffin, ultrasound and friction massage. (Keynoosh H)
One study found that Graston Technique and eccentric training decreased pain and increased DASH scores. More studies need to be done on this treatment. (Papa JA)

Pediatric and Adolescent Considerations – Orthopedic/Musculoskeletal

There is limited evidence specific to general rehabilitation of musculoskeletal issues in children and adolescents versus adults. As there may be differences in these populations some consideration may be needed in determining the need of skilled care. This does not include significant issues due to developmental delay. The following may guide review decisions in regards to younger patient care:

Activity of Daily Living

Children need to play and explore their environment for myriad of benefits. Their "work" should involve participation at home, school and socially with age matched peers. This could include participation in recess, physical education, play and other physical activities similar to peers; navigating school hallways, physical and educational requirements, socializing with peers and employment for adolescents (Isenberg JP et al 2002). Sport participation is not a required daily activity at any age. Skilled care to assist in returning to a chosen activity may be needed based on a patient's presentation and inability to perform the above functions.

Attention/Task Completion

There is some evidence that attention is still changing up to approximately 17 years of age. There may be more impulsivity in approach to tasks, especially up to about age 15. Some minor allowance with highly structured programs for young children/teens may need to be made due to attention span differences. (Fortenbaugh et al 2015, DiFiori et al 2010).
Adolescents can be effective with taught self-care, manual, soft-tissue mobilization; resulting in improved function over a 5 week period of time. Adolescents can complete progressive home programs that include self-manual technique. (Le Gal et al 2016).
There is moderate evidence that adherence to medical self-care programs are higher in pediatric/adolescent populations than in adults. Adherence does not appear to be a function of illness severity or age and gender, but likely more on socioeconomic and psychological issues. Based on systematic reviews of over 56,000 subjects, comparing adult to pediatric adherence. (DiMatteo et al 2002, 2004).

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Growth/Maturation

Youth have shown similar results, as adults, to adult rehabilitation programs in skilled care of patello-femoral pain, ACL reconstruction, ankle sprain and spondylolisthesis, among others. There is no evidence that physical therapy in general be more involved due to age. It has been suggested that due to generally faster healing times younger populations may require less/no treatment depending on presentation. (Van Middelkoop et al 2017; Cohen et al 2010).

Some concern may be made for patients receiving care during rapid growth periods. These generally peak at 12 for females and 14 for males; with some continued growth until skeletal maturity. Immature tendon-bone attachment sites and physis are at risk for overuse injury. So far, growth has not been shown to be related to decreased flexibility. (DiFiori et al 2010). There is no evidence to indicate additional treatment is needed due to a growth spurt as long as the patient is progressing.

Adolescent tendon development can be out of balance with muscle development. Consideration should be made of the properties of developing tendons and the stress placed over them. (Mersmann et al 2014). This may guide treatment dosing as well as rest to avoid excessive stress.

Overuse/Sport

Overuse physical injuries in youth are common and often related to overuse during sport participation. Risk factors include periods of accelerated growth, age, body size, training volume and previous injury. These factors should be monitored to assess the need of limitation in physical activity. The most effective treatment after an overuse injury was extended periods of rest (Arnold et al 2017). Structural abnormalities seen in patello-femoral pain appear similar in adolescents and adults; as does clinical presentation (Van Middelkoop et al 2017).

Hypermobility

Adolescent athletes with hypermobility did not appear to have more injury frequency or lower muscle function than those without (Schmidt et al 2017). Children with Joint hypermobility/Ehlers-Danlos syndromes that participate in dance have fewer joint pain and instability reports (Nicholson et al 2017). Adolescents with hypermobility do not appear to have more pain-related fear or perceived disability compared to non-hypermobile peers (Van Mulenbroek et al 2017). There does not appear to be evidence that patients with hypermobility require more intensive treatment.

- Recommendations (based mostly on level 4-5 evidence) from Cincinnati Children's Hospital Medical Center on the care of youth with hypermobility (CCHMC 2014):
  - Focus on return to function with management of pain rather than resolution of pain.
  - Provide a more targeted approach with importance on self-management.
  - Selection of activity that does not exacerbate symptoms.
  - Home programs be continuous, progressive and part of daily routine.
  - Use of habitual physical activity that promotes neuromuscular control in a pain-free way (swimming, yoga, tai chi).

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- Visits be scheduled using a periodic model that allows enough time for the patient to establish regular HEP performance and make mild improvement prior to being seen again.
- More therapy may be recommended during pubertal changes if showing decline in function.

Home and Self-Care Techniques

Instruct patient on avoiding pain provoking activities. The patient can be taught self-stretching, use of thumb spica orthosis, cross friction massage and progressive strengthening. It is also important to educate patients in proper ergonomics. Patients should understand the need to minimize forceful exertions and repetition.

Home Medical Equipment

- Cold packs
- Heat packs
- Theraband for strengthening
- Theraputty for strengthening
- Thumb spica orthosis

Self-Care Techniques

- In acute phase, reduce strenuous activity. Cold packs and orthosis
- Instruction in home exercise program for ROM and stretching
- Progress strengthening exercises as tolerated
- Proper work station set up, proper body mechanics
- Cold packs/hot packs, if needed, to relieve discomfort

Alternatives/Adjuncts to Physical/Occupational Therapy Management

- Surgery
- Medication
- Injection
- Acupuncture

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Pediatric

Autism Spectrum Disorder	**700**
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Autism Spectrum Disorder

Definition (DSM V)[12]

Autism spectrum disorder (ASD) is characterized by: (A) Persistent deficits in verbal and non-verbal communication and social interaction across multiple contexts. (B) Restricted, repetitive patterns of behavior, interests, or activities. (C) Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life). (D) Symptoms cause clinically significant impairments in social, occupational, or other important areas of current functioning. (E) These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay.

Synonyms[12]

- Autism
- Autistic disorder
- Asperger's disorder
- Pervasive developmental disorder- not otherwise classified
- Rett syndrome- if they meet diagnostic criteria for Autism
- Childhood disintegrative disorder- if they meet diagnostic criteria for Autism

Prevalence

Autism spectrum disorder currently affects approximately 1 in 68 children in the United States, with an overall estimate of 1 in 160 individuals worldwide.[5] There is a higher prevalence of autism in boys versus girls (4 to 1). Risk factors include both genetic and environmental factors. Genetic factors account for 50%. The critical window for environmental exposure is uncertain, however evidence suggests the prenatal period is significant.[12]

Presentation

Children with ASD vary widely in their presentation. Autism is a complex, pervasive, heterogeneous condition with multiple etiologies, sub-types, and developmental trajectories. Due to this, high level clinical research is challenging as there is extensive variability in presentation and response to intervention. [22, 25] Therapy practitioners work collaboratively with individuals on the autism spectrum, their families, other professionals, organizations, and community members. Treatment of ASD is usually multidisciplinary, involving physicians, speech, occupational, and physical therapists, behavioral and developmental specialists, and other disciplines to address core symptoms and related developmental and functional deficits[7].

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Potential areas of deficits:[5]

- ADLs
- IADLs
- Sleep
- Play/Leisure
- Social/communication
- Education
- Work performance
- Sensory integration & modulation
- Behavior
- Cognition
- Motor planning & coordination
- Strength

Overview:

Therapy services with children with autism should include individualized assessments and intervention plans that promote collaboration among the therapists, family, and additional caregivers throughout the lifespan to achieve best results.[18] Services can be provided to the client at the person, group, and population levels and may include direct service, consultation, education, and advocacy to support the person, family members, health professionals, educational staff, and community agencies.[5] Research shows that age of entry into services is a key factor in predicting outcomes.[35] Therapy intervention services should be intensive and comprehensive and facilitate active engagement of the individual. The literature provides support for the use of developmental and behavioral approaches to intervention, particularly for young children.[5]

Purpose of Therapy:

PT Role: Physical therapists provide services that help restore function, improve mobility, relieve pain, and prevent or limit permanent physical disabilities in patients with injury or disease. They restore, maintain, and promote overall functional potential. Physical therapy improves participation in daily routines at home and school, acquisition of new motor skills, development of better coordination and a more stable posture, improvement of reciprocal play skills, development of motor imitation skills, and increase fitness and stamina (apta.org).

OT Role: Occupational therapy helps people function in all of their environments (e.g., home, work, school, community) and addresses the physical, psychological, and cognitive aspects of their well-being through engagement in occupation (aota.org). In respect to autism, the role for occupational therapy is to help families adapt activities, routines, and environments to increase the participation of the child in family life and to educate parents about the relationship between sensory processing and environments. Occupational therapy helps to restore family occupations.[9]

The World Health Organization (2001) considers full participation in daily activities and routines as the ultimate indicator of health and functioning. Moreover, the achievement of intellectual, physical, social, emotional, and communicative potential in childhood is dependent on full occupational engagement.[8]

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Critical Periods or Lifespan Considerations

Therapy practitioners work with people with ASD beginning in early childhood and provide interventions to prepare them for the transition to adulthood.[10] ASD symptoms persist and their individual needs change throughout the lifespan. Research has shown that early detection and treatment along with periodic reassessment and intervention throughout the lifespan leads to better outcomes and quality of life.

Early intervention (EI) programs are provided to children between the ages of 0 and 3 years. Research has found that children with ASD who receive therapy prior to age 4 have demonstrated the ability to be enrolled in regular education classrooms, whereas children that initiated services after age 4 remained in special education programs.[35] Symptoms, such as sensory and motor impairments, and atypical brain development and function are apparent in the first 12 months and may precede behavioral symptoms.[28] Emphasis on early intervention and support for caregivers will lower healthcare costs in the long term.[14] As the child ages, therapy services moves from a focus on non-verbal communication and play skills to involving higher level communication and behavior skills. Motor and coordination based services are addressed as developmentally appropriate. As the child reaches school age, services may address needs for active participation and education based performance.[18] Therapy intervention for adults with autism focuses on education and training of the client, parents and additional care providers to include vocational training and management of day to day activities.[29]

Assessment

Standardized testing should be completed during the evaluation. Criterion referenced testing and skilled observational information should also be included, especially when standardized testing was unable to be completed due to a specific reason. The evaluation should include an assessment of the following areas as related to age/developmental stage and appropriateness:

- ADLs
- IADLs
- Sleep
- Play/Leisure
- Social/communication
- Education
- Work performance
- Sensory integration & modulation
- Behavior
- Cognition
- Motor planning & coordination
- Strength

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Standardized Pediatric Tests [17, 20]

Skill Area	Test
Motor	Alberta Infant Motor Scale (AIMS)
	Battelle Developmental Inventory (BDI)
	Bayley Scales of Infant Motor development (BSID-III)
	Bruininks-Osteretsky Test of Motor Proficiency, Second Edition (BOT-2)
	Developmental Assessment of Young Children (DAYC)
	Developmental Profile 3 (DP-3)
	Developmental Test of Visual Motor Integration (VMI)
	Developmental Test of Visual Perception (DTVP 2 & 3)
	Gross Motor Function Measure (GMFM)
	Miller Function and Participation Scales (M-FUN)
	Motor-Free Visual Perception Test (MVPT)
	Movement Assessment Battery for Children, Second Edition (Movement ABC-2)
	Peabody Developmental Motor Scales, second edition (PDMS-2)
	Pediatric Evaluation of Disability Inventory (PEDI) (PEDI-CAT computerized adaptive test)
	Pediatric Quality of Life Inventory (Peds QL)
	Test of Gross Motor Development – 2 (TGMD-2)
	6-Minute Walk Test (6MWT)
ADL/ IADL	Battelle Developmental Inventory (BDI)
	Bayley Scales of Infant Motor development (BSID-III)
	Developmental Assessment of Young Children (DAYC)
	Developmental Profile 3 (DP-3)
	Pediatric Evaluation of Disability Inventory (PEDI) (PEDI-CAT computerized adaptive test)
	Pediatric Quality of Life Inventory (Peds QL)
	The Roll Evaluation of Activities of Life (The REAL)
	Vineland Adaptive Behavior Scales (Vineland II & III)
Sensory	Sensory Integration & Praxis Test (SIPT)
	Sensory Processing Measure (SPM)
	Sensory Profile (SP) & Sensory Profile 2 (SP-2)
Social	Battelle Developmental Inventory (BDI)
	Bayley Scales of Infant Motor development (BSID-III)
	Developmental Assessment of Young Children (DAYC)
	Developmental Profile 3 (DP-3)
	Pediatric Evaluation of Disability Inventory (PEDI) (PEDI-CAT computerized adaptive test)
	Pediatric Quality of Life Inventory (Peds QL)
	Sensory Processing Measure (SPM)
	Vineland Adaptive Behavior Scales (Vineland II & III)

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Admission Criteria

- Medical diagnosis of ASD is made or child is deemed at risk.
- Standardized test scores are 1 standard deviation or more below the mean.
- Skilled observational statements and/or criterion based testing indicates a functional deficit.
- Identified deficit can be measured and progress demonstrated throughout the treatment plan.
- Client is in need of additional caregiver education, updated home program, and equipment needs.
- The child must demonstrate active engagement in the therapeutic activities.[5]

Therapy Management

Frequency, Intensity & Duration:

The overall frequency, intensity, and duration of skilled therapy services for children with autism will vary widely based on their presentation of multiple factors: age, severity of deficits, potential for progress, support system, cognitive level, developmental level, temperament and personality. Therefore, intervention could include direct services ranging from periodic maintenance to three times per week. Brief episodes of care may be needed throughout the lifespan.[37] Research shows that children with autism benefit from 1 on 1 learning throughout the day.[35] They benefit from intensive, comprehensive intervention of up to 40 hours per week with the majority of intervention delivered within a home program carried out by parents/caregivers, teachers etc.[34, 35, 37] Of the multiple factors related to treatment, the factor that produced the most significant positive outcomes was duration of treatment.[35] Predictors of success were found to be: imitation, language, daily living skills, and socialization. Rapid acquisition of new skills and change in IQ after 1year of treatment were strongly predictive of favorable outcomes.[34]

Therapy services must be periodic and episodic to address specific functional problems related to emerging issues of health, growth, development, and family needs. Frequency and duration of treatment typically diminishes with age, but new issues emerge over the lifespan that may require short periods of intervention. Periodic skilled maintenance care is also appropriate to prevent loss of a functional skill or enhance the adaptation to such functional loss. Best practice therapy avoids learned helplessness and dependence on therapy. It fosters the child's competence in his or her environment, prevents secondary complications and disability, and uses home programs and other community resources to promote independence.[36]

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Treatment Areas:

Sensory:

Sensory features (i.e. hand flapping, spinning, ear covering, etc.) affect daily functioning and are seen in 80- 95% of children with autism.[15,20] Children with autism do not demonstrate the expected improvement in these skills as with typical development. As supported by two separate systematic reviews by Case-Smith (2015) and Watling (2015): clinic based sensory integrative therapy (SIT) and multi-sensory based interventions (mSBIs) show improvement in sleep, eating, sensory behaviors, attention, ADLs, relaxed content state, and social skills. However, Tomcheck and Koenig (2016) says the evidence for the use of SIT to improve sleep, adaptive skills, autism features and sensory processing is weak or insufficient. Single sensory based intervention (sSBI) are shown not to be effective.[2, 10, 19, 38]

- SIT, developed by Ayres, provides play-based activities with enhanced sensation to elicit and reinforce the child's adaptive responses. SBI: structured, adult-directed sensory strategies that are integrated into the child's daily routine to improve behavioral regulation. SIT for children (3x/week for 6-10 weeks) with ASD and sensory processing problems demonstrates positive effects on the child's individualized goals (per parent and teacher report) and sSBIs have almost no evidence of positive effects.[19]
- Weighted vests and auditory integration training when used as a single strategy (sSBI), do not have evidence documenting their effectiveness.[2, 38]
- Clinic-based mSBI included enhanced vestibular, proprioceptive, and tactile sensory experiences. Active participation in mSBIs demonstrated increases in sustained focus, decreases in self-injurious behavior, and increased perceived relaxation and happiness were found after independent participation in a multisensory center.[2]

Behavior:

Early (0-6 years) intensive (direct and indirect services of 20-40 hours per week) behavioral interventions that occurred over 14-36 month durations showed benefits for adaptive behavior, cognitive performance, expressive language, receptive language, daily communication skills, socializing and daily living skills.[16, 23, 37] Applied behavior analysis (ABA) principles can be applied with sensory-based strategies for better outcomes. Examples of behavior interventions: discrete trial training, Early Intensive Behavioral Intervention, incidental teaching, Picture Exchange Communication System, pivotal response training, and Treatment and Education of Autistic and related Communication Handicapped Children (TEACCH), and cognitive–behavioral therapy[6]

- A blend of behavior-based and sensory-based interventions can improve feeding skills and behaviors.[10]
- There is moderate evidence to support behavioral techniques to address restricted and repetitive behaviors.[8]

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- Children with ASD (with or without intellectual disability) and co-occurring psychiatric conditions, when compared with children with ASD and no psychiatric conditions, were more likely to have unmet developmental needs—both in terms of receiving all necessary treatment and services as well as in seeing all necessary providers. Special considerations should be given for further service and treatment options that address their distinct behavioral and emotional challenges.[26]
- Behavioral interventions have been shown to improve parental self-efficacy, confidence and competence. Behavioral interventions, relaxation and mindfulness training show weak/insufficient evidence to improve parental stress and family coping.[38]

ADL/IADLs:

Intervention is effective for children and adolescents with ASD to improve self-care and play. Interventions include the use of activities that promote social interaction, problem solving, and pivotal behaviors (e.g., joint attention, initiative, persistence, executive functioning, and cooperation) and address specific skill acquisition. Effective interventions also address contextual factors such as structure, consistency of routine, sensory environments that optimize attention and arousal, and caregiver skills that contribute to occupational performance.[5] Cognitive–behavioral approaches have been shown to improve ADLs and IADLs. Technology-enhanced interventions have been shown to have insufficient evidence to improve ADL performance.[38]

- ADLs such as feeding, dressing, and personal hygiene are often priorities for parents of children with ASD because they increase a child's ability to live independently and decrease the need for one-on-one assistance in the home and community.[10]
- IADLs such as meal preparation, shopping, home maintenance (e.g. chores, cleaning), health management (e.g. fitness), and communication management (e.g. telephones) are relevant to independent living and community engagement.[10]
- Foundational skills in ADLS and IADLs allow people to participate in other critical activities such as education and work.[10]

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Motor Coordination:
Motor skills are generally more advanced than language or social skills in children with ASD. However, motor problems can also be significant. Gross and fine motor skills such as gait, ball skills, balance, dexterity, motor imitation, handwriting, cutting with scissors and sense of rhythm may be delayed.[37] Children with ASD often present with motor and coordination deficits that would benefit from therapeutic intervention. These motor deficits are evident at an early age for children who are at risk for autism, and these motor deficits may persist through to adulthood. The early detection and treatment of these deficits leads to better outcomes. Children with autism learn best through self-exploration and play. They should be taught new motor skills by being given one demonstration followed by open play and problem solving of the task.[3, 13] Children with ASD utilize proprioceptive information rather than visual feedback when learning new motor tasks. However, they use visual feedback information to maintain appropriate force.[24, 30]

- Studies have shown an observable difference in motor development trajectory between ages 2 and 6 months in high risk and low risk individuals for autism.[21]
- Early detection and intervention of motor impairments including grip strength, motor speed, and bringing hands to midline support acquisition of later cognitive, language and gestural skills in infants at high risk for ASD.[3, 21]
- The ASD population has difficulties processing somatosensory and visual information. This affects postural and upper limb control. This impacts perceptual-motor skills and social functioning.[26]
- The fine motor task that dominates a child's school day is handwriting. Children on the autism spectrum often have poor handwriting legibility, which hinders their academic achievement.[1]

Strength:
Deficits in strength strongly impact functional and age appropriate motor skills in individuals with ASD. Deficits are apparent from a young age and persist through adolescence and early adulthood. Strength may initially be addressed with direct services and then transitioned in a short period of time to indirect services with a home program.

- Improvement of grip strength may lead to greater independence in functional activities involving self-care, school tasks, and play.[3]
- Decreased grip strength negatively impacts pencil control in ASD. Pinch strength does not affect pencil control. In ASD, grip and pinch strength (or pencil control) does not affect handwriting legibility. Grip and lateral pinch only (not neat, pinch or tripod pinch) has a significant impact on functional skills (ADLs).[1]

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Sleep:
Research indicates that between 50% and 80% of children with ASD are estimated to have sleeping difficulties. Sleep and rest are important for optimal functioning in ADLs, IADLs, education, and work.[10] Therefore it is important to address these issues to improve overall outcomes.

Education:
School readiness and successful participation in formal education creates opportunities for children to develop life skills and become active members of the community. Specialized support and strategies may be necessary to facilitate a meaningful and effective academic experience.[10]

- Brief physical exercise before academic tasks can help with accuracy but not with attention or stereotypic behaviors.[10]

Work:
Research supports that when individuals with ASD can participate in work and ADLs, they achieve a higher quality of life and improved self-efficacy and self-sufficiency. Therapists have the skills and expertise to address vocational skills and employment during the middle and high school transition points. Implementing effective interventions will be critical to the economy and workforce as a growing number of young adults with ASD seek postsecondary options. [10]

- Supported self-management, video prompting, video modeling, and supported employment interventions result in moderate effects on work performance. [10]
- Use of mobile and tablet technology to teach vocational tasks is one of the most studied and effective strategies for increasing functional performance and independence in work among people with ASD. [10]
- Supported employment to improve quality of life and work retention have weak/insufficient evidence.[38]

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Cognition:
Children with autism may present with cognitive deficits. Therapy services address deficits in functional cognition that enable individuals to participate more fully in self-care, work, leisure, and community activities which enhances quality of life while reducing the burden on caregivers and societal resources.[33] Cognitive interventions had significant positive effects for attention, working memory, and memory tasks.[4] Research supports interventions for cognitive therapy predominantly in the home and school.[2, 4, 34] One of the strategies that may be used to address functional cognitive deficits is the Cognitive- Functional intervention. Cognitive-Functional intervention focuses on acquiring executive strategies in occupational performance for important occupations, such as play, self-care, and social participation. This intervention encourages participation by teaching specific strategies and using games and activities to challenge the executive components necessary for success in areas of occupation.[32]

- Computerized training was supervised by parents in children's homes. The number of sessions ranged from 12 to 102 (median 25), with sessions ranging in length from 20 min to 2–3 hours (median 45 minutes). The duration of the interventions ranged from 25 days to 20 weeks (median 6 weeks).[4]
- Cognitive interventions have the potential to support sensory self-regulation among children with identified sensory-processing differences.[31]

Social:
Group based social skills training programs that take place in the clinic & in the community setting show effective results in people with autism. The most beneficial format included a 1 hour session for at least 8 sessions. To increase social communication skills, the use of Picture Exchange Communication System (PECS), joint attention, activity-based intervention, parent-mediated strategies, computer-based interventions, are the most effective techniques. Social stories, classroom-based interventions and peer mediated interventions are not proven to be effective in improving social skills.[8, 38]

Play/ Leisure:
There is moderate evidence of being able to improve leisure participation. Strategies include recess time at school and exposure to social stories. Occupational therapy has shown improvement in self-care and play. Interventions that address contextual factors such as structure, consistency of routine, sensory environments that optimize attention and arousal, and caregiver skills contribute to occupational performance.[5, 8]

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Areas/ Approaches:

Clinicians need to be able to move from a bottom-up approach (addressing client factors/ deficits) to a top-down approach (building on strengths) fluidly when treating children with ASD. Common approaches used with ASD include: SIT, mSBI, relationship-based interventions, developmental skill-based programs, social cognitive skill training, parent-directed or -mediated approaches, and intensive behavioral intervention. Skilled services include the child, family, and others that play a role in the child's life. Therapy outcomes are best if they are family centered and attend to family occupations, daily activities, routines, rituals, and client factors of the child and family. Interventions that incorporate applied behavior analysis (ABA) techniques are beneficial for improving work skills, self-care, play/leisure, and peer engagement and in minimizing the disruption of sensory behaviors.[7, 11] Research for complementary and alternative medicine (CAM) treatments for Autism is inconclusive at this time. Initial results are indicating they are not effective. CAMs include: dietary supplements, vitamins, hyperbaric oxygen, hormone injections, swimming with dolphins, horseback riding, yoga, and massage.[27]

Medically based PT & OT services:

Therapy resources are most responsibly allocated when they are driven by their potential to improve function and not simply by the existence of a diagnosis. Best practice PT and OT avoids learned helplessness and dependence on therapy. It fosters the child's competence in his or her environment, prevents secondary complications and disability, uses home programs and other community resources to promote independence, and recognizes periods of steady state sensorimotor functioning.

Home Medical Equipment

- Safety items and equipment
- Orthotics/Prosthetics
- Wheelchairs with seating systems
- Gait assistive devices
- Augmentative communication devices
- Environmental control units
- Sensory equipment
- Feeding equipment

Self-Management Techniques

- Family/caregiver training in adaptive strategies, therapeutic interventions, and equipment management.
- Parent instruction for children with autism is varied. However, it consistently promotes enhanced communication and interaction–play between the caregiver and the child, a decrease in problem behaviors in the child, and the establishment of effective routines.[6]
- Parent education and coaching provided in a center is valuable to establish an initial and comprehensive home program.[6]

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Adjuncts to Physical/Occupational Therapy Management

- AAC Specialist
- Audiologist
- Behavioral Therapist
- Educational and community based programs
- Family/caregiver
- Nursing
- Nutritionist
- Psychologists
- Respite care
- Social worker
- Specialty physicians
- Speech-Language Pathologist
- Teacher
- Vocational services

Reassessment:

To support ongoing treatment:

- Re-evaluation and testing should be completed every 6 months and must indicate a continued functional deficit.
- Measurable functional progress must be documented. The therapist should be reassessing the effectiveness of the treatment strategies within each skilled session and modifying them as indicated. If progress is not apparent within 6-12 weeks, intervention should be discontinued.[37]
- Functional SMART (specific, measurable, achievable, realistic, and time related) goals on the plan of care.
- Goals must be updated for the next authorization period and should include new or higher level skills that require skilled intervention to achieve.
- The child must demonstrate active engagement in the therapeutic activities.[5]
- Parent compliance and carryover with the home program.

Discharge Criteria

- Goals and objectives of treatment have been met.
- Test scores no longer show a functional deficit requiring skilled services.
- Compensatory strategies are successfully established.
- Individual is unwilling to participate/attendance is poor (efforts to address factors have not been successful).
- No reasonable potential for progress and has not demonstrated measurable functional progress for 3 months.[37]

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- Therapy techniques do not require skilled services.
- When serious medical, psychological and behavioral conditions are limiting tolerance/participation to treatment, therapy services should be postponed if efforts to address the issues are unsuccessful.
- Following discharge, a child may be re-evaluated due to growth changes or new problems or concerns.

Autism Mandates

- Many state legislatures have enacted autism-specific insurance mandates that require for-profit, commercial, health maintenance organization (HMO), and nonprofit health insurance companies regulated by the state to pay for medically necessary and evidence-based autism treatments for certain groups of people. Most state mandates require coverage until the patient reaches a certain age, usually in the range of 19 through 22 years.[14]
- Eighty-six percent of Americans live in a state with some ASD reform statutes or administrative regulations.[14]
- For the good of families, patients, and the country's fiscal situation, we must continue to encourage family member involvement in caring for people with ASD, promote home or community-based care and, as appropriate, reduce reliance on overburdened Medicaid state plan and waiver programs.[14]
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Adolescent Idiopathic Scoliosis (AIS)

Definition

Adolescent idiopathic scoliosis (AIS) is a type of scoliosis which is defined as a three-dimensional deformity of the spine.[1-9] It occurs in individuals between the ages of 10 and 18 years who have a lateral curvature of the spine with a Cobb angle of ≥ 10°. [2,3,10-12]

Target Populations

Inclusions

- 10 years of age and older
- Cobb Angle greater than 10°
- Up to Risser sign 5 (Skeletal Maturity)

Exclusions

- Infantile scoliosis
- Juvenile scoliosis
- Diagnosable cause of scoliosis
- Leg length discrepancy of > 1 cm by means of physical examination
- Lower limb deformities interfering with spinal posture
- Other disease processes (i.e. Muscular Dystrophy, Ehlers-Danlos Syndrome, etc)

Target Users:

- Physical Therapists
- Occupational Therapists
- Physicians
- Patients or Caregivers

Differential Diagnosis

- Infantile Scoliosis
- Juvenile Scoliosis
- Congenital Scoliosis
- Neuromuscular Scoliosis
- Connective tissue abnormalities

Overview of Adolescent Idiopathic Scoliosis

Adolescent idiopathic scoliosis (AIS) is a type of scoliosis that occurs around the age of 10 years and has an unknown cause. [1-3,6,11,12] Other forms of idiopathic scoliosis are juvenile idiopathic scoliosis and infantile idiopathic scoliosis.[4] Other types of scoliosis with known causes include neuromuscular scoliosis (neuromuscular disturbances such as those seen in people who have Muscular dystrophy), congenital scoliosis (failure of formation/segmentation of vertebrae and ribs during development), neurofibromatosis and connective tissue abnormalities, such as Ehlers-Danlos syndrome. [4,11]

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Prevalence of AIS is 1-3%. [1,3,6,7,12,13] AIS may bring about limitations in spinal movement, weakening of spinal musculature, back pain, difficulty in respiratory/pulmonary function, cosmetic deformities, and reduced quality of life.[1,5,6,9,11]

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Normal Development

Gross motor development is generally normal. If there are neuromuscular concerns, the patient most likely does not have Adolescent Idiopathic Scoliosis.

Management and Intervention

The primary goal for rehabilitation for people with AIS is to decrease the progression of the curves which will result in preventing respiratory dysfunction, easing back pain and improving cosmetic deformities. [1,10]

The treatment methods are somewhat controversial. Treatment is generally determined by the Cobb angle and the skeletal maturity of a person with AIS.

Treatment methods and approaches:

- "Wait and See"/Observation:
  - Cobb angle 10-25° in Anglo-Saxon countries [2,9,10]
- Scoliosis specific exercise (Schroth Method):
  - Cobb angle 15-25° in non-Anglo-Saxon countries (may become more popular in Anglo-Saxon countries due to increased evidence supporting)[1]
  - Cobb angle of 15-25° with Risser sign 3 or less (growth)[7]
  - Cobb angle of 11-45° with Risser sign of 4 or 5 (skeletal maturity)[7]
- Scoliosis specific exercise (Schroth Method) and Brace:
  - Cobb angle 25-45°.[1,2]
- Brace only:
  - Cobb angle 25-45° [7,9,10]
- Surgery:
  - Cobb angle greater than 45°. [2,5,7-10]

Interventions supported by evidence:

- Core stabilization (Exercises performed in Ko and Kang study include: pelvic tilts, cat-camel, crunches, bridges, superman, arm/leg raises in supine, prone and quadruped, and hand walkouts. Three sets of 12 repetitions were performed for each exercise.
- Schroth method of Scoliosis-Specific exercises
- Active Self-correction and task-oriented exercises
- Bracing
- Surgery

Interventions not supported by evidence:

- Electrical stimulation[7]
- Spinal manipulation[2,7]
- General physiotherapy exercises[7]

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Critical Periods or Lifespan Considerations

- After age of 10 years
- Gender (female more likely to have increased progression of curve)
- Cobb Angle (angle >25° at presentation, likely to have larger curve)
- Risser sign (0-1 skeletal immaturity; 4-5 skeletal maturity)
- Periods of rapid growth in adolescence
- Absence of menarche
- Family history of AIS
- Surgery for curvatures > 50° at skeletal maturity is beneficial due to the progression of the curvature over the next 30-40 years by 20-30°.[8]
- Curvatures which are < 30° are less likely to progress after skeletal maturity, however, those > 30° after skeletal maturity, tend to progress into adulthood resulting in health and social issues.[7,9,10]

Goals of intervention are:

- Decrease pain
- Maintain/prevent respiratory dysfunction through reduction of curvature
- Spinal musculature/core strengthening
- Improve awareness, posture, and body mechanics during functional activities to reduce additional musculoskeletal strain and prevent worsening of curvature

Assessment:

- Posture
- Breathing pattern
- Respiratory deficits
- Lumbar strength
- Lumbar flexibility

Objective Findings

- Cobb angle via X-ray in anterior-posterior direction in standing
- Risser sign via anteroposterior X-ray
- Scoliometer measurement of trunk rotation angle
- Measurement of rib hump via Adams forward bend test with use of two rigid rulers
- Waist asymmetry assessed in standing

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Tests Specific to Diagnosis

Assessment	Significance
Cobb Angle	Measures lateral curvature; if progressing more likely to need a brace or surgery. Depends on Risser sign
Risser sign	Skeletal maturity- high angle with low skeletal maturity more likely to require surgery. Cobb angle less than 30° with complete skeletal maturity, less likely to need surgical intervention

Initiation of Physical Therapy Treatment Criteria

- Cobb angle between 10 and 25° will either observe until angle greater than 25° or will begin exercises (Core stabilization, Scoliosis Specific Exercises, Active Self-Correction and Task oriented exercises).
- Cobb angle between 10 and 45° exercises (in conjunction with use of bracing between 25 and 45°).

Discharge Criteria

- Termination of therapy services should occur when:
  - Patient and/or family is independent with home program.
  - Respiratory function is optimized.
  - Curvature is progressing (refer back to physician as patient may require surgical consultation or more aggressive treatment/bracing)

Physical/Occupational Therapy Management/Intervention

The duration and frequency is determined at the initial session and is dependent on the exercise program, patient compliance with exercise program, patient progress, and patient compliance with brace wear.

- **Schroth method** (Scoliosis Specific Exercises – other names include The Schroth method, Scoliologic® 'Best Practice' and Physiologic®):
  - Literature has varied frequency and duration for these exercises:
  - Schroth intervention for 5 one-hour sessions with physical therapist for two weeks, then weekly one-hour sessions in group session, along with 30-45 minutes of home program for 6 months. (10-18 years of age, Cobb angle 10-45°, Risser 0-5, Brace or no brace)[9]
  - Another group's treatment program included three times a week for (1.5 hour sessions) for 6 weeks as outpatients with their caregivers being instructed in the program in order for them to carryover the program after the 6 weeks of outpatient visits were completed. They were to incorporate their exercises in to their activities of daily living until the end of a six month period.(10-18 years of age, Cobb angle 10-60°, Risser 0-3, no other treatment for scoliosis) [14]
  - Four sessions per week for 2 hours each for a duration of 2 months.(11-19 years of age, Cobb angle 6-56°, no brace wear during study)[15]

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- Core stabilization:
  - Two times a week for 10 weeks being provided core stabilization exercises compared to other group receiving traditional exercises. These patients were all to wear braces 22 hours a day.(10-16 years old, referred for a spinal brace)[12] Resulted in improved Apical Vertebral Rotation.
  - Core stabilization for 12 weeks: 3 times a week for 60 minutes each session for 12 weeks.(Cobb angle between 10 and 20°)[11] Resulted in decreased Cobb Angle.
- **Active Self Correction and Task-oriented exercises:** This group had Cobb angles less than 25° and did not receive any other treatments for their scoliosis, attended weekly one hour outpatient physical therapy appointments and performed home program for 30 minutes twice a week. Intervention lasted until skeletal maturity.[6]
  - Episodic care may be indicated when changes to the angle occurs and to ensure patients are independent with home program.

Goal/Outcome	Examples of Interventions
Decrease pain	Schroth method exercises, core stabilization, Scoliosis specific exercises, kinesiotaping, spinal stabilization exercises
Optimize respiratory function	Schroth method exercises with focused breathing
Decrease/maintain Cobb angle	Schroth method exercises, core stabilization
Improve awareness, posture, and body mechanics during functional activities to reduce additional musculoskeletal strain and prevent worsening of curvature	Schroth method exercises, core stabilization, Scoliosis specific exercises, kinesiotaping, spinal stabilization exercises, education

Self-Management Techniques

- Home exercise programs developed with Schroth method techniques.

Adjuncts to Physical/Occupational Therapy Management

- Bracing

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Congenital Muscular Torticollis

Synonyms

- Wry neck[1-3]
- Twisted neck[1, 2]
- Fibromatosis colli[1, 2]

Definition

- Congenital muscular torticollis (CMT) is a condition where an infant displays head tilting to one side and turning of the head to the opposite side, primarily resulting from unilateral shortening or fibrosis of the sternocleidomastoid (SCM) muscle.[1, 2, 4-10] CMT is discovered at birth or shortly after birth and identified as one of the most common infant musculoskeletal conditions with a postural deformity.[5, 8, 9, 11] A sternocleidomastoid mass may or may not be palpable and may not appear until the infant is 2-4 weeks old.[6, 7] Target Populations

Inclusions

- Infants birth to 12 months
- Greater than 5 degrees of cervical range of motion variation from uninvolved side
- Diagnosis of congenital muscular torticollis

Exclusions

- Spinal cord injury[3]
- Cervical fracture[3]
- Klippel- Feil Syndrome[3]
- Sandifer Syndrome[3, 12]
- CNS tumor[3]
- Ocular torticollis[3]

Target Users

- Physical Therapists
- Occupational Therapists
- Physicians
- Advanced Nurse Practitioners
- Parents or Caregivers

Differential Diagnoses

- Clavical Fracture
- Brachial plexus injury
- Sandifer Syndrome (involves GERD and torticollis type of posture)
- Osseous torticollis (Klippel-Feil Syndrome, C1-C2 rotary subluxation)[12]
- Cervical scoliosis
- Hemivertebrae
- Ocular dysfunction
- CNS tumor
- Osteoblastoma

Pediatric

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Co-morbidities[1-5, 12]

- Hip dysplasia
- Plagiocephaly
- Talipes equinovarus
- Developmental delay
- Facial asymmetry

Overview of Congenital Muscular Torticollis

- The pathogenesis of CMT is unknown, however, it is thought to occur following birth trauma, intrauterine crowding, compression of soft tissue and/or abnormalities in the sternocleidomastoid muscle tissue itself.[6, 10]
- The incidence rate varies from 0.3-2.0%, however, it could be as high as 16% of live births.[1-5, 7, 8, 10-12]
- Neurological or musculoskeletal disorders often accompany CMT.[1] The disorder is the third most common congenital musculoskeletal disorder, behind congenital hip dysplasia and congenital talipes equinovarus.[4, 5, 7]
- The classification of CMT is generally divided into three subgroups:
  - Mass- palpable mass within the SCM resulting in limitations in passive cervical mobility
  - Muscular- passive mobility limitations with no palpable mass present in SCM
  - postural (positional)- postural preference, however, no palpable mass and no limitations in passive range of motion[1, 5]
- A severity classification has been developed by the American Physical Therapy Association (APTA) Section on Pediatrics. Based on:
  - the age of the infant when the asymmetry is noticed
  - age of referral to physical therapy
  - type of CMT
  - degree of muscle tightness.[1]
- Referrals for CMT to physical therapists have increased due to the “Back to Sleep” campaign.[1, 10-12] Infants are sleeping on their backs. Parents are afraid to place the infants on their tummies even when the infant is awake. Infants are being kept in car seats, swings, and other positioning devices where they are positioned on the back of their heads, which increases the frequency of torticollis and plagiocephaly.[1]

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Congenital Muscular Torticollis Classification[1]

	Early Mild	Early Moderate	Early Severe	Late Mild	Late moderate	Late Severe	Late Extreme
Age at the time of presentation	0-6 months	0-6 months	0-6 months	7-9 months	10-12 months	7-12 months	7-12 months
Degree of Cervical Rotation Tightness	<15 degrees	15-30 degrees	>30 degrees	<15 degrees	<15 degrees	>15 degrees	> 7 months with SCM mass or >30 degrees

Critical Periods

- Newborn identification of cervical, head or facial asymmetry within first 2 days of birth
- 0-3 months of age is best time to perform stretches on infant and able to achieve full cervical range of motion fastest [13]
- Refer to physician or physical therapist as soon as identified to have positional preference, facial asymmetry, mass on SCM, decreased cervical mobility, and/or plagiocephaly;
- 3-12 months after discharge from treatment for CMT or when begins walking for follow up to assess for positional preference, asymmetries, and developmental delays[1, 4]

Management/Intervention

- Treatment of the infant with torticollis is guided by the age of the infant, the severity of the torticollis, the abilities of the parents to perform the exercises and repositioning procedures, the diagnosis of plagiocephaly, and the presence of associated neuromuscular or orthopedic impairments.Passive stretching has been most effective in correcting the cervical range of motion deficits.
- The earlier physical therapy treatment begins the better the results.[1, 2, 4, 7, 8, 13] If a child is referred to physical therapy services at less than one month of age, by the time the infant is 2.5 months old, the CMT has been shown to be 98% resolved.[4]
- The more severe the torticollis and the longer the delay in initiation of physical therapy treatment results in increased time in physical therapy and increases the likelihood of the need for surgery.[1, 4, 7, 8]
- Those who undergo surgery to correct the CMT will need intensive physical therapy intervention for 3-4 months following the procedure.[3]

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- Referrals to physical therapy should be made as soon as any clinician or family member recognizes tightness in the neck, a mass in sternocleidomastoid muscle, flattening of head and preference for keeping head to one side. [1, 8]

Components of Evaluation

Subjective

- Birth History
- Positioning during feeding
- Sleep position
- Time spent on tummy
- Time spent in equipment/positioning devices

Objective Findings[1]

- Posture
- Acceptance to positioning in supine, prone, sitting and standing with support as needed based on age appropriate level
- Bilateral passive cervical rotation and lateral flexion
- Bilateral active cervical rotation and lateral flexion
- Passive range of motion in upper and lower extremities (screening for hip dysplasia and spine asymmetry)
- Active range of motion in upper and lower extremities
- Pain or discomfort
- Skin integrity, skin folds at neck and hip, presence of SCM mass
- Craniofacial asymmetries
- Head/skull shape

Specific Considerations

- Rule out red flags (require medical management).[1, 4]
  - Ocular motor asymmetry
  - Palpable extramuscular masses
  - Asymmetrical head positioning with abnormal muscle tone (not consistent with CMT)
  - Suspected hip dysplasia
  - Absence of movement in any extremity
  - Spinal anomalies
- Identify co-morbidities requiring medical management, and those that affect therapy management[1-4, 9, 12]
  - hip dysplasia
  - talipes equinovarus
  - brachial plexus injury
  - early developmental delay
  - facial asymmetry
  - plagiocephaly

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- Determine if trauma-related; determine nature and extent of traumatic event.
- Refer to MD[1, 4]
  - Presence of Red Flag
  - Little to no progress after 4 to 6 weeks of initial intense intervention

Physical/Occupational Therapy Management and Intervention

Primary Interventions[1, 3, 4, 13]

The primary intervention for infants with CMT includes passive stretching of the shortened SCM, passively rotating the head to the shortened side and tilting the head in the opposite direction with shoulders stabilized. The intervention should address:

- cervical passive and active range of motion (manual and passive stretching and strengthening through active movements against gravity)
- trunk mobility (active movements while in developmental positions and handling)
- symmetrical movement throughout extremities (active engagement of the infant in weight bearing activities, functional mobility, and reaching activities)
- environmental adaptations to ensure position changes and promote active cervical rotation (change direction of infant placement in crib or on changing table to promote turning of head to other side, decrease time spent in swing and car seat, place toys so patient turns to tighter side)
- promote parent/caregiver education (educate on importance of tummy time, adaptations that can be made to environment and in how parents/caregivers feed and interact with infant in order to encourage full bilateral cervical rotation)
- Also, the therapist should be cognizant of the infant's motor development.[1, 4, 5, 13]

Supplemental Interventions[1]

Interventions with Limited Level II Evidence

- Microcurrent
- Myokinetic Stretching

Interventions with Level III Evidence

- Kinesiological taping (KT) – recent study by Giray reports no additive effect with use of kinesiotape[6]

Intervention with level IV Evidence

- The Tscharnuter Akademie for Motor Organization (TAMO) approach is based on the dynamic theories of motor control.

Interventions with Level V Evidence

- The Tubular Orthosis for Torticollis (TOT) collar

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- Orthotic to decrease movement toward side of head tilt and promote active movement away from side of head tilt.

- Soft foam collar
  - Used post-surgery and post-botox
- Custom-fabricated cervical orthoses
  - Stabilize cervical spine, no reports in literature of use in infants

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Interventions without Evidence of Efficacy

- The following approaches are reported in the literature, but have been shown not to provide any additional benefit or have not been studied systematically:
  - Manual therapy
  - Soft Tissue Massage
  - Craniosacral Therapy
  - Total Motion Release
  - Feldenkrais

Other interventions

- Botulinum toxin (Botox) could enhance the effectiveness of stretching on the side of the contracture and allow strengthening of overstretched and weakened muscles on the opposite side of the neck.
- Surgery:
  - Unresolved CMT signs and symptoms at one year of age.
  - Greater than 15 degrees of cervical rotation deficit after 6 months of therapy treatment.
  - Infant older than 12 months of age with SCM mass[3, 9]
- Postoperative physical therapy consisting of range-of-motion exercises is recommended after surgical release of the SCM. A cervical collar could also be included in the postoperative management.

Goals/Outcomes[2, 4, 6, 13]

- Age-appropriate active and passive range of motion of cervical and trunk movements
- Prevention of contractures or further loss of motion in infants with SCM nodules or significant fibrosis;
- Symmetry of shape in the face, head, and neck
- Development of postural reactions in all directions
- Midline upright posture of the head and neck without persistent tilt to the involved side; and
- Symmetry of gross motor patterns throughout development.

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Tests Specific to Diagnosis

Assessment	Significance
Cervical Active ROM with arthrodial goniometer	➢ Degree and difference between sides are indicative of severity[5, 6, 9]
Cervical Passive ROM with arthrodial goniometer	➢ Degree and difference between sides are indicative of severity
Palpation	➢ Mass present in SCM muscle indicative of more severe CMT which will require more treatment time and possible surgical procedure[1]
Muscle Function Scale	➢ Describes muscle function in the lateral flexors of an infant's neck through ordered categorical scores (for patients greater than 4 months of age)[5, 6, 9]
Ultrasound	➢ Assess muscle tissue for cysts and tissue integrity ➢ Identify location and presence of a mass[3, 13]
Xray	➢ May identify C1-C2 subluxation[3, 4]

Discharge Criteria

- Full passive range of motion within 5 degrees of the uninvolved side
- Active symmetrical movement patterns throughout the passive range
- Motor development is age appropriate
- No visible head tilt
- Parent/caregivers verbalize understanding of what to monitor as the child grows
- Patient is discharged when the parent/care-giver can continue management of symptoms with an independent home program.
- Patient is unable to progress towards improved outcomes because of medical complications, or other personal circumstances.
- Patient is no longer objectively demonstrating benefit from therapy; and/or
- Family chooses not to continue therapy

Follow-up Screening[1, 4, 10]

- 3-12 months following discharge or when patient is beginning to ambulate to evaluate positional preference, the structural and movement symmetry of the neck, face, head, and trunk, hips, upper and lower extremities, and developmental milestones.
- 3-6 months following discharge if the patient was discharged between 4 and 6 months of age

Recommended Frequency of Treatment[1, 5, 9]

- No specific recommendation of intensity of treatment is appropriate for all cases.

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- The earlier physical therapy treatment begins, the better the results will be.
- Passive stretching and active positioning should be frequently performed throughout each day by the parent/caregiver.
- Responses to treatment regularly evaluated for effectiveness.
- The episode of care ranges from 1.5 month to a maximum of 6 months of conservative care.
- Physical therapy intervention three times a week has been shown to produce better/faster results than parents performing home program.
- Another study showed performing manual stretches100 times vs 50 times a day improved head tilt and cervical passive range of motion more.

Home and Self-Care Techniques

- Parents can be taught to perform gentle passive stretches, cervical passive and active range of motion, trunk active range of motion and ways to adapt the infant's environment, encouraging looking the opposite direction than preferred and maintaining the infant's head in midline.
- Parental compliance is extremely important for successful outcomes.
- Parents and caregivers can also be taught how to apply kinesiotape or TOT collar if utilized as a secondary intervention.

Home Medical Equipment

- Cervical orthoses
- Cranial remolding orthoses

Self-Care Techniques

- Passive stretching exercises
- Parent holding positions
- Positioning
- Environmental adaptations
- Strengthening activities

Referrals/Adjuncts to Physical/Occupational Therapy Management

Refer patient to their pediatrician or the following specialist for evaluation of alternative treatment options if:

- Visual dysfunction is observed refer to Ophthalmology
- Hip screen is failed refer to Orthopedics
- Neurological screen is failed refer to neurology
- Patient presents with bony end feel, refer to Orthopedics
- Improvement does not meet above guidelines, or improvement has reached a plateau refer to pediatrician

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Feeding Aversion

Definition

A patient, with adequate feeding/swallowing abilities, chooses to refuse oral consumption of food or liquids. Learned feeding avoidance behaviors that may have been related to a prior organic/ medical issue.[11]

Presentation

Symptomatology	Possible consequence or cause
A feeding/swallowing evaluation reports swallowing abilities to be within normal limits, yet the patient is unable to consume appropriate foods/liquids for age and development ➢ Refusal by verbalizing/turning away/closing & covering mouth/refusal to swallow. ➢ Selectivity by food type/ flavor, color or texture ➢ Able to eat in one setting but not another ➢ Extreme gagging or vomiting during or after meals ➢ Spitting out food/ pocketing/ Emesis ➢ Behavior outbursts such as screaming, tantrums, or attempts to escape the feeding environment ➢ Throwing food/shut down	➢ Autism[14,23] ➢ Cardiac Disease ➢ Cerebral Palsy ➢ Cleft Palate/Structural abnormalities ➢ Congenital Heart Disease ➢ Constipation ➢ Cystic Fibrosis ➢ Delayed Gastric Emptying ➢ Developmental Delays ➢ Down Syndrome ➢ Gastroesophageal Reflux Disease (GERD) ➢ Genetic Syndromes ➢ Hearing related difficulties ➢ History of Dysphagia resulting in a fear of feeding/swallowing ➢ Premature Birth ➢ Previous placement of a Tracheotomy ➢ Pulmonary Disease ➢ Respiratory Difficulties ➢ Sensory Disorder[12] ➢ Surgical procedures affecting swallowing ➢ Oral Motor Dysfunction ➢ Behavioral Disorder (accounts for 43% of feeding disorders)[22] ➢ Cardiorespiratory (accounts for 34% of feeding disorders)[22] ➢ Mechanical/ Structural (accounts for 53% of feeding disorders)[22] ➢ Metabolic Disorders (accounts for 12% of feeding disorders)[22] ➢ Neurological Disorders (accounts for 62% of feeding disorders)[22] ➢ Serious feeding difficulties requiring medical intervention occur in 3–10% of children[22]
Extreme gagging or vomiting during or after meals	➢ Delayed Gastric Emptying ➢ Food Allergies (including Celiac Disease) ➢ Gastroesophageal Reflux Disease (GERD) ➢ Sensory Disorder
Behavior outbursts such as screaming, tantrums, or attempts to escape the feeding environment	➢ Food Neophobia ➢ Sensory Disorder

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Low percentile for weight on the chart for the National Academy of Pediatrics	➢ Nutritional Effects ➢ Ongoing need for enteral or parenteral nutrition ➢ Prolonged status of inadequate caloric intake
Growth Deficiency	➢ Dehydration ➢ Growth Hormone Deficiency ➢ Nutritional effects ➢ Ongoing need for enteral or parenteral nutrition ➢ Prolonged status of inadequate caloric intake
Failure to Thrive	➢ Caregiver abuse or neglect ➢ Primary or secondary caused by limited food exposure in early ➢ development
Food Allergies/ Associated Pain with Eating	➢ Celiac Disease ➢ Eosinophilic Esophagitis (EoE) ➢ Food Protein-Induced Enterocolitis Syndrome (FPIES) ➢ GERD ➢ H. Pylori (Bacterial Infection) ➢ Short Gut Syndrome
Sensory	➢ Autism Spectrum Disorder (ASD) ➢ Intellectual Deficits with difficulty with motor planning & flexibility[14] ➢ Muscle weakness in face and/or neck ➢ Neurological/Sensory Memory with past experiences ➢ Over-respond to presence of foods that trigger avoidance ➢ Sensory processing deficits: Auditory/ visual/ gustatory/ olfactory/tactile/ vestibular/ proprioceptive. Research showed tactile and taste/ smell were main factors.[22] Sensory deficits affect pre-oral phase/ swallow.[12] ➢ TBI
Social/ Emotional/ Environmental	➢ Avoidant Restrictive Food Intake Disorder (ARFID) ➢ Child that experiences a trauma such as: infantile anorexia ➢ possibly secondary to force feeding/anxiety ➢ Difficult parent-child interactions at meal times ➢ Food Neophobia[23] ➢ Peer/Social Influence[23]
Medication Side Effects	➢ Lethargy/Decreased Appetite

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Typical vs Atypical Characteristics

Typical (Picky Eater)	Feeding Aversions
Limitations in number of foods; likes specific foods but will eat at least one food from most food texture or nutrition groups	Restricted range or variety of foods Significantly reduced food repertoire – refuses to eat entire categories of food types or textures (Less than 20)
Slow to try new foods	Avoids one or more food groups May avoid all vegetables which may be perceived as having a bitter flavor (genetic difference in ability to detect bitter flavor)[23]
Like some food in particular ways (brand specific/ restaurant specific)	Unusual aversions or fear surrounding foods
Food jag (eats one particular food/ or small group of food preferences at each meal). The food jag will end on its own after a short period of time. Following food jag, will return to previously eaten foods. (*ASHA Leader Blog 6/12/14 Melanie Potock- Preventing Food Jags what's a parent to do*) http://blog.asha.org/2014/06/12/preventing-food-jags-whats-a-parent-to-do/)	Foods lost to food jags are NOT regained after taking a break
Can tolerate new food on their plate (may be reluctant and/or respond with negative behaviors	Demonstrates sensory aversion to new/ non-preferred foods on plate or table (Complete refusal/ "cries & falls apart")
Can usually touch or taste new foods	Will not tolerate sensory input related to new foods
Will not typically starve themselves or make themselves ill	May starve themselves or make themselves ill, may find comfort in a hungry state[11]
May eat different foods than family but will eat with the family	May refuse to eat meals with family and almost always eats different foods than the family. Altered eating schedule or patterns

Normal Development:

Swallowing Phases: (http://www.asha.org/Practice-Portal/Clinical-Topics/Pediatric-Dysphagia/)

1. Oral Preparation Stage—preparing the food or liquid in the oral cavity to form a bolus including sucking liquids, manipulating soft boluses, and chewing solid food.
2. Oral Transit Phase—moving or propelling the bolus posteriorly through the oral cavity.
3. Pharyngeal Phase—initiating the swallow; moving the bolus through the pharynx.
4. Esophageal Phase—moving the bolus through the cervical and thoracic esophagus and into the stomach via esophageal peristalsis.

- Dysphagia can occur in any phase of the swallow. Although there are differences in the relationships between anatomical structures and in the physiology of the swallowing mechanism across the age range (i.e., infants, young children, adults).

Pediatric

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Three developmental feeding periods: [23]

1. Nursing period
2. Transitional feeding period
3. Modified adult feeding period

General Feeding Information:

- "Feeding and swallowing disorders (also known as **dysphagia**) include difficulty with any step of the feeding process—from accepting foods and liquids into the mouth to the entry of food into the stomach and intestines. A **feeding** or **swallowing disorder** includes developmentally atypical eating and drinking behaviors, such as not accepting age-appropriate liquids or foods, being unable to use age-appropriate feeding devices and utensils, or being unable to self-feed. A child with dysphagia may refuse food, accept only a restricted variety or quantity of foods and liquids, or display mealtime behaviors that are inappropriate for his or her age." (http://www.asha.org/Practice-Portal/Clinical-Topics/Pediatric-Dysphagia/)
- "In the second year, toddlers consume a diet that resembles their families' preferences. Introduction of a variety of nutritious foods and flavors is important during both the transitional and modified adult periods as younger toddlers are initially more accepting of novel foods compared to preschool children, who may be reluctant to try new foods. The **reluctance to try new foods is low at weaning and rapidly rises to a peak between 2 and 6 years,** with considerable variability."[23]
- "The most important phase for learning food preferences and appetite control may be the beginning of complementary feeding (CF). Infants discover the sensory (texture, taste and flavor) and nutritional properties (energy density) of foods that will ultimately compose their adult diet."[13]
- "Learning to eat has to occur quickly, in particular because the mode of feeding evolves dramatically during the **first thousand days (3 years) of life**, from "tube" feeding through the cord in utero, through oral feeding with milk after birth, complementary feeding (CF) around mid-course of the first year, until eating family foods by the end of the first year. After this period, Neophobia/ fussiness start peaking and introduction of new foods becomes more difficult."[13]
- "About a quarter of infants experience difficulties with pieces in foods, but such difficulties should not drive parents to delay introduction of more solid textures, since **delaying introduction to lumpy foods beyond 10 months is associated with texture acceptance problems at later ages."[13]**
- "Mild feeding difficulties occur in up to 25–45% of healthy children and 80% of children with developmental delays or chronic disease. Serious feeding difficulties requiring medical intervention occur in 3–10% of children."[22]

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Findings

Goals of a Feeding Aversion Evaluation

- Examination for possible causes or contributing factors to the complaint. A referral to appropriate medical professional if the patient presents with signs or symptoms of behavioral or physiological factors that impact the patient's swallowing/ feeding status. Common diagnoses are Gastroesophageal Reflux Disease, Developmental Delays, Sensory Disorders, and Surgeries or procedures affecting swallowing such as a tracheotomy.
- To determine how feeding aversion impacts the patient's ability to maintain adequate nutrition and hydration.

Scope of a Feeding Aversion Evaluation

The evaluation and subsequent treatment must be conducted by a licensed Occupational Therapist.

- Case/Feeding History including reports from a team approach of family members, teachers, and medical professionals involved in the patient's care. Case history should also include if inadequate caloric intake was reported by a treating physician.
- Observation of the patient eating and drinking with age appropriate or developmentally appropriate utensils. A narrative including strengths and weaknesses of the observed feeding/swallowing skills should be included.
- Oral motor assessment including an assessment of muscles and structures needed for appropriate feeding/swallowing skills to determine if oral motor deficiencies are present.
- Collect detailed information about home environment and various factors related to feeding.
- Consultation from a registered dietician/nutritionist as needed to determine nutrition and hydration needs.

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Objective Measures	➢ Mealtime Behavior Questionnaire* ➢ About Your Child's Eating -R* ➢ Child Development Inventory ➢ Pediatric Symptom Checklist ➢ The Behavioral Pediatrics Feeding Assessment Scale (BPFAS) ➢ The Child Eating Behavior Inventory (CEBI) ➢ The Children's Feeding Assessment Questionnaire (CFAQ) ➢ The Feeding Scale ➢ Mealtime Observation Schedule (MOS) ➢ Brief Autism Mealtime Behavior Inventory (*BAMBI)* ➢ Examples of parent-friendly feeding checklists can be found in Bahr's (2010) parent book, Nobody Ever Told Me (or My Mother) That!: Everything from Bottles and Breathing to Healthy Speech Development. ➢ The Developmental Pre-Feeding Checklist (Morris & Klein, 2000, pp. 697–711) is widely used by feeding specialists. It is research-based and reflects typical feeding development from birth to 2-years of age ➢ Sensory Profile ➢ PEDI ➢ REAL
Feeding Observation	➢ Type of food presented ➢ Quantity of solids & liquids consumed daily ➢ Method of presentation ➢ Meal process/structure ➢ Child reaction to food presentation ➢ Parent response to feeding behaviors ➢ Outcome of feeding behaviors
Team Collaboration	➢ Pediatrician, Developmental Pediatrician ➢ Speech Language Pathologist ➢ Gastroenterologist, Otolaryngologist, ENT/Allergist/Pulmonologist ➢ Behavioral Therapist, Psychologist ➢ Nutritionist, Dietician ➢ Nursing, Social Workers ➢ Teachers, Paraprofessionals ➢ **Parent Participation**- Key factor for progress & carryover[16]

Admission Criteria

Birth to 6 years[16]

- If the caloric intake is not sufficient, the following factors should be considered:
  - Oral motor weakness or structural impairment
  - Conditions that may cause consistent loss of calories through vomiting
  - Conditions that may cause muscle weakness

- If the patient's caloric intake is sufficient, but growth deficiency is still evident, the following factors should be considered:
  - Medical conditions that affect caloric absorption
  - Not consuming a balanced diet

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- If caloric intake is sufficient, and growth is appropriate for development, one or more the following conditions must be present for approval of feeding/ swallowing therapy:
  - The patient currently has a G-tube or is participating in a G-tube weaning program
  - The patient is at risk for placement of a G-tube secondary to falling below the 10th percentile on the Growth Chart for the National Academy of Pediatrics
  - The patient currently consumes supplemental nutrition
  - Chronic food refusal with limited variety of food group consumption[15]
  - Failure to advance textures[15]
  - Inappropriate mealtime behaviors (ex: throwing food, grazing patterns of eating, etc.)[15]
  - Sensory disorders that affect typical developmental feeding progression or swallowing phases[12]

7 - 18 years[16]

- Indication for skilled intervention is dependent on multiple documented factors:
  - Prior treatment received: Duration, intensity, progress, carry over, number of episodes of treatment, gaps in episodes of treatment, etc.
  - Severity of the nutritional deficit, as documented by a physician or dietician
  - Current potential for progress: Rationale that indicates client potential for progress that differs from prior status
  - Patient commitment/ desire to participate
  - Family participation and carryover
  - Community support

Management

- Management of this condition will vary depending upon the patient's individual need.
  - Development of a treatment plan to increase the types, textures, and amounts of food and liquids accepted by the patient.
  - Development of age appropriate feeding skills/ mealtime routines in the least restrictive environment possible.
  - Behavior and sensory modification techniques to extinguish unwanted behavioral responses toward feeding.
  - Team collaboration between a variety of disciplines including Speech Language Pathologist, Behavioral Therapist, Nutritionist/Dietician, primary care physician, Gastroenterologist, and other treating providers.
  - The provider MUST clearly document extensive caregiver training, participation, and carryover into the patient's daily living activities. (Food intake journal, environmental adaptations, behavioral response chart, etc).

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Treatment Options	Approaches to Treatment
Evidence Based Techniques	➢ Pre-Chaining and Food Chaining© Therapy Programs ➢ Pre-chaining focuses on a treatment program to keep the child as close to the developmental progression of oral skills as possible during the first year of life ➢ Food chaining© is a systematic method for the treatment of children with food selectivity and aversive eating behaviors ➢ Sequential Oral Sensory Approach to Feeding (The S.O.S. Approach): Children proceed hierarchically, tolerating, interacting with, smelling, touching, tasting, and eventually eating novel foods ➢ Talk Tools Oral Placement Therapy®: focuses on techniques to add a tactile component to feeding and therapy, enabling clients to "feel" the movements necessary for the development of feeding and speech clarity [35] ➢ The Transdisciplinary Effect Assessment and Treatment (TR-eat™) model: a collaborative treatment model for children with complex feeding problems that blend behavioral principles with oral motor therapeutic skills to address difficult feeding problems [36]
Intervention Strategies	➢ Provide visuals ➢ Reduce linguistic load ➢ Offer choices ➢ Address sensory processing concerns ➢ Offer reinforcers to increase motivation ➢ Behavior Strategies: Differential attention, Positive reinforcement, Escape extinction/ escape prevention, Stimulus fading, Simultaneous presentation, Differential reinforcement of alternative behavior (DRA), Use of a flipped spoon as a presentation method,[15] shaping, modeling, first/ then token system. Research shows that escape extinction and differential reinforcement significantly increase acceptance of non-preferred food[16] ➢ Oral motor and oral placement strategies[15] ➢ Repeated exposure to novel/non-preferred food.[15] Being exposed repeatedly to a food is the primary factor that determines its acceptance.[13] It is recommended that a child be exposed 10 to 15 times to a previously unfamiliar or non-preferred food to increase intake for children with feeding difficulties.[15]

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Considerations

- A proactive, family-centered approach (particularly in the first three years[5] could prevent many feeding disorders because parents, caregivers, and professionals will know what skills to encourage, when to encourage them, when a child is going "off track," and when to refer a child to a feeding specialist.[13]
- Research indicates that the optimal time for feeding aversion intervention is by age 6.[16]
- Treatment should be:
  - Multi-disciplinary approach. The Speech and OT treatment plans must focus on different aspects of care.
  - Episodic & periodic in nature
  - Progress should be reported at least every 3 months
  - Typical duration of up to 1 year. (If has G-tube status with no prior oral intake may take up to 2 years).
  - Ongoing parent involvement is required
  - Frequency and intensity of skilled services should vary along with care moving from direct to indirect services over the continuum of care

Discharge Criteria

- The patient has acquired age appropriate feeding/swallowing skills. Patient is consuming adequate amount and variety of food groups to support developmentally appropriate growth.
- The patient has not shown progress towards reasonable goals, and has reached a plateau.
- Caregivers are able to independently carryover the treatment plan in the home environment to support continued progress.
- The goals do not require the skills of a certified therapist. (The strategies are now repetitive in nature without needing ongoing changes to the treatment plan).
- The goals are duplicative in a nature to another therapist's current treatment plan.

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Idiopathic Toe Walking

Definition

Idiopathic toe walking (ITW) is a pathological gait pattern, due to unknown cause, for children who persistently ambulate on bilateral tiptoes after age 2 years.[1] ITW applies to children who have no signs of neurological or orthopedic conditions.[2] Toe walking, habitual toe walking, achilles tendon tightness and congenital short tendon calcaneus may be used to describe ITW.[3] ITW is characterized by an absent or limited initial contact (heel strike) during gait and weight bearing occurring only on the forefoot.[1]

Target Populations

Inclusions:[1,4-7]

- Ages 2-21 years
- Toe walking for at least 6 months
- Toe walking for more than 25% of the time
- No signs or evidence of underlying neurological or orthopedic conditions
- May have neuropsychiatric comorbidities such as ADHD, sensory processing disorder, cognitive and/or language delays

Exclusions:

Although many conditions are associated with toe walking, ITW specifically excludes:[3,8]

- Autism Spectrum Disorder
- Cerebral Palsy
- Congenital talipes equinovarus (clubfoot)
- Muscular Dystrophy
- Spinal Muscular Atrophy
- Spina Bifida
- Unilateral toe walking from injury or trauma

Target Users:

- Physical Therapists
- Occupational Therapists

Physicians

- Parents or Caregivers

Differential Diagnosis[1]

- Genetic Sensorial Neuropathy Type I
- McArdle Disease
- Autism Spectrum Disorder

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Overview of ITW

Toe walking may develop temporarily in early ambulation, but it is considered abnormal in healthy children after the age of two years.[4] ITW is a diagnosis of exclusion for persistent pathological gait pattern characterized by bilateral forefoot weight bearing without heel contact which may lead to ankle injuries, tripping, falling, pain and contractures of the gastroc-soleus complex.[1] It is estimated that ITW occurs in 7 to 24 % of the population and is more common in boys than girls.[9]

The cause of ITW continues to be investigated. Research demonstrates a family predisposition since nearly half of children have one or more relatives with a history of ITW.[5,9] Children with complications during or after birth have a greater incidence of ITW.[10] Electromyography studies indicate that the gastrocnemius and anterior tibialis muscles synergies are out of sync during the gait cycle.[11] In children who toe walk, the gastrocnemius has a greater ratio of type I muscle fibers than type II.[3] Current research indicates that children with ITW process sensory input differently (such as vibration) than children without ITW, however, the evidence is not strong enough to demonstrate a causal relationship with sensory processing disorder.[12]

Children with ITW often demonstrate immature characteristics such as constant running instead of modulating a walking pace, jumping or hopping rather than coordinated stepping and avoidance of controlled eccentric transition movements.[13] The imbalanced biomechanics of dorsiflexion and plantarflexion lead to a failure in achieving proper upright posture causing the trunk to lean forward and place weight bearing on the forefoot.[13]

Some children with ITW may demonstrate a normal gait temporarily when requested or while concentrating on walking.[11] Evidence indicates that half of all children with ITW will self-correct by age 5.5 years, but it is impossible to predict those who will or will not self-correct.[5] Therefore, conservative treatment is recommended as early as possible to prevent musculoskeletal disorders such as: development of plantarflexion contracture, excessive pelvic tilt, genu valgum, genu recurvatum or external tibial torsion.[13]

Normal Gait Development

Children learn to walk independently at various ages. According to the World Health Organization, the mean age is 12.1 months but may be as early as 8.2 months or as late as 17.6 months before walking is considered delayed.[14] Toddlers initially walk with stiff legs and flat feet using a low walking speed, high cadence, short step length, wide base of support and prolonged double support.[3,13,15] This immature gait pattern relies on simultaneous hip and knee flexion during swing, no gastroc-soleus power at the ankle during push off and incomplete hip and knee extension during stance.[13]

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Within 6 months of independent walking, a toddler's gait matures through postural control integration with dynamic mobility.[16] During this time, a toddler may walk on their tiptoes but should develop consistent heel strike around 18 months of age.[3] Children continue to fine tune their gait as they grow. By age 3 to 4 years, children walk with a more adult gait pattern.[16] Mature gait is characterized by the weight bearing which begins at heel strike (initial contact) and is transferred forward through the ankle during mid-stance and ends with forefoot push-off (toe off). There is controversy in the literature regarding the age at which a mature gait is achieved. Some researchers report mature gait at 5 to 7 years, while others cite 7 to 8 years, while others indicate gait is not mature until adolescence.[13,15-17]

Physical/Occupational Therapy Management and Intervention

Assessment includes: [18]

Recommended Tess	Significance
Range of Motion	➢ Passive dorsiflexion in subtalar neutral with knee extended and flexed ➢ Active dorsiflexion with knee extended
Gait Analysis	➢ Percentage of time ankle is in plantarflexion during stance and/or swing ➢ Lack of 1st, 2nd, 3rd ankle rockers ➢ Premature heel rise ➢ Knee hyperextension during stance ➢ Increased anterior pelvic tilt, lumbar lordosis and/or increased hip flexion
Neurological exam	➢ Assess muscle tone
Strength	➢ Anterior tibialis ➢ Gastrocnemius
Integument	➢ Presence of calluses, bunions or redness
Pain	➢ Age appropriate pain scale
Gross Motor Skills	➢ Squatting ➢ Transition to/from floor and standing ➢ Stairs ➢ Balance ➢ Jumping ➢ Coordination
Additional Screenings	**Tools**
Sensory Processing	➢ Short Sensory Profile
Speech and Language	➢ *Ages and Stages* Communication section

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Management and Intervention

ITW treatment methods and timing are controversial.[3] Conservative management of ITW may include: muscle stretching/strengthening, ankle joint manipulations, motor control interventions, auditory feedback, orthotics, night splints, serial casting, changes in sensory input (such as vibration, different flooring surfaces), and botulinum toxin A injections.[3] The effectiveness of conservative treatment depends on the age of child, degree of gastroc-soleus contracture and the percentage of time spent toe walking.[18] However, current evidence indicates that motor control interventions applied alone are ineffective in correcting ITW.[13] Surgery is reserved for older children who have failed conservative treatment and present with ankle/foot pain and fixed contractures.[3]

The levels of evidence for ITW management strategies to achieve normal heel-toe gait are: surgery [4] (high), serial casting [19] (moderate), orthotics [20] (moderate), Botox [21] (very low), and motor control interventions only[13] (low).

The priorities of ITW management are to obtain 10° of dorsiflexion, strengthening core and lower extremities, balance training, gait training with articulating AFOs and implementation and monitoring of a home exercise program (HEP).[18]

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Intervention/Treatment and Frequency

It is recommended that conservative treatment be initiated when there are limitations in dorsiflexion PROM or AROM, decreased dorsiflexion strength, gait abnormalities or decreased balance.[18]

Initial Presentation ROM is measured in subtalar neutral & with knee extended	Treatment	Frequency and Duration	Goals
≤ 0° or neutral DF PROM	Serial Casting	Weekly for 6 weeks	10° of DF PROM
0° to 5° of DF PROM	Emphasis: Prolonged stretching using night splints and HEP Additional treatment (tx) options: manual therapy, joint mobilizations, standing balance	Bi-weekly PT to monitor HEP for 4 to 6 months (consider serial casting if after 4-6 months tx only obtains 0° to 5°)	10° of DF PROM
5° to 10° of DF PROM	Night splinting progressing to daytime articulating AFOs Additional tx options: stretching, strengthening, manual therapy, joint mobilizations, balance training, augmented auditory feedback, gait/treadmill training, HEP	Bi-weekly PT to monitor HEP for 4 to 6 months	10° of DF PROM Heel-toe gait Improve balance skills
≥10° of DF PROM	Articulated AFOs for daytime use Additional tx options: possible night splints, stretching, strengthening, manual therapy, joint mobilizations, gait/treadmill training, auditory feedback, HEP	Monthly PT to monitor HEP for 4 to 6 months	Maintain or increase DF ROM Increase heel-toe walking to 75% of the time

- Frequency may be adjusted due to progress or lack of progress with tx and HEP.
- Plateaus or regression in ROM and/or ITW may occur during growth spurts, anxiety, illness, fatigue or lack of follow through at home. During these times, HEP is essential. Therapy reassessment may be needed after resuming HEP for 4 weeks.
- PT follow up for orthotic management may be needed periodically.

(Table extrapolated from LeCras S, et al. 2011)

Risks and Benefits

The risks associated with serial casting, AFOs, night splints are compromised skin integrity.[18] Botox and surgery carry inherent risks; however, surgery may lead to over lengthening of the gastrocnemius and/or sural nerve damage.[4]

Benefits of early identification and management of ITW may decrease loss of ankle range of motion, contractures, postural imbalances, pain and improve development of a normal gait pattern, thus decreasing the need for invasive treatments.[18]

Expected Outcomes

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The expected outcome of ITW intervention is an increase in dorsiflexion to obtain heel strike 75% of the time or greater during gait without AFOs.[18]

Discharge Criteria

Termination of therapy services should occur when:[18]

- Non-compliance of child and/or caregiver,
- Ankle dorsiflexion is maintained at greater than or equal to 10° for 6 months with home exercise program,
- Heel-toe ambulation occurs in greater than 75% of unprompted gait without AFOs,
- Gross motor skills are maximized and/or age-appropriate normal, and
- Independence is demonstrated in home exercise program.

When to Refer[18]

Condition:	Refer to:
Sudden onset of toe walking or unilateral toe walking	Neurologist or Orthopedist
Signs or symptoms of Autism Spectrum Disorder	Developmental Pediatrician
Signs or symptoms of neuromuscular involvement	Neurologist or Physiatrist
Congenital Orthopedic condition	Orthopedist

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Pediatric Intoeing

Definition

Pediatric in-toeing is defined as when the feet turn inward instead of pointing straight ahead during walking or running in typically developing children of less than 8 years old.[1] In-toeing is the medical term used for what is commonly referred to as pigeon-toed.[1]

Target Populations

Inclusions:[2]

- Typically developing children of less than 8 years old
- Walking or running with toes pointed inward

Exclusions:[2]

- Cerebral Palsy
- Spina bifida
- Slipped capital epiphysis
- Legg Calve Perthes disease
- Clubfoot
- Children with neurological disorders

Target Users:

- Physical Therapists
- Occupational Therapists
- Physicians
- Parents or Caregivers

Differential Diagnosis

- Hip dysplasia[3]
- Idiopathic clubfoot[1]
- Congenital talipes equinovarus[1]

Overview of Intoeing

Intoeing is a common childhood gait pattern where the feet, and sometimes both legs, face each other.[2] In addition to the aesthetics of an intoeing gait pattern, other signs and symptoms may include: frequent tripping, clumsiness, and fatigue like pains in legs or low back at the end of the day.[2] Intoeing occurs in approximately 5.9% of the population and is more prevalent in girls than boys by a 2.4 to 1 ratio.[4] Children who W-sit are also more prone to intoeing.[4]

The majority of intoeing concerns are due to normal growth variants that resolve on their own by age 8 years.[1,2,5-7] It is estimated that 95% of intoeing cases self-correct by age 8 years.[6] However, this condition is worrisome to parents and may result in unnecessary referrals to pediatricians, orthopedic specialists and physical therapists.[5,7,8]

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Although limited, Current evidence indicates that conservative treatment such as stretching, exercises and bracing for in-toeing, is not necessary or effective and may even be harmful. [2,6,7,9] High level evidence recommends that children under the age of 8 years be evaluated for the cause of intoeing and proper caregiver education be provided through consultative visits.[2,3,6,7,10] Children who experience limping, progressive intoeing, unilateral intoeing, swelling or pain with gait should be referred to an orthopedic surgeon.[1,3]

Surgical osteotomies are reserved for older children (greater than 8 years old) that demonstrate severe intoeing and are usually performed for cosmetic and not prophylactic reasons.[3,7,11]

Causes of Pediatric Intoeing

Intoeing is caused by twisting or torsion of the leg at any level: foot (metatarsus adductus), tibia (internal tibial torsion), or the hip (femoral anteversion).[3] Due to skeletal growth, the age of the child may provide clues to the cause of intoeing. Intoeing in infants is usually from metatarsus adductus, in toddlers the cause is typically internal tibial torsion and in children less than 10 years the cause is usually femoral anteversion.[1,3]

Metatarsus Adductus:

- Also known as metatarsus varus.[9]
- The forefoot is adducted and the lateral border of the foot curved or convexed.[9]
- Differs from clubfoot since the heel is not in equinovarus.[9]
- May be present at birth due to intrauterine crowding or as a result of sleeping in prone with feet tucked under buttocks.[6]
- Severity is measured by flexibility of holding the heel in neutral and abducting the forefoot.[6]
  - Grade I the forefoot passes neutral position
  - Grade II the forefoot achieves neutral
  - Grade III the forefoot is unable to passively achieve neutral.[6]
- Grades I and II typically resolve by 12 months, whereas Grade III may need 6 weeks of serial casting.[6]

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Internal Tibial Torsion:

- Internal twisting of the tibia may occur before birth due to intrauterine crowding.[1]
- Is most noticeable once a child begins to walk.[6]
- As the child grows taller, the tibia untwist.[1]
- Is the most common cause of intoeing in children ages 1 to 5 years.[12]
- Is often asymmetrical and tends to affect the left foot more often than the right foot.[6]
- 95% of all children with internal tibial torsion resolve without treatment by the age of 8 years.[6]
- Residual deformities have not been shown to affect running, jumping or the risk of future arthritis.[6]
- Treatment of tibial torsion (such as stretching, orthotics, bracing) in an infant or child is not supported by current evidence.[1-3,6,9]

Femoral Anteversion:

- Internal rotation of the femur may also be described as excessive femoral torsion.[1]
- The upper end of the femur is twisted which allows the hip to turn more inward.[1]
- Both the knees and feet turn inward during walking.[1]
- Often runs in families.[6]
- Usually bilateral.[6]
- Child will prefer to W-sit.[1]
- Spontaneously corrects as children grow older.[1]
- Special shoes, braces and exercises are unnecessary.[1]
- Surgery is not considered until after age 9 to 10 years.[1]

Cultural Considerations

Children who are from cultures that spend time kneeling on the floor with legs internally rotate have an increased incidence of tibial torsion prevalence throughout their life.[13] This may lead to degenerative arthritis later in life.[13]

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Physical/Occupational Therapy Management and Intervention

Physical and Occupational Therapy for intoeing is limited to reassuring parents or caregivers that in-toeing will self-correct. Parents need to be educated in the natural progression of intoeing and activities to avoid, such as kneeling and W-sitting.[1,2,6] Treatment consisting of bracing, night splints, twister cables, orthotics, special shoes and/or exercise are contraindicated by current evidence. [1-3,6,9]

Assessment	Significance
Age of onset for intoeing gait [3]	Assists with determining root cause of intoeing
Forefoot alignment	To determine metatarsus adductus
Foot Progression Angle (FPA) is the angle formed by the line of progression (direction of gait) and foot print bisection line through 2nd toe [2]	Normal range -3° to +20° (negative indicates intoeing) Measurement greater than 2 SD is an abnormal FPA
Thigh-Foot Angle is the angle between the foot and thigh axis in prone with knee flexed to 90° [6]	Mean is 10° (norm -5° to 30°) Negative angles less than -5° indicate intoeing and positive angles indicate out toeing
Hip Internal and External ROM measured in prone [6]	Mean ER is 45° Mean IR is 50° for boys and 40° for girls >45 degrees IR in newborns and >15 IR in children 8 or older can be indicative of intoeing

Risks and Benefits

Physical and Occupational Therapy consultative visit(s) may provide parent or caregiver reassurance and education on the natural progression of intoeing. [1,2,6] Yearly consultative visits with physical or occupational therapist may be beneficial in monitoring intoeing for abnormal progression and for referring children to orthopedic surgeons. Treatments of lower extremity exercises, stretches, bracing, orthotics and special shoes are clearly contraindicated by the evidence. [1-3,6,9]

Expected Outcomes

Intoeing spontaneously resolves without treatment by age 8 years. [1,2,5-7]

Treatment Intensity and Frequency Guidelines

Consultative therapy model is appropriate when expertise is needed to identify problems or recommend a solution for a specific issue such as frequent tripping, and to monitor the severity of in-toeing. If in-toeing persists after age 8 years, the child must be referred to a pediatric orthopedic physician.

When to Refer to a pediatric orthopedic physician: [9]

- Abnormal muscle tone warrants further testing
- Limited hip abduction and leg length discrepancy
- Pain with ambulation
- Unilateral intoeing
- Intoeing after age 8 years

Discharge Criteria

- Termination of therapy services should occur when:

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- goals of treatment have been attained
- the degree of improvement is no longer functionally significant

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Neuromuscular Disorders

Definitions

Neuromuscular disorders are a heterogeneous group consisting of several different types, varying age of onset, and severities, that result from structural, genetic, endocrine, metabolic, toxic exposure or inflammatory pathologies.[1] These disorders may cause static or progressive impairments that threaten structural integrity and/or functional capabilities. Static or non-progressive neuromuscular disorders may include, but are not limited to: cerebral palsy, spina bifida, acquired or traumatic brain injuries, complications associated with prematurity, brachial plexus injury, drug or poison toxicity, and genetic disorders. Progressive neuromuscular disorders may include, but are not limited to: muscular dystrophies, spinal muscular atrophy, congenital myopathy, metabolic disorders, and other rare genetic disorders such as Huntington's disease.[2]

Cerebral palsy (CP) is an overarching term that covers various types of pathology. Cerebral palsy is a permanent disorder of movement and posture, which often include disturbances of sensation perception, cognition, communication, behavior and secondary problems, resulting in activity limitations. CP is one of the most common causes of childhood disability with a prevalence of 2.11 per 1000 births worldwide and estimated 2 to 3 per 1000 births in the United States.[3] Although there are significant improvements in survival of preterm infants, which is a direct risk for CP, the incidence of CP remains stable for the past 50 years.[4] Early diagnosis of CP is possible as early as 12 weeks of age.[44]

Operational Definitions:

Medically-based therapy is recommended to improve function, manage impairments or complex medical needs. Improvements in function lead to improved activity and participation. The age of the child, period of brain, bone, and muscle plasticity, type of interventions, dosage and participation have the greatest effect on outcomes.[5] Intensive, goal-directed or task-oriented interventions provided during critical periods of neuroplasticity are supported by current evidence.[6-11] Episodic based care is recommended when treatment is focused on reducing secondary impairments or occurs outside critical periods for progress or regression.[9, 12]

- **Critical period** is defined as a period when biologic or physiological conditions make the client especially sensitive to certain environmental stimuli and development of a new or lost skill is most likely. Critical periods for gross and fine motor development or skill acquisition following injury and surgeries are well established in the scientific literature. Current evidence supports the critical periods are:
  - Early infancy to toddler years are a critical period for neuroplasticity and overall development;[5, 6, 8, 10, 13, 44]
  - During early infancy and prepuberty for improving bone structure and function; [5]
  - During childhood for participation interventions for development of cognitive, social, emotional, visual, perceptual and motor skills;[5]
  - Up to age 7 years for skill mastery when a child is provided context-based skill exposure to task;[12]

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- **Episodic based care** is a specific period of intervention targeting a patient's specific need with a definite beginning and an end date.[9, 14] Patients with chronic conditions, such as CP or muscular dystrophy, may require multiple episodes of care throughout their lifespan.[9, 14] Each episode should have a meaningful outcome and not simply be continuations of goal setting.[15] "Researchers have found that short-duration, intensive, and episodic physical therapy models followed by rest periods resulted in higher adherence and improvement in motor performance, as well as both parents and therapists perceiving that the child attained their goals more rapidly. An episodic care approach also may be more amenable to parents of children with chronic conditions, who may prefer breaks between episodes of therapy to allow for a rest period and to participate in other community activities as opposed to receiving therapy for an indefinite length of time."[14] An episode of care ends when the child is in a steady state and needs time to practice for repetition.[9]
- **Complex needs** occur with an illness or disability that requires considerable external support to manage usual daily tasks; these complex needs may result from birth, illness or injury. Complex needs may include management of complex behaviors, monitoring equipment, splints/orthotics/serial casting, external fixation devices, and monitoring of the client's health status related to oxygen monitoring, cardiac devices, enteral feeding devices, colostomy bags, intravenous catheters, dialysis, tracheostomy tubes, urinary catheters, skin integrity and augmentative communication devices.
- **Progress** is change that extends beyond measured quantity and its true value (i.e. measurement error), but rather on the identification of functional changes that make a real difference in the lives of patients and families.[16]
- **Regression** is the loss of an acquired function or failure to progress after a period of relatively typical development as the result of a recognized event, illness or environmental change.[16]
- **Impairments** may be primary or secondary. According the International Classification of Functioning, Disability, and Health (ICF) model, primary impairments are organ or system level deficits that are apparent at the time of diagnosis; and secondary impairments are organ or system level deficits that occur over time because of primary impairments.[17, 18]
  - Examples of primary impairments:
    - Spasticity or Hypotonia
    - Impaired motor control
    - Impaired sensory processing
    - Ligamentous laxity
  - Examples of secondary impairments:
    - Joint contractures
    - Decreased strength
    - Impaired balance
    - Decreased proprioception

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- **Activity** is defined as performing a task or action.[17] Children with neuromuscular disorders may demonstrate activity limitations in areas of gross motor activities, fine motor activities, play, and self-care activities. Examples of activity limitations may include: gait deficits, impaired mobility, unable to feed self, or inability to dress self. There are three stages to skill attainment:[15]
  - Acquisition phase – the ability to perform a newly learned skill and requires skilled therapeutic services to address underlying deficits, establish adaptive strategies and equipment to promote success, consistent updating the plan of care through the use of therapist's assessment skills and ongoing caregiver education.
  - Fluency phase – is the rate at which a newly acquired skill is performed. This phase requires practice and repetition for fluency and less direct therapeutic services.
  - Maintenance – refers to the child's ability to perform an activity and participate successfully without the need for ongoing therapy. This phase is supported by consultative services to monitor and identify potential problems before the child's activity and participation are adversely affected.
- **Participation** is the involvement in life situations.[17] Children with neuromuscular disorders may experience participation restrictions at home and in the community as well as in social, sport and leisure activities. Examples of participation are: recess, physical education classes, sports, and family recreational activities. Rarely are these related to medical necessity.

Purpose of Guideline

Dosing of interventions in pediatric physical and occupational therapy has been identified as a national priority.[19] Dosing includes frequency of sessions (number of sessions a week), intensity (number of exercise repetitions or how hard the patient works), time (minutes per session), and type of intervention (therapeutic exercise, gait training, education, etc.).[20] Physical and Occupational therapy may be delivered at different frequencies and durations, which creates challenges for providers and clinical reviewers. These challenges are further fueled by the lifelong chronic nature of neuromuscular disorders, natural emotions experienced by caregivers and the fact that evidence significantly precedes point of care.[21] The purpose of this guideline is to provide an overview of pediatric neuromuscular conditions and convey current evidence in order to guide consistent utilization management decisions.

Components of Evaluation and Management

The examination process and procedures must be tailored to the child's age, medical status, diagnosis, child and caregiver goals and priorities. The ICF model may be helpful to frame the assessment of body functions and structures, function and disability, personal and environmental factors.[18]

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Subjective

- Medical:
  - Patient must be deemed medically stable to participate in therapy
  - Identify co-morbidities requiring medical management and those that affect therapy management
  - If post-surgical, determine any precautions or limitations
  - Identify recent illnesses, procedures or hospitalizations
  - Identify any special precautions such as allergies, seizures, etc.
  - Identify past therapy treatment history and response
  - Obtain pregnancy and delivery history (if applicable)
- Caregiver:
  - Clarify caregiver knowledge base, skills, and learning style to empower them with information and partnership[23]
  - Identify the caregiver's goals and priorities[22]
  - Identify current services and specialist involved in the child's care[22]
  - Identify current equipment such as braces and assistive devices[22]
  - Identify social situation in home and what supports are available[22]
  - Identify age which key developmental milestones were reache[22]
- Child:
  - Identify his/her interests, strengths and goals
  - Identify his/her likes and dislikes

Objective Findings

The evaluation is aimed to identify impairments of body function and structure that may impact functional activities and participation. The following chart is divided into three columns. The first column lists impairments identified during the examination. The activity and participation columns consist of tests-measures to objectively quantify limitations associated with impairments. In addition to impairment/activity/participation assessments, classification scales, developmental testing and criterion-referenced tests provide a complete clinical picture and are important in clinical planning and assessing outcomes.

a. Impairment, Activity and Participation Assessment

Impairment	Activity	Participation
Musculoskeletal **Strength** ◆ isometric ◆ functional **Range of Motion** ◆ passive ◆ active **Flexibility** **Joint integrity** **Postural alignment**	**Gross motor skills performance**[24] ◆ Gross Motor Function Measure (GMFM)[25] ◆ Peabody Developmental Motor Scales (PDMS-2)[26] ◆ Bayley Scales of Infant Development III ◆ Alberta Infant Motor Scales (AIMS)[27]	➤ Canadian Occupational Performance Measure (COPM) ➤ Children's Assessment

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- static
- dynamic

Neurological

Muscle tone/spasticity
- Modified Ashworth Scale (MAS)
- Tardieu Scale

Balance
- Pediatric Balance Scale
- Functional Reach Test

Coordination

Motor Planning

Proprioception

Reflexes
- Primitive
- Righting
- Equilibrium
- Deep Tendon

Sensory Processing
- Sensory Profiles
- Sensory Integration and Praxis Test (SIPT)

Visual
- Beery-Buktenica Developmental Test of Visual-Motor Integration (Beery VMI)
- Test of Visual Motor Skills (TVMS-3)
- Motor Free Visual Perception Test (MVPT)
- Wide Range Assessment of Visual Motor Ability (WRAVMA)

Cardiopulmonary

Vital Signs
- Heart rate
- Respiratory rate

Endurance
- 6 Minute Walk Test

Pain
- Visual or Verbal Analog Scale
- FACES Pain Rating Scale
- Face, Legs, Activity, Crying, Consolability Scale (FLACC)
- Test of Gross Motor Development (TGMD-2)
- Bruninks-Oseretsky Test of Motor Proficiency (BOT-2)[28]
- Movement Assessment Battery for Children (Movement ABC-2)

Fine motor skills performance[24]
- Peabody Developmental Motor Scales (PDMS-2)[26]
- Bruininks-Osertesky Test of Motor Proficiency (BOT-2)[28]
- Miller Function and Participation (M-FUN)

Gait[24]
- Analysis of spatial and temporal gait parameters such as: velocity, cadence, step and stride length, base of support over level and uneven surfaces
- 6 Minute Walk Test[29]
- 10 Meter Walk Test
- Observational Gait Scale (OGS)
- Timed Up and Go (TUG)[30]

Functional Mobility
- Pediatric Evaluation of Disability Inventory (PEDI and PEDI-CAT)[31]
- Test of Gross Motor Development (TGMD-2)
- Gillett Functional Assessment Questionnaire (FAQ)[32]

Self-Care Skills
- Roll Evaluation of Daily Living (REAL)
- Pediatric Evaluation of Disability Inventory (PEDI and PEDI-CAT)
- Wee FIM

Play Skills
- Preschool Play Scale

of Participation and Enjoyment (CAPE)
- Pediatric Inventory of Disability Inventory (PEDI and PEDI-CAT)
- School Function Assessment (SFA)
- Goal Attainment Scale (GAS)
- Activites Scale for Kids (ASK)

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b. Classification Scales

Classification scales are useful for making clinical decisions, setting realistic goals, maintaining realistic expectations and improving communication between clinicians.[44]

Classification Scales		
Scale	**Purpose**	**Levels**
Gross Motor Function Classification System-Expanded and Revised (GMFCS)[12, 33]	The GMFCS is the international gold-standard for gross motor classification of CP utilized for prognosis, goal setting, and research.[24, 34, 35] It is most accurate after age 2 years.[44] GMFCS is determined by age category and performance of sitting, transfers and mobility in the home, school and community settings. Children reach 90% of their gross motor potential by:[12] Level I – 4.8 years Level II – 4.4 years Level III – 3.7 years Level IV – 3.5 years Level V – 2.7 years	Level I - Walks without limitations Level II – Walks with limitations Level III – Walks using a hand-held mobility device Level IV – Self-mobility with limitations, may use powered mobility Level V – Transported in a manual wheelchair
Manual Ability Classification System (MACS)[36]	MACS is used with children with CP to classify their ability to use one or both hands to handle objects in daily activities.[37]	Level I – Handles objects easily and successfully Level II – Handles most objects but with reduced quality and/or speed Level III – Handles objects with difficulty and needs help to prepare and/or modify activities Level IV – Handles a limited selection of easily managed objects in adapted situations Level V – Does not handle objects and has severely limited ability to perform even simple actions

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Standardized Developmental Tests

Developmental milestones are a set of functional skills or age-specific tasks that most children can do at a certain age range. Although each milestone has an age level, the actual age when a normally developing child reaches that milestone can vary. Resources for reviewing developmental milestones are readily available online:

- https://www.cdc.gov/ncbddd/actearly/milestones/index.html
- https://pathways.org/topics-of-development/milestones/

Objective testing must be used to establish baseline measurements of deficits. Periodic reassessment of deficits is required to demonstrate progress.

Assessment	Description
Alberta Infant Motor Scale (AIMS) (0-18 months)	Assesses motor development in infants who are at risk of abnormal motor development
Battelle Developmental Inventory (BDI) (Birth-8 years)	Tests personal-social, adaptive (personal responsibility, self-care), motor (fine, gross, and perceptual), communication, and cognition;
Bayley Scales of Infant and Toddler Development (Age 1-42 months)	Tests adaptive behavior (communication, self-care, self-direction), cognitive, language, motor (fine and gross), social-emotional
Beery-Buktenica Developmental Test of Visual-Motor Integration (Beery VMI) (2-18 years)	Tests visual motor integration, visual perception and motor coordination, perception and motor coordination.
Brigance Inventory of Early Development III-Standardized (Brigance IED III-Standardized) (Birth to 7 years)	5 Domains: Physical development (gross & fine motor), language, academic skills/ cognitive (literacy & math/science), adaptive behavior, social-emotional
Bruininks Oseretsky Test of Motor Proficiency (BOT-2) (4-21 years)	Tests gross and fine motor proficiency
Developmental Assessment of Young Children-2 (DAYC-2)	Tests cognitive, communication, social-emotional, physical development, and adaptive behavior
Developmental Profile 3 (DP-3) (Birth to 12.11 years)	Tests physical, adaptive behavior, social/emotional, cognitive, communication
Developmental Test of Visual Perception-2 (DTVP-2) (4-10 years)	Tests motor-free and motor-enhanced visual perception
Miller Function and Participation (M-FUN) (2-7.11 years)	Tests visual motor, fine motor and gross motor
Motor-Free Visual Perception Test (MVPT) (4-85 years)	Tests visual perceptual skills without reliance on motor skills
Movement ABC (3-16.11 years)	Assesses mild to moderate motor skills deficits
Peabody Developmental Motor Scales-2 (PDMS-2) (Birth to 6 years)	Tests gross, fine, and visual motor skills

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Pediatric Evaluation of Disability Inventory (PEDI) (6 months-7 years) Pediatric Evaluation of Disability Inventory - Computerized Adaptive Testing (PEDI-CAT) (birth to 20 years)	PEDI tests Tests self-care, mobility, and social function; PEDI-CAT tests 4 Domains: Daily activities, Mobility, Social/ Cognitive, Responsibility
Roll Evaluation of Daily Lift (REAL) (ages 2-18.11)	Tests ADL and IADL
Test of Visual Motor Skills (TVMS-3) (ages 3-90 years)	Tests visual motor skills
Test of Visual Perceptual Skills (TVPS)	Tests visual discrimination, visual memory, visual-spatial relations, form constancy, visual sequential memory, visual figure-ground, visual closure
Wide Range Assessment of Visual Motor Ability (WRAVMA) (3-17 years)	Tests visual motor skills of drawing, matching and pegboard

c. Criterion-Referenced Tests

In pediatric physical and occupational therapy, motor abilities of children with disabilities are often compared to those of children with normal motor development. Evidence recognizes that children with severe and multiple disabilities should have criterion-referenced instruments of motor abilities since norm-based tests are unsuitable.[38] Commonly used criterion referenced tests are:

- Gross Motor Function Measure (GMFM) 88 and 66 is an outcome measure that may be used for children 5 months of age and older who have cerebral palsy, acquired brain injury or Down Syndrome.[24] The GMFM is the international standard of assessment for gross motor skills that effect everyday mobility and participation.[24] Clinically important change is 1.5 to 3 points.[24]
- Pediatric performance measures for physical therapy are: Functional Independence Measure for Children (WeeFIM), PEDI, Gillette and Functional Mobility Scale (FMS).[24, 38]
- Melbourne Assessment of Unilateral Limb Function is an outcome measure for upper extremity function in children older than 2.5 years of age.[24]
- Pediatric performance measures for occupational therapy include: ABILHAND Kids, PEDI, WeeFIM.[24, 38]
- Goal Attainment Scaling – 2nd edition (GAS) and the Canadian Occupational Performance Measure (COPM) are a criterion-referenced tools used to identify and set realistic child/parent/caregiver goals.[39] Goals can be written for all levels of function as identified by the ICF. These tools are beneficial in establishing episodes of care and monitoring progress.

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Treatment Criteria

- For those aspects of sensorimotor function for which there are standardized tests, significant dysfunction is commonly indicated by performance that is moderately to severely delayed which is measured at 1.5 standard deviations or more below the mean.
- Findings indicate a periodic functional skills issue, in which a specific goal is likely to be obtained in a predictable time frame.
- Anatomical and physiological changes related to growth and development associated with neuromuscular disorders.
- Identified deficit can be measured and progress demonstrated throughout the treatment plan.
- Need for home program development, education and training.
- Need for patient or caregiver training in medical, functional or adaptive equipment.

Treatment Intensity and Frequency Guidelines

Research defines severity and complexity criteria for determining frequency and duration for outpatient pediatric physical and occupational therapy.[9] Patients fall into categories based upon factors of: potential to participate (age, diagnosis, progress and motivation), critical period for skill acquisition or regression, level of skilled clinical decision making, and readiness of patient and caregiver (compliance and motivation).[9, 40, 41] Intensive and/or weekly therapy is most appropriate in young children, whereas motor development trajectory curves plateau at age 7 years after which episodic care is appropriate to address activity, participation or new secondary impairments.[12]

In pediatric physical and occupational therapy, there are four models of frequency:[9]

- Intensive therapy:
  - Patient has potential for rapid progress towards goals. Rapid changes in condition necessitate frequent changes in treatment. Appropriate for patients in an extremely critical period for skill acquisition or plasticity related to development or medical condition with the use of evidence supported and effective treatment interventions such as CIMT/BIT/Treadmill training.[5, 9, 10, 41-43] Evidence indicates when home programs are carefully designed and continually updated by therapists, the home program is a realistic solution to achieving intensive therapy dosage.[11]
- Weekly/frequent therapy:
  - Patient demonstrates continuous progress towards established goals. Requires frequent intervention for a limited duration to achieve improve function, activity or participation and requires frequent revisions or updates of home program. Treatment may be 1-2 times per week or 2-3 times per month.[5, 8-10, 13, 41]
- Periodic/monthly therapy:
  - Appropriate for patients not in a critical period for skill acquisition or at risk of regression and for maintenance of home program.[9, 15, 22, 44]

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- Consultative therapy:
  - Appropriate when expertise is needed to identify problems or recommend a solution.[9, 15, 22, 44]

Clinical Factors	Intensive 3-11x/wk	Weekly or Bimonthly 1-2x/wk or every other week	Periodic monthly or less often at regular intervals	Consultative or as needed
Potential to participate and benefit from the therapy process considering: - Age - Diagnosis - Prognosis - Motivation - Stage of Readiness	➢ Rapid functional progress or potential for rapid decline ➢ Critical medical condition with risk of loss of function ➢ Almost daily changes in condition	➢ Patient shows continuous progress towards established goals	➢ Patient shows slow rate of goal achievement in identified areas ➢ Does not regress ➢ Patient may not be able to cooperate or participate in therapy sessions	➢ Patient or caregiver able to meet new challenges due to change in life stage or medical condition. ➢ Clinical decision making used to identify problems; recommend solutions ➢ Issues identified by family/patient, not dictated by condition
Critical period for skill acquisition or potential regression based on development or condition	➢ Extremely critical period based on condition	➢ Critical period	➢ Not in a critical period ➢ Related to life stage or medical condition changes	➢ Specific challenges identified by patient/caregiver ➢ Need for specific adaptive equipment or strategy
Need for clinical decision making/problem solving from licensed therapist	➢ Requires clinical skills of licensed therapist ➢ Very limited amount of therapy program can be safely performed by patient/ caregiver	➢ Requires clinical skills and problem solving of a licensed therapist for most of program	➢ Clinical skills and problem solving required to assess condition status ➢ Home program updates ➢ Home program can be safely performed by patient/caregiver	➢ Home program carried out ➢ independently by patient/caregiver ➢ Clinical skills and problem solving by therapist needed for specific challenge identified by patient/caregiver
Level of support necessary to assist patient in attaining goals, attending therapy, compliance, etc.	➢ High level of support required to attain goals ➢ Minimal or no contribution by patient/caregiver	➢ High level of support required to attain goals ➢ Patient/caregiver able to participate, but not independently	➢ Minimal support required to address factors that may impede ability to progress towards goals.	➢ Support is needed only to address specific challenges identified by patient/caregiver ➢ Associated with life changes ➢

▪ (Adapted from Bailes, Burch and Reder, 2008)

Pediatric

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Physical and Occupational Therapy Intervention

"Rehabilitation services framed by the child and family's goals are considered best practice and reflect the substantial psychological evidence base about goal-based motivational learning."44

Therapy resources are most responsibly allocated when they are driven by their potential to improve function and not simply by the existence of a diagnosis. Best practice PT and OT utilizes family-entered care and avoids learned helplessness and dependence on therapy.[23] Therapy management fosters the child's competence in his or her environment, prevents secondary complications and disability, and uses home programs and other community resources to promote independence and empower parents/caregivers.[23, 45] Current best practice focuses on promoting functional outcomes through child-active approaches, compensatory or environmental adaptation and prevention of secondary health issue approaches, rather than improving specific motor skills that follow normal developmental sequencing.[42-44]

Novak and colleagues completed a systematic review of pediatric interventions for children with cerebral palsy and found 24% of interventions are proven to be effective, 70% are uncertain and 6% are proven ineffective.[42]

- Current evidence reports that effective interventions include: constraint induced movement therapy, bimanual training, goal-directed training, context-focused therapy, home programs, strengthening, and gait training.[5, 8, 10, 42, 43, 44]
- Systematic reviews of evidence have determined the following treatments are ineffective: passive home-based activities, stretching to prevent contractures, therapy suites, neuro-developmental treatment (NDT), hyperbaric oxygen and sensory integration.[10, 42, 43, 46]

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Goal/Outcome	Examples of Interventions: [5,8,10,42-44]
Aerobic capacity	Aquatic programs, gait and loco-motor training, walking and wheelchair propulsion programs
Access to household and community activities	Mobility, gait and locomotion training, balance and coordination, perceptual training, sensory processing, transfer training
Independence in self-care	Training in bed mobility, transfers, bathing, dressing, grooming, and toileting.
Prescription, application, and training in use of adaptive equipment	➢ Written or augmentative communication devices ➢ Environmental modifications ➢ Assistive devices: crutches, canes, walkers, wheelchairs ➢ Power devices: motorized wheelchairs and scooters ➢ Adaptive devices: seating systems, raised toilet seats, grab bars; supine, prone or dynamic standers ➢ Orthotic devices: braces, shoe inserts, splints ➢ Prosthetic limbs ➢ Protective devices: cushions, helmets ➢ Supportive devices: compression garments, collars,
Improved respiration	Breathing strategies and techniques to maximize ventilation, positioning, movement, and exercises to improve function
Improved oral-motor skills	Teach strategies and techniques for feeding, eating, biting, chewing, swallowing and drinking.
Improved joint integrity and mobility	Flexibility exercises, massage, joint/soft tissue mobilization, serial casting Note: High-quality evidence indicates manual stretch for the treatment and prevention of contractures does not have clinically important effects on joint mobility [46]
Improved motor function	CIMT/BIT, robotic training, body weight-supported treadmill training, biofeedback, strengthening, functional electrical stimulation
Reduce edema, lymphedema, or effusion	Compression bandaging, compression garments, taping, total contact casting, vasopneumatic compression devices, gravity-assisted compression devices
Home Programs	Home programs are indispensable elements of PT/OT intervention, augmenting the effects of therapy and promoting functional application of acquired skills. These programs are developed by the PT and OT and are implemented by parents and caregivers. They may also be self-directed based on the child's developmental maturity and skill level. During the times of direct treatment, the home program serves as an adjunct to treatment, and requires regular review and updating. During periods when little or no functional changes occur, the home program serves to sustain the child's structural and functional status.
Self-Management Techniques	Assessing the child and caregiver's readiness for change through motivational interview, providing shared-decision making and empowering families to care for children with chronic conditions rather than being dependent on therapy.

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Referrals and Adjuncts to Physical/Occupational Therapy:

- Orthopedist
- Neurologist
- Pediatrician
- Psychologist
- Speech-Language Pathologists
- Audiologists
- Orthotists
- Nutritionists
- Developmental Interventionist
- Community based programs
- Respite Care
- Behavioral intervention
- Special education
- Vocational services

Discharge Criteria

- Termination of therapy services should occur when:
  - Episode goals have been reached for that functional level;
  - The family chooses not to continue therapy or demonstrates noncompliance;
  - When therapy services no longer produce a functional and measurable outcome
  - Lack of progress in a reasonable time-frame;
  - When care is repetitive, skilled therapy services are no longer required and the caregiver/patient can continue with the home program; and/or
  - Improvements that can be attributed to only maturation is not an indication for ongoing treatment.

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Maximal Complex Motion Necessary for Functional Activities

Shoulder Motion (in degrees)

Activity	Motion	Mean	Source
Eating	Flexion	52	Matsen1
	Abduction	22	Safaee-rad et al2
	Medial rotation	18	Safaee-rad et al
	Horizontal adduction	87	Matsen
Drinking with a cup	Flexion	43	Safaee-rad et al
	Abduction	31	Safaee-rad et al
	Medial rotation	23	Safaee-rad et al
Washing axilla	Flexion	52	Matsen
Combing hair	Horizontal adduction	104	Matsen
	Abduction	112	Matsen
	Horizontal adduction	54	Matsen
Maximal elevation	Flexion/abduction	148	Matsen
Maximal reaching up back	Horizontal adduction	55	Matsen
	Extension	56	Matsen
	Horizontal abduction	69	Matsen
Reaching perineum	Extension	38	Matsen
	Horizontal abduction	86	Matsen

Elbow Motion (in degrees)

Activity	Flexion Range Min-Max	Pronation	Supination	Source
Use telephone	43-136	41	23	Morrey3
Rise from chair	21-95	34	-10	Morrey
Open door	24-57	35	24	Morrey
Read newspaper	78-104	49	-7	Morrey
Pour pitcher	36-59	43	22	Morrey
Put glass to mouth	49-130	10	13	Morrey
Drink from cup	78-129	-4	31	Safaee-rad et al
Cut with knife	89-107	42	-27	Morrey
Eat with form	85-128	11	52	Morrey
Eat with spoon	101-123	23	59	Safaee-rad et al

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Wrist Motion (in degrees)

Activity	Extension Min-Max	Ulnar Deviation Min-Max	Source
Put glass to mouth	11-24		Brumfield4
Drink from a glass	2-22	5-20	Ryu5
Drink from handled cup	-8-6	8-16	Safaee-rad et al
Eat with a fork	3-18	3 to -5	Safaee-rad et al
Feeding tasks: fork, spoon, cup	-7-21	19 to -2	Cooper6
Cut with a knife	-30 to -5	12-27	Ryu
Pour from pitcher	-20-22	12-32	Ryu
Turn doorknob	-40-45	-2-32	Ryu
Use a telephone	-15-40	-10-12	Ryu
Turn steering wheel	-15-45	-17-27	Ryu
Rise from chair	-10-60	5-30	Ryu

Wrist Motion during Personal Care (in degrees)

Activity	Extension	Flexion	Ulnar Deviation	Radial Deviation	Source
Hand to top of head	-	21	16	-	Ryu
Hand to Occiput	-	10	10	-	Ryu
Hand to front of chest	-	25	-	5	Ryu
Hand to sacrum	-	20	48	-	Ryu
Hand to foot	0.9	-	9	-	Ryu

Finger and Thumb Motion during 11 Functional Activities (in degrees)

(Holding a telephone, can, fork, scissors, toothbrush, and hammer, using a zipper and comb, turning a key, printing with a pen, and unscrewing a jar)
Source:

1. Totten, PA, and Flinn-Wagner, S: Functional evaluation of the hand. In Stanley, BG, and Trbuzi, SM (eds): Concepts in Hand Rehabil. FA Davis, Philadelphia, 1992.
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Motion	Range	Mean	SD
Finger MCP flexion	33-73	61	(12)
PIP flexion	36-86	60	(12)
IP flexion	20-61	39	(14)
Thumb MCP flexion	10-32	21	(5)
IP flexion	20-43	18	(5)

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Hip Flexion (in degrees)

	Livingston, et al[7]	McFayden and Winter[8]	Protopapadaki et al[9]
Activity	**Range**	**Mean**	**Mean**
Walking on level surfaces	0-30	44	-
Ascending stairs	0-66	60	65
Descending stairs	0-45	66	49
Sitting	-	90-112	-
Squatting	-	115	-
Stooping	-	125	-
Putting on socks	-	120 flex, 20 abd, 20 lateral rot.	-

Knee Flexion (in degrees)

	Jevsevar et al Mean age=53[10]	Livingston et al Women 19-26 yrs	Laubenthal et al Men mean age=25[11]	Rowe et al Mean age=67[12]
Motion	**Mean**	**Mean Range**	**Mean Range**	**Mean**
Walk on level surfaces	63			65
Ascend stairs	93	2-105	0-83	80
Descend stairs	87	1-107	0-83	78
Rise from chair	90			90
Sit in chair			0-93	91
Tie shoes			0-106	
Lift object from the floor			0-117	
Put on socks			0-117	

Ankle Motion (in degrees)

Motion	Gait Level Surfaces	Stair Ascent	Stair Descent
Dorsflexion	0-10 (Murray)	14-27 (Livingston et al)	21-36 (Livingston et al)
Plantarflexion	15-30 (Murray) 0-31 (Ostrosky et al)	23-30 (Livingston et al) 15-25 (McFayden and Winter)	424-31 (Livingston et al) 40 (Protopadaki et al)

Cervical Motion (in degrees)

Motion	Range	Source
Looking up (flexion)	40-50	Bennett and Associates13
Looking over the shoulder (rotation)	60-70	Bennett and Associates

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Lumbar Motion (in degrees)

Motion	Gait Level Surfaces	Stair Ascent
Sit to stand	35	Hsieh and Pringle14
Stand to sit	42	Hsieh and Pringle
Putting on socks	57	Hsieh and Pringle
Picking up objects from floor	60	Hsieh and Pringle

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