Cigna Medical Coverage Policies – Musculoskeletal
Knee Surgery: Arthroscopic and Open Procedures

Effective May 31, 2023

Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

This evidence-based medical coverage policy has been developed by eviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

CMM-312:Knee Surgery - Arthroscopic and Open Procedures

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Definitions

- **Arthrofibrosis:** a condition of the appendicular skeletal system that has resulted from disease, injury, or surgery, and results in pain and restricted range of motion due to internal scarring of the joint with consequent stiffness.
- **Autologous Chondrocyte Implantation (ACI) or Autologous Chondrocyte Transplantation (ACT):** a cell-based cartilage repair surgical technique which utilizes an individual's own cells in an effort to repair damage to articular cartilage with the goal of improving joint function and reducing pain. The procedure involves the collection and culture of articular cartilage cells (i.e., chondrocytes) that are then implanted into the cartilage defect with the intent that the cultured cells will contribute to the regeneration and repair of the articular surface.
  - **Hybrid autologous Chondrocyte Implantation (ACI):** ACI is combined with other surgical repair techniques of cartilage defects (e.g., osteochondral autograft transfer).
- **Kellgren-Lawrence Grading System:** a radiographic grading system that has been developed for describing osteoarthritic changes to the tibial-femoral joint of the knee. When used, the radiographic findings on plain x-rays are typically reported within one of the following categories:
  - **Grade 0** – No radiographic features of osteoarthritis are present
  - **Grade I** – Doubtful narrowing of joint pace and possible osteophytic lipping
  - **Grade II** – Definite osteophytes and possible narrowing of joint space
  - **Grade III** – Moderate multiple osteophytes, definite narrowing of joint space, some sclerosis, and possible deformity of bone contour
  - **Grade IV** – Large osteophytes, marked narrowing of joint space, severe sclerosis, and definite deformity of bone contour
- **Kissing Lesion:** an articular cartilage defect on opposing joint surfaces of the knee and that are in contact either between the patella and distal femur or the distal femur and tibia (e.g., bipolar lesion).
- **MACI® Implant (Vericel Corporation, Cambridge, MA [formerly Genzyme Biosurgery]):** Until recently**,** Carticel® (Vericel Corporation, Cambridge, MA [formerly Genzyme Biosurgery]) was the only technology that received FDA approval for the culturing of chondrocytes. MACI® Implant (Matrix Induced Autologous Chondrocyte Implant) received approval from the U.S. Food and Drug Administration December 2016 as an autologous cellularized scaffold indicated for repair of single or multiple symptomatic, full-thickness cartilage defects of the knee with or without bone involvement in adults. MACI® Implant is utilized as part of an ACI procedure in which cartilage cells are removed during arthroscopy, and shipped to a laboratory, where the cells are cultured over a period of several weeks. The cells are seeded on a porcine collagen membrane, and once the culturing process is complete, the cells seeded on the membrane are returned to the surgeon for implantation during the procedure. The membrane is placed into the defect, and over several months the cells create a matrix that is intended to cover the articular surface of the knee. The safety and effectiveness of MACI® Implant in joints other than the knee has not been established.
- **Modified Outerbridge Classification:** a system that has been developed for judging articular cartilage injury to the knee. This system allows delineation of

varying areas of chondral pathology, based on the qualitative appearance of the cartilage surface as viewed on MRI and can assist in identifying those injuries that are suitable for repair techniques. The characterization of cartilage in this system is as follows:

- **Grade I** – Softening with swelling
- **Grade II** – Fragmentation and fissuring less than one square centimeter (1 cm^2)
- **Grade III** – Fragmentation and fissuring greater than one square centimeter (1 cm^2)
- **Grade IV** – Subchondral bone exposed

- **Mosaicplasty** (or osteochondral cylinder transplantation)**:** a surgical technique which consists of harvesting cylindrical bone-cartilage grafts and transplanting them into focal chondral or osteochondral defects in the knee. After excision of the chondral lesion, an abrasion arthroplasty is performed to refresh the base of the defect. The grafting procedure involves collecting grafts from the posterior aspect of the distal femoral articular surfaces (medial condyle, lateral condyle or trochlea) and implanting the grafts in a mosaic-like pattern that will contribute to regeneration and repair the articular surface. A recipient tunnel is created and sized with a drill bit slightly larger than the length of the graft. The harvested graft is placed in the tunnel by a press-fit method. All subsequent grafts are inserted in a similar pattern.
- **Non-surgical management** (with regard to the treatment of knee pain): any provider-directed non-surgical treatment which has been demonstrated in the scientific literature as efficacious and/or is considered reasonable care in the treatment of knee pain. The types of treatment involved can include, but are not limited to: ice, relative rest/activity modification, acupuncture, weight loss, supervised physiotherapy modalities, and therapeutic exercises, prescription and non-prescription medications, assistive devices (e.g., brace, cane, crutches, walker, wheelchair), and/or intra-articular injections (e.g., steroid and/or viscosupplementation).
- **Osteochondral Allograft Transplantation (OATS Procedure):** a procedure that is similar to mosaicplasty, involving the use of a larger, single plug that usually fills an entire defect. It is often performed to graft chondral defects that are also associated with anterior cruciate ligament (ACL) tears. This method allows arthroscopic access to both the ACL and the chondral defect for the performance of a repair and the grafting procedure.
- **Outerbridge Classification:** a system that has been developed for judging articular cartilage injury to the knee. This system allows delineation of varying areas of chondral pathology, based on the qualitative appearance of the cartilage surface as viewed by direct visualization intraoperatively, and can assist in identifying those injuries that are suitable for repair techniques. The characterization of cartilage in this system is as follows:
  - **Grade I** - Softening with swelling
  - **Grade II** - Fragmentation and fissuring less than one square centimeter (1 cm^2)
  - **Grade III** - Fragmentation and fissuring greater than one square centimeter (1 cm^2)
  - **Grade IV** - Subchondral bone exposed

- **Subchondral Drilling or Microfracturing:** a surgical procedure which is performed after the calcified cartilage is debrided and the surgeon creates tiny fractures in the adjacent bones (through the use of an awl). Blood and bone marrow (which contains stem cells) seep out of the fractures, creating a blood clot that releases cartilage-building cells. The microfractures are treated as an injury by the body, which is why the surgery results in new, replacement cartilage. Studies have shown that microfracturing techniques do nor fill the chondral defect fully and the repair material that forms is fibrocartilage. Fibrocartilage is not as mechanically sound as the original hyaline cartilage; it is much denser and isn't able to withstand the demands of everyday activities as well as hyaline cartilage and is; therefore, at a higher risk of breaking down. The procedure is less effective in treating older individuals, overweight individuals, or in larger cartilage lesions. Furthermore, chances are high that after only one or two years, symptoms start to return as the fibrocartilage wears away, forcing the individual to reengage in articular cartilage repair.

General Guidelines

Application of Guideline

- The determination of medical necessity for the performance of knee surgery is always made on a case-by-case basis.
- Manipulation of a knee joint under general anesthesia is included in all arthroscopic knee procedures and is therefore considered incidental to the base procedure requiring medical necessity review.
- For advanced imaging indications for conditions about the knee, refer to **MS-25: Knee**
- For coverage indications for articular cartilage allograft materials, please reference the **Cigna Medical Coverage Policy**: **0118 Bone, Cartilage and Ligament Graft Substitutes**

Arthroscopic or Open Procedure for Fracture, Tumor, Infection, or Foreign Body

Arthroscopic or open knee surgery may be considered **medically necessary** for **ANY** of the following:

- When surgery is being performed for fracture, tumor, infection or foreign body that has led to or will likely lead to progressive destruction.

Diagnostic Arthroscopy

Diagnostic Arthroscopy Indications

- Diagnostic arthroscopy is considered **medically necessary** as a stand-alone procedure when **ALL** of the following criteria have been met:

- Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment) for at least six (6) months in duration
- Any **ONE** of the following physical examination findings:
  - Limited range of motion
  - Evidence of joint swelling/effusion
  - Joint line tenderness
- Failure of provider-directed non-surgical management for at least three (3) months in duration
- Absence of Kellgren-Lawrence Grade II or greater findings on plain radiographs
- MRI or CT arthrogram is inconclusive for internal derangement/pathology

Diagnostic Arthroscopy Non-Indications

Not Medically Necessary

- Diagnostic Arthroscopy is considered **not medically necessary** for **ANY** other indication or condition.

Experimental Investigational, or Unproven (EIU)

- Based on lack of scientific evidence of efficacy and safety, the following is considered **experimental, investigational, or unproven (EIU)**:
  - "In-office" diagnostic arthroscopy (e.g., Mi-Eye™, VisionScope®)

Arthroscopic Debridement (Chondroplasty)/Loose Body/Foreign Body Removal

Arthroscopic Debridement (Chondroplasty) and Loose Body/Foreign Body Removal Indications

- Arthroscopic debridement (chondroplasty), loose body removal, and foreign body removal are considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Individual reports pain and any **ONE** of the following mechanical symptoms:
    - Knee range of motion is "blocked" due to pain
    - Giving way, subjective weakness, or buckling of the knee
    - Painful locking, clicking, catching, or popping during weight-bearing activities
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
    - **Note**: In the presence of painful locking, clicking, catching, or popping during weight-bearing activities secondary to an intra-articular loose body or foreign body, three (3) months of provider-directed non-surgical management is not required.
  - Concurrent findings on **EITHER** of the following:
    - MRI or CT arthrogram demonstrates articular cartilage degeneration and any **ONE** of the following:

        - Loose body or foreign body within the joint
        - Unstable flaps of articular cartilage
        - Meniscal tear that extends to the articular surface (not simply degenerative changes, i.e., fraying) in conjunction with articular cartilage degeneration within the same compartment
        - Impinging osteophytes, which would be reasonably expected to result in mechanical symptoms and loss of knee joint function
    - Orthogonal radiographs demonstrate a loose body within the tibiofemoral or patellofemoral joint space

Arthroscopic Debridement (Chondroplasty) and Loose Body/Foreign Body Removal Non-Indications

- Arthroscopic debridement (chondroplasty) and loose body removal is considered **not medically necessary** in the presence of Kellgren-Lawrence Grade II or greater findings on plain radiographs except for loose body removal in the presence of an acutely locked knee on physical examination.
- Arthroscopic debridement (chondroplasty), loose body removal, and foreign body removal are considered **not medically necessary** for **ANY** other indication or condition.

Synovectomy

Synovectomy Indications

- Synovectomy (limited [e.g., plica or shelf resection], as a stand-alone procedure, or a major procedure with 2 or more compartments [e.g., medial and lateral]) is considered **medically necessary** when **ALL** of the following criteria have been met:
    - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
    - Any **ONE** of the following physical examination findings:
        - Limited range of motion
        - Evidence of joint swelling/effusion
        - Joint line or plica tenderness
    - Failure of provider-directed non-surgical management for at least three (3) months in duration
    - MRI or CT arthrogram demonstrates evidence of synovitis or plica
        - **Note**: Advanced imaging is not required for the clinical diagnosis of patellar clunk syndrome following knee replacement surgery
    - Absence of Kellgren-Lawrence Grade IV findings on plain radiographs
    - Presence of any **ONE** of the following:
        - Plica syndrome
        - Inflammatory arthritis (i.e., rheumatoid arthritis, gout, pseudogout, psoriatic arthritis)
        - Pigmented villonodular synovitis (PVNS)
        - Synovial chondromatosis
        - Lyme synovitis

- Hemophilia
- Hemochromatosis
- Non-specific synovitis (including proliferative synovitis, post-operative synovitis as a sequela from a knee replacement, patellar clunk syndrome, cyclops lesion, etc.)
- Recurrent hemarthrosis (i.e., secondary to sickle cell anemia, bleeding diathesis, etc.)

Synovectomy Non-Indications

- Synovectomy is considered **not medically necessary** for **ANY** other indication or condition.

Meniscectomy or Meniscal Repair

Meniscectomy or Meniscal Repair Indications

- Meniscectomy (partial or total) **or** meniscal repair is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - **TWO OR MORE** of the following physical examination findings:
    - Limited range of motion
    - Evidence of joint swelling/effusion
    - Joint line tenderness
    - Positive McMurray's Test, Thessaly Test, or Apley's Compression Test
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
    - **Note**: Meniscal tear with a locked knee on physical examination does not require three (3) months of provider-directed non-surgical management.
  - MRI or CT arthrogram demonstrates a meniscal tear that extends to the articular surface (not simply degenerative changes, i.e., fraying) and correlates with the individual's reported symptoms and physical examination findings
  - Absence of Kellgren-Lawrence Grade II or greater findings on plain radiographs
    - **Note**: Acute meniscal tear with associated function-limiting pain or locked knee on physical examination does not require absence of Kellgren-Lawrence Grade 2 or greater findings on plain radiographs
- Meniscectomy/saucerization for discoid lateral meniscus is considered **medically necessary** when MRI confirms the presence of a discoid meniscus and **ALL** of the above criteria are met (other than demonstration of a meniscal tear).
- Meniscal debridement **is considered medically necessary** when performed in conjunction with other medically necessary arthroscopic procedures on the knee (e.g., anterior cruciate reconstruction).

Meniscectomy or Meniscal Repair Non-Indications

- Meniscectomy (partial or total) or meniscal repair is considered **not medically necessary** for **ANY** other indication or condition.

Meniscal Allograft Transplantation

Meniscal Allograft Transplantation Indications

- Meniscal allograft transplantation is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands or employment)
  - Prior significant trauma resulting in an irreparable meniscal tear or has undergone a meniscectomy where at least 50% of the meniscus has been removed
  - Any **ONE** of the following physical examination findings:
    - Limited range of motion
    - Evidence of joint swelling/effusion
    - Joint line tenderness
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
  - Individual is not considered an appropriate candidate for total knee arthroplasty
  - Body Mass Index (BMI) 35 or less
  - Age 49 years or younger

Meniscal Allograft Transplantation Non-Indications

- Meniscal allograft transplantation is considered **not medically necessary** for **ANY** other indication or condition including, when **EITHER** of the following are present:
  - Upon standing radiographs, individual demonstrates osteoarthritic change in the knee including joint space narrowing and osteophytes which is classified by the Kellgren-Lawrence Scale as Grade III or IV
  - Upon MRI, individual demonstrates articular degeneration in affected compartment which is classified by the Modified Outerbridge Classification as Grade III or IV

Anterior Cruciate Ligament (ACL) Reconstruction

Anterior Cruciate Ligament (ACL) Reconstruction Indications

- Anterior cruciate ligament (ACL) reconstruction with allograft or autograft is considered **medically necessary** when **ALL** the following criteria have been met:
  - Function-limiting pain and/or a of knee function during the course of preoperative treatment which interferes with **ANY** of the following:
    - Ability to carry out age appropriate activities of daily living
    - Demands of employment
    - Need to return to activities that require cutting, pivoting, and/or agility in which ACL insufficiency may predispose to further instability episodes that may result in new articular or meniscal cartilage injuries
  - Individual reports knee instability which is noted as giving way, subjective weakness, or “buckling” during the course of preoperative treatment
  - Any **ONE** of the following physical examination findings:

- Positive Lachman's Test
- Positive Anterior Drawer Test
- Positive Pivot Shift Test

- Failure of provider-directed non-surgical management for at least three (3) months in duration, except in an acute injury setting where joint instability has been documented and **ANY** of the following are present:
  - Need to return to activities that require cutting, pivoting, and/or agility activities in which ACL insufficiency may predispose to further instability episodes that may result in new articular or meniscal cartilage injuries
  - A confirmed ACL tear and a repairable meniscus tear
  - Concomitant ligament injuries (i.e., multi-ligamentous knee injury) that require reconstruction to provide stability
- MRI, CT arthrogram, or arthroscopy demonstrates a tear/disruption or significant laxity of the anterior cruciate ligament (ACL)

Anterior Cruciate Ligament (ACL) Reconstruction Non-Indications

- Anterior cruciate ligament (ACL) reconstruction is considered **not medically necessary** for **ANY** other indication or condition.

Anterior Cruciate Ligament (ACL) Repair

- Anterior cruciate ligament (ACL) repair is considered **experimental, investigational, or unproven (EIU)**.

Anterolateral Ligament (ALL) Reconstruction

Anterolateral Ligament (ALL) Reconstruction Indications

- Anterolateral ligament reconstruction is considered **medically necessary** when**ALL** of the following criteria have been met:
- Anterolateral ligament (ALL) reconstruction is required to augment the anterior cruciate ligament (ACL) reconstruction
  - Function-limiting pain and/or a documented loss of knee function during the course of preoperative treatment which interferes with **ANY** of the following:
    - Ability to carry out age appropriate activities of daily living
    - Demands of employment
    - Need to return to activities that require cutting, pivoting, and/or agility in which ACL insufficiency may predispose to further instability episodes that may result in new articular or meniscal cartilage injuries
  - Individual reports knee instability which is noted as giving way, subjective weakness, or "buckling" during the course of preoperative treatment
  - Any **ONE** of the following physical examination findings:
    - Positive Lachman's Test
    - Positive Anterior Drawer Test
    - Positive Pivot Shift Test
  - Failure of provider-directed non-surgical management for at least three (3) months in duration, (except in an acute injury setting where joint instability has been documented), and **ANY** of the following are present:

- Need to return to high-demand sports that require cutting, pivoting, and/or agility activities in which ACL insufficiency may predispose to further instability episodes that may result in new articular or meniscal cartilage injuries
- A confirmed ACL tear and a repairable meniscus tear
- Concomitant ligament injuries (i.e., multi-ligamentous knee injury) that require reconstruction to provide stability

- MRI, CT arthrogram, or arthroscopy demonstrates a tear/disruption or significant laxity of the anterior cruciate ligament (ACL)

Anterolateral Ligament (ALL) Reconstruction Non-Indications

- Anterolateral Ligament (ALL) reconstruction is considered **not medically necessary** for **ANY** other indication or condition.

Posterior Cruciate Ligament (PCL) Reconstruction

Posterior Cruciate Ligament (PCL) Reconstruction Indications

- Posterior cruciate ligament (PCL) reconstruction with allograft or autograft is considered **medically necessary** when **ALL** the following criteria have been met:
  - Function-limiting pain and a documented loss of knee function which interferes with the ability to carry out the age appropriate activities of daily living and/or demands of employment
  - Any **ONE** of the following physical examination/radiographic imaging findings:
    - Positive Posterior Drawer Sign
    - Positive Posterior Sag Sign or Tibial Drop Back Test
    - Positive Quadriceps Active Test
    - Eight (8) millimeters or more of increased posterior translation on stress radiographs
  - Failure of provider-directed non-surgical management for at least three (3) months in duration, except in an acute injury setting where hemarthrosis, effusion and joint instability have been documented and **EITHER** of the following are present:
    - Need to return to activities that require cutting, pivoting, and/or agility activities in which PCL insufficiency may predispose to further instability episodes that may result in new articular or meniscal cartilage injuries
    - Concomitant ligament injuries (i.e., multi-ligamentous knee) that require reconstruction to provide stability
  - MRI, CT Arthrogram, or arthroscopy demonstrates a tear/disruption or significant laxity of the posterior cruciate ligament (PCL)

Posterior Cruciate Ligament (PCL) Reconstruction Non-Indications

- Posterior cruciate ligament (PCL) reconstruction is considered **not medically necessary** for **ANY** other indication or condition.

Medial/Lateral Collateral Ligament (MCL/LCL) Repair/ Reconstruction

Medial/Lateral Collateral Ligament (MCL/LCL) Repair/Reconstruction Indications

- Medial/lateral collateral ligament (MCL/LCL) repair/reconstruction with allograft or autograft is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain and/or loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment
  - Individual reports knee instability which is noted as giving way, subjective weakness, or buckling
  - **EITHER** of the following physical examination findings:
    - Positive Valgus Stress Test (Medial)
    - Positive Varus Stress Test (Lateral)
  - Failure of provider-directed non-surgical management for at least three (3) months in duration, except in an acute injury setting of the lateral collateral ligament (LCL) (including the posterolateral corner) where total disruption of the ligament documented on MRI or CT arthrogram and effusion and joint instability have been documented on physical examination
  - MRI or CT arthrogram demonstrates a tear/disruption of the medial or lateral collateral ligament (MCL/LCL)

Medial/Lateral Collateral Ligament (MCL/LCL) Repair/Reconstruction Non-Indications

- Medial collateral ligament (MCL) repair/reconstruction is considered **not medically necessary** in an acute injury setting, including an isolated MCL repair.
- Medial/lateral collateral ligament (MCL/LCL) repair/reconstruction is considered **not medically necessary** for any other indication or condition.

Autologous Chondrocyte Implantation (ACI) or Autologous Chondrocyte Transplantation (ACT)

Autologous Chondrocyte Implantation (ACI) or Autologous Chondrocyte Transplantation (ACT) Indications

- Autologous chondrocyte implantation (ACI) or autologous chondrocyte transplantation (ACT) (using the MACI® implant) is considered **medically necessary** for the treatment of symptomatic single or multiple full-thickness cartilage defects of the distal femoral articular surface (i.e., medial condyle, lateral condyle, or trochlea) and/or patella caused by acute or repetitive trauma when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Presence of **BOTH** of the following findings:

    - A stable knee with intact or reconstructed ligaments (ACL or PCL) and menisci.
        - A concurrent ligament stabilization or meniscal procedure at the time of ACI would be acceptable.
    - Normal tibial-femoral and/or patella-femoral alignment
- Failure of provider-directed non-surgical management for at least three (3) months in duration
- A full-thickness distal femoral articular surface (i.e., medial condyle, lateral condyle or trochlea) and/or patellar chondral defect of 1-10cm^2 in size has been identified during an MRI or CT arthrogram, or during an arthroscopy and the Modified Outerbridge Classification or Outerbridge Classification is Grade III or Grade IV
- Absence of osteochondritis dissecans (OCD) lesion that requires bone grafting
- Absence of inflammatory arthritis or other systemic disease affecting the joints
- Absence of osteoarthritis or generalized tibial chondromalacia
- Minimal to absent osteoarthritic changes in the surrounding articular cartilage (e.g., Kellgren-Lawrence Grade II or less)
- Normal articular cartilage at the lesion border (contained lesion)
- For femoral and patellar chondral lesions, absence of a corresponding 'kissing lesion' with a Modified Outerbridge Classification of Grade III or IV of the distal femur (trochlea, condyles), patella, or tibia
- Body Mass Index (BMI) 35 or less
- Age 15-55 years

Autologous Chondrocyte Implantation (ACI) or Autologous Chondrocyte Transplantation (ACT) Non-Indications

Not Medically Necessary

- Autologous chondrocyte implantation is considered **not medically necessary** for any other indication or condition, including when **ANY** of the following are present:
    - Any knee joint surgery within six (6) months before screening excluding surgery to procure a biopsy or a concomitant procedure to prepare the knee for a MACI® implant
    - Presence of a corresponding 'kissing lesion' with a Modified Outerbridge Classification Grade III or IV defect(s) on the distal femur (trochlea, condyles), patella, or tibia
    - Presence of Kellgren-Lawrence Grade III or IV osteoarthritic changes in the surrounding articular cartilage
    - Total meniscectomy, meniscal allograft, or bucket-handle tear or displaced tear requiring > 50% removal of the meniscus in the target knee
    - Septic arthritis within one (1) year before screening
    - Known history of hypersensitivity to gentamicin, other aminoglycosides, or products of porcine or bovine origin
    - Uncorrected congenital blood coagulation disorders
    - Cruciate ligament instability

Experimental, Investigational, or Unproven (EIU)

- Autologous chondrocyte implantation using the MACI® implant for treatment of cartilaginous defects other than the distal femur or patella (i.e., proximal tibia) and of cartilaginous defects involving other joints (e.g., ankle, elbow, shoulder) is considered **experimental, investigational, or unproven (EIU)**.
  - For ACI performed for locations other than the knee, please reference the **Cigna Medical Coverage Policy: 0515 Miscellaneous Musculoskeletal Procedures**
- Hybrid autologous chondrocyte implantation performed with osteochondral autograft transfer system (Hybrid ACI/OATS) technique for the treatment of osteochondral defects is considered **experimental, investigational, or unproven (EIU)**.

Osteochondral Allograft/Autograft Transplantation Systems (OATS)/ Mosaicplasty

Osteochondral Allograft/Autograft Transplantation Systems (OATS)/ Mosaicplasty Indications

- Osteochondral allograft/autograft transplantation (OATS)/mosaicplasty is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Presence of **BOTH** of the following findings:
    - A stable knee with intact or reconstructed ligaments (ACL or PCL) and menisci.
      - A concurrent ligament stabilization or meniscal procedure at the time of OATS would be acceptable.
    - Normal tibial-femoral and/or patella-femoral alignment
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
  - A full-thickness distal femoral articular surface (i.e., medial condyle, lateral condyle or trochlea) and/or patellar chondral defect that has been identified during an MRI or CT arthrogram, or during an arthroscopy and the Modified Outerbridge Classification or Outerbridge Classification is Grade III or Grade IV
  - **EITHER** of the following:
    - Osteochondral autograft transplants and mosaicplasty:
      - Small (i.e., ≤ 2.5 cm^2 total) chondral defects with sharp, definite borders surrounded by normal-appearing hyaline cartilage
    - Osteochondral allograft transplants:
      - Larger (i.e., ≤ 10.0 cm^2 total) chondral defects with sharp definite borders surrounded by normal appearing hyaline cartilage
  - Absence of inflammatory arthritis or other systemic disease affecting the joints
  - Minimal to absent osteoarthritic changes in the surrounding articular cartilage (e.g., Kellgren-Lawrence Grade 2 or less)
  - Normal articular cartilage at the lesion border (contained lesion)

- Absence of osteoarthritis or generalized tibial chondromalacia, steroid-induced cartilage or bone disease
- For femoral and patellar chondral lesions, absence of a corresponding 'kissing lesion' with a Modified Outerbridge Classification of Grade III or IV of the distal femur (trochlea, condyles), patella, or tibia
- Individual is not a candidate for total knee arthroplasty
- Body Mass Index (BMI) of less than 35
- Age 49 years or younger

Osteochondral Allograft/Autograft Transplantation Systems (OATS)/ Mosaicplasty Non-Indications

Not Medically Necessary

- Osteochondral allograft/autograft transplantation (OATS)/mosaicplasty of the distal femoral articular or patellar surface is considered **not medically necessary** for **ANY** other indication or condition.

Experimental, Investigational, or Unproven (EIU)

- Osteochondral allograft/autograft transplantation (OATS)/mosaicplasty is considered **experimental, investigational, or unproven (EIU)** for treatment of articular cartilage defects in locations other than the distal femur or patella (i.e., proximal tibia).
  - For osteochondral grafting performed for locations other than the knee (e.g., ankle, shoulder, elbow), please reference the **Cigna Medical Coverage Policy: 0515 Miscellaneous Musculoskeletal Procedures**
- Hybrid autologous chondrocyte implantation performed with osteochondral autograft transfer system (Hybrid ACI/OATS) technique for the treatment of osteochondral defects is considered **experimental, investigational, or unproven (EIU)**.

Abrasion Arthroplasty/Subchondral Drilling/Microfracturing

Abrasion Arthroplasty/Subchondral Drilling/Microfracturing Indications

- Abrasion arthroplasty, subchondral drilling or microfracturing is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Presence of **BOTH** of the following findings:
    - A stable knee with intact or reconstructed ligaments (ACL or PCL) and menisci.
      - A concurrent ligament stabilization or meniscal procedure at the time of abrasion arthroplasty would be acceptable.
    - Normal tibial-femoral and/or patella-femoral alignment
  - Failure of provider-directed non-surgical management for at least three (3) months in duration

- A full-thickness distal femoral articular surface (i.e., medial condyle, lateral condyle or trochlea) and/or patellar chondral defect of ≤ 2.5 cm^2 in size on the weight-bearing surface that has been identified during an MRI or CT arthrogram, or during an arthroscopy and the Modified Outerbridge Classification or Outerbridge Classification is Grade III or IV

Abrasion Arthroplasty/Subchondral Drilling/Microfracturing Non-Indications

- Abrasion arthroplasty, subchondral drilling, or microfracturing is considered **not medically necessary** for **ANY** other indication or condition.

Procedures for Patellofemoral Conditions

- Procedures for anterior knee pain with or without recurrent patellar instability can include both bony and/or soft tissue surgical procedures.
  - Bony surgical procedures can include tibial tubercle osteotomy/tubercleplasty (e.g., Fulkerson, Maquet) and trochleoplasty.
  - Soft tissue surgical procedures can include medial patellofemoral ligament (MPFL) reconstruction/repair, extensor realignment and/or muscle advancement or release (e.g. Cambell, Goldthwaite type procedure) and lateral retinacular release.

Procedures for Patellofemoral Conditions Indications

Medial Patellofemoral Ligament (MPFL) Reconstruction/Repair

- Medial patellofemoral ligament (MPFL) reconstruction/repair for anterior knee pain with or without recurrent patellar instability are considered **medically necessary** when **ALL** of the following criteria have been met:
  - Any **ONE** of the following:
    - Function-limiting anterior knee pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
    - Recurrent patellar instability interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
  - Any **ONE** of the following physical examination findings:
    - Positive J sign
    - Positive moving patellar apprehension test
    - Lateral patellar translation > ½ (one-half) of the patellar width
    - Tenderness of the medial or lateral facets
    - Patellar grind test (Clarke's sign)

    Radiographic or other findings must include a tear of the MPFL identified by **ANY** of the following:
    - visualized on MRI, CT, or Ultrasound (US)
    - identified by arthroscopy
    - on physical examination with **EITHER** of the following findings:

- MPFL palpation test findings with the knee in full extension and the patella medially subluxated noting tenderness to palpation of the origin of the MPFL
- Patella glide test findings > 75% lateral subluxation of the patella width at 30 degrees of knee flexion

Trochleoplasty

Trochleoplasty for anterior knee pain with or without recurrent patellar instability is considered **medically necessary** when **ALL** of the following criteria have been met:

- Any **ONE** of the following:
  - Function-limiting anterior knee pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Recurrent patellar instability interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment
- Failure of provider-directed non-surgical management for at least three (3) months in duration
- Any **ONE** of the following physical examination findings:
  - Positive J sign
  - Positive moving patellar apprehension test
  - Lateral patellar translation > ½ (one-half) of the patellar width
  - Tenderness of the medial or lateral facets
  - Patellar grind test (Clarke's sign)
- Include **ANY** of the following radiographic findings:
  - Supratrochlear spur
  - Lateral trochlear inclination (LTI) > 11 degrees
  - Crossing sign
  - Double-contour sign

Procedures Other Than Medial Patellofemoral Ligament (MPFL) Reconstruction Or Trochleoplasty

Procedures other than medial patellofemoral ligament (mpfl) reconstruction or trochleoplasty performed for anterior knee pain with or without recurrent patellar instability is considered **medically necessary** when **ALL** of the following criteria have been met:

- Any **ONE** of the following:
  - Function-limiting anterior knee pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Recurrent patellar instability interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment
- Failure of provider-directed non-surgical management for at least three (3) months in duration
- Any **ONE** of the following physical examination findings:
  - Positive J sign
  - Positive moving patellar apprehension test

- Lateral patellar translation > ½ (one-half) of the patellar width
- Tenderness of the medial or lateral facets
- Patellar grind test (Clarke's sign)

- Include **ANY** of the following:
  - Radiographic evidence of patellar tilt > 20 degrees
  - Patella alta (e.g., Insall-Salvati, Blackburne-Peel, Caton-Deschamps ratios)
  - Sulcus angle > 145 degrees
  - Increased tibial tubercle-posterior cruciate distance of > 24 mm
  - Increased TT-TG (tibial tubercle-trochlear groove) distance of > 20 mm
  - Concordant osteochondral defect of the patellofemoral joint (e.g., MRI, CT scan, or previous arthroscopic procedure)
  - Acute patellar dislocation with associated intra-articular fracture

Procedures for Patellofemoral Conditions Non-Indications

- Procedures for patellofemoral conditions are considered **not medically necessary** for any other indication or condition.

High Tibial Osteotomy

High Tibial Osteotomy Indications

- High tibial osteotomy is considered **medically necessary** when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - **ALL** of the following physical examination findings:
    - Less than 15 degrees of fixed varus deformity
    - The individual must be capable of at least 90 degrees of flexion
    - Joint stability in full extension
    - Intact anterior cruciate ligament (ACL)
  - Failure of provider-directed non-surgical management for at least three (3) months in duration
  - Unicompartmental osteoarthritis of the knee
  - Age 60 years or less
  - Individual is not a candidate for a knee arthroplasty

High Tibial Osteotomy Non-Indications

- High tibial osteotomy is considered **not medically necessary** for **ANY** other indication or condition, including when **ANY** of the following criteria is present:
  - Inflammatory arthropathy (i.e., rheumatoid arthritis)
  - Chondrocalcinosis
  - Anterior cruciate ligament (ACL) tear
  - Degenerative change affecting more than 1/3 of the femoral condylar surface
  - Osteochondral defect more than five (5) mm in depth

Lysis of Adhesions

Lysis of Adhesions Indications

- Lysis of adhesions is considered **medically necessary** for arthrofibrosis when **ALL** of the following criteria have been met:
  - Function-limiting pain (e.g., loss of knee function which interferes with the ability to carry out age appropriate activities of daily living and/or demands of employment)
  - Individual demonstrates less than 90 degrees of knee flexion by two (2) months after surgery, including knee replacement or trauma
  - Failure of provider-directed non-surgical management for at least two (2) months in duration, including **BOTH** of the following:
    - Anti-inflammatory medication and/or cortisone injection (unless contraindicated)
    - Physical therapy (i.e., active exercise and manual therapy designed to increase joint mobility and range of motion)

Lysis of Adhesions Non-Indications

- Lysis of adhesions is considered **not medically necessary** for **ANY** other indication or condition.

Procedures Not Addressed Elsewhere

- Based on lack of scientific evidence of efficacy and safety, the following are considered **experimental, investigational, or unproven (EIU)**:
  - Knee subchondroplasty
  - Focal resurfacing of a single knee joint defect (e.g., Arthrosurface Knee HemiCAP®, UniCAP®)

Procedure (CPT®) Codes

This guideline relates to the CPT® code set below. Codes are displayed for informational purposes only.Any given code's inclusion on this list does not necessarily indicate prior authorization is required.

CPT®	Code Description/Definition
27331	Arthrotomy, knee; including joint exploration, biopsy, or removal of loose or foreign bodies
27332	Arthrotomy, with excision of semilunar cartilage (meniscectomy) knee; medial OR lateral
27333	Arthrotomy, with excision of semilunar cartilage (meniscectomy) knee; medial AND lateral
27334	Arthrotomy, with synovectomy, knee; anterior OR posterior
27335	Arthrotomy, with synovectomy, knee; anterior AND posterior including popliteal area
27340	Excision, prepatellar bursa
27347	Excision of lesion of meniscus or capsule (eg, cyst, ganglion), knee
27355	Excision or curettage of bone cyst or benign tumor of femur;
27356	Excision or curettage of bone cyst or benign tumor of femur; with allograft
27357	Excision or curettage of bone cyst or benign tumor of femur; with autograft (includes obtaining graft)
27358	Excision or curettage of bone cyst or benign tumor of femur; with internal fixation (List in addition to code for primary procedure)

This guideline relates to the CPT® code set below. Codes are displayed for informational purposes only.Any given code's inclusion on this list does not necessarily indicate prior authorization is required.

CPT®	Code Description/Definition
27360	Partial excision (craterization, saucerization, or diaphysectomy) bone, femur, proximal tibia and/or fibula (eg, osteomyelitis or bone abscess)
27403	Arthrotomy with meniscus repair, knee
27405	Repair, primary, torn ligament and/or capsule, knee; collateral
27407	Repair, primary, torn ligament and/or capsule, knee; cruciate
27409	Repair, primary, torn ligament and or capsule, knee; collateral and cruciate ligaments
27412	Autologous chondrocyte implantation, knee
27415	Osteochondral allograft, knee, open
27416	Osteochondral autograft(s), knee, open (eg, mosaicplasty) (includes harvesting of autograph[s])
27418	Anterior tibial tubercleplasty (eg, Maquet type procedure)
27420	Reconstruction of dislocating patella; (eg, Hauser type procedure)
27422	Reconstruction of dislocating patella; with extensor realignment and/or muscle advancement or release (eg, Campbell, Goldwaite type procedure)
27424	Reconstruction of dislocating patella; with patellectomy
27425	Lateral retinacular release, open
27427	Ligamentous reconstruction (augmentation), knee; extra-articular
27428	Ligamentous reconstruction (augmentation), knee; intra-articular (open)
27429	Ligamentous reconstruction (augmentation), knee; intra-articular (open) and extra-articular
27438	Arthroplasty, patella; with prosthesis
27440	Arthroplasty, knee, tibial plateau;
27442	Arthroplasty, femoral condyles or tibial plateau(s), knee;
29850	Arthroscopically aided treatment of intercondylar spine(s) and/or tuberosity fracture(s) of the knee, with or without manipulation; without internal or external fixation (includes arthroscopy)
29851	Arthroscopically aided treatment of intercondylar spine(s) and/or tuberosity fracture(s) of the knee, with or without manipulation; with internal or external fixation (includes arthroscopy)
29855	Arthroscopically aided treatment of tibial fracture, proximal (plateau); unicondylar, includes internal fixation, when performed (includes arthroscopy)
29856	Arthroscopically aided treatment of tibial fracture, proximal (plateau); bicondylar, includes internal fixation, when performed (includes arthroscopy)
29866	Arthroscopy, knee, surgical; osteochondral autograft(s) (eg, mosaicplasty) (includes harvesting of the autograft[s])
29867	Arthroscopy, knee, surgical; osteochondral allograft (eg, mosaicplasty)
29868	Arthroscopy, knee, surgical; meniscal transplantation (includes arthrotomy for meniscal insertion), medial or lateral
29870	Arthroscopy, knee, diagnostic; with or without synovial biopsy (separate procedure)
29871	Arthroscopy, knee, surgical; for infection, lavage and drainage
29873	Arthroscopy, knee, surgical; with lateral release
29874	Arthroscopy, knee, surgical; for removal of loose body or foreign body (eg, osteochondritis dissecans fragmentation, chondral fragmentation)
29875	Arthroscopy, knee, surgical;synovectomy, limited (eg, plica or shelf resection) (separate procedure)
29876	Arthroscopy, knee, surgical; synovectomy, major, two or more compartments (eg, medial or lateral)
29877	Arthroscopy, knee, surgical; debridement/shaving of articular cartilage (chondroplasty)
29879	Arthroscopy, knee, surgical; abrasion arthroplasty (includes chondroplasty where necessary) or multiple drilling or microfracture
29880	Arthroscopy, knee, surgical; with meniscectomy (medial AND lateral, including any meniscal shaving) including debridement/shaving of articular cartilage (chondroplasty), same or separate compartment(s), when performed

This guideline relates to the CPT® code set below. Codes are displayed for informational purposes only.Any given code's inclusion on this list does not necessarily indicate prior authorization is required.	
CPT®	**Code Description/Definition**
29881	Arthroscopy, knee, surgical; with meniscectomy (medial OR lateral, including any meniscal shaving) including debridement/shaving of articular cartilage (chondroplasty), same or separate compartment(s), when performed
29882	Arthroscopy, knee, surgical; with meniscus repair (medial OR lateral)
29883	Arthroscopy, knee, surgical; with meniscus repair (medial AND lateral)
29884	Arthroscopy, knee, surgical;with lysis of adhesions, with or without manipulation (separate procedure)
29885	Arthroscopy, knee, surgical; drilling for osteochondritis dissecans with bone grafting, with or without internal fixation (including debridement of base of lesion)
29886	Arthroscopy, knee, surgical; drilling for intact osteochondritis dissecans lesion
29887	Arthroscopy, knee, surgical; drilling for intact osteochondritis dissecans lesion with internal fixation
29888	Arthroscopically aided anterior cruciate ligament repair/augmentation or reconstruction
29889	Arthroscopically aided posterior cruciate ligament repair/augmentation or reconstruction
This list may not be all inclusive and is not intended to be used for coding/billing purposes. The final determination of reimbursement for services is the decision of the health plan and is based on the individual's policy or benefit entitlement structure as well as claims processing rules.	

Procedure (HCPCS) Codes

This guideline relates to the HCPCS code set below. Codes are displayed for informational purposes only. Any given code's inclusion on this list does not necessarily indicate prior authorization is required.	
J7330	Autologous cultured chondrocytes, implant
This list may not be all inclusive and is not intended to be used for coding/billing purposes. The final determination of reimbursement for services is the decision of the health plan and is based on the individual's policy or benefit entitlement structure as well as claims processing rules.	

References

1. Aaron R, Skolnick A, Reinert S, Ciombor D. Arthroscopic debridement for osteoarthritis of the knee. *J Bone Joint Surg Am*. 2006;88(5):936-943.
2. Abrams G, Alentorn-Geli E, Harris J, Cole B. Treatment of a Lateral Tibial Plateau Osteochondritis Dissecans Lesion With Subchondral Injection of Calcium Phosphate. Arthrosc Tech. 2013;2(3):e271-e274. doi:10.1016/j.eats.2013.03.001.
3. Adler V, Pa L, Ko J, et al. Autologous chondrocyte transplantation for the treatment of articular defects of the knee. *Scr Med*. 2003;76(3):241-250.
4. Alleyne K, Galloway M. Management of osteochondral injuries of the knee. *Clin Sports Med*. 2001;20(2):343-364.
5. Altman R, Hochberg M, Moskowics, R, et al.; Subcommittee on Osteoarthritis Guidelines. Recommendations for the medical management of osteoarthrits of the hip and knee. American College of Rheumatology Subcommittee on Osteoarthritis Guidelines. *Arthritis Rheum*. 2000;43(9):1905-1915.
6. Angadi D, Edwards D, Melton J. Calcium phosphate injection of symptomatic bone marrow lesions of the knee: what is the current clinical evidence?. *Knee Surg Relat Res*. 2020;32(1). doi:10.1186/s43019-019-0013-3.
7. Anley CM, Morris GV, Saithna A, et al. Defining the role of the tibial tubercle-trochlear groove and tibial tubercle-posterior cruciate ligament distances in the work-up of patients with patellofemoral disorders. *Am J Sports Med*. 2015;43(6): 1348-53. doi:10.1177/0363546515576128.
8. Askenberger M, Mostrom EB, Ekstrom W, et al. Operative repair of medial patellofemoral ligament injury versus knee brace in children with an acute first-time traumatic patellar dislocation. *Am J Sports Med*. 2018;46(10): 2328-40. doi: 10.1177/0363546518770616.
9. Balcarek P, Walde T, Frosch S, Schüttrumpf J, Wachowski M, Stürmer K. MRI but not arthroscopy accurately diagnoses femoral MPFL injury in first-time patellar dislocations. *Knee Surg Sports Traumatol Arthrosc*. 2012;20(8):1575-1580. doi:10.1007/s00167-011-1775-7.

10. Bartha L, Vajda A, Duska Z, et al. Autologousosteochondralmosaicplasty grafting. J Orthop Sports PhysTher. 2006;36(10):739-750.
11. Beard D, Davies L, Cook J et al. The clinical and cost-effectiveness of total versus partial knee replacement in patients with medial compartment osteoarthritis (TOPKAT): 5-year outcomes of a randomised controlled trial. *Lancet*. 2019;394(10200):746-756. doi:10.1016/s0140-6736(19)31281-4.
12. Bentley G, Biant L, Carrington R, et al. A prospective, randomised comparison of autologous chondrocyte implantation versus mosaicplasty for osteochondral defects in the knee. *J Bone Joint Surg Br*. 2003;85(2):223-230.
13. Berger Y, Ftaita S, Thienpont E. Does Medial Patellofemoral Osteoarthritis Influence Outcome Scores and Risk of Revision After Fixed-bearing Unicompartmental Knee Arthroplasty?. *Clin Orthop Relat Res*. 2019;477(9):2041-2047. doi:10.1097/corr.0000000000000738.
14. Bernstein J, Quach T. A perspective on the study of Moseley et al: Questioning the value of arthroscopic knee surgery for osteoarthritis. *Cleve Clin J Med*. 2003;70(5):401, 405-406, 408-410.
15. Biant LC, Bentley G, Vijayan S, et al. Long-term results of autologous chondrocyte implantation in the knee for chronic chondral and osteochondral defects. *Am J Sports Med*. 2014;42(9): 2178-83.
16. Biau D, Tournoux C, Katsahian Set al. Bone-patellar tendon-bone autografts versus hamstring autografts for reconstruction of anterior cruciate ligament: meta-analysis. *BMJ*. 2006;332(7548):995-1001.
17. Bradley J, Heilman D, Katz B, et al. Tidal irrigation as treatment for knee osteoarthritis: A sham- controlled, randomized, double-blinded evaluation. *Arthritis Rheum*. 2002;46(1):100-108.
18. Briggs T, Mahroof S, David L, et al. Histological evaluation of chondral defects after autologous chondrocyte implantation of the knee. *J Bone Joint Surg Br*. 2003;85(7):1077-1083.
19. Brignardello-Petersen R, Guyatt GH, Buchbinder R, et al. Knee arthroplasty versus conservative management in patients with degenerative knee disease: a systematic review. *BMJ Open*. 2017;7:e016114. doi:10.1136/bmjopen-2017-016114.
20. Brouwer, Reinoud W, Huizinga, Maarten R, Duivenvoorden, Tijs, van Raaij, Tom M, Verhagen, Arianne P, Bierma-Zeinstra, Sita MA, Verhaar, Jan AN. Osteotomy for treating knee osteoarthritis. *Cochrane Database of Systematic Reviews*. 2014, Issue 12. Art. No.: CD004019. doi: 10.1002/14651858.CD004019.pub4.
21. Burger J, Kleeblad L, Laas N, Pearle A. The Influence of Preoperative Radiographic Patellofemoral Degenerative Changes and Malalignment on Patellofemoral-Specific Outcome Scores Following Fixed-Bearing Medial Unicompartmental Knee Arthroplasty. *J Bone Joint Surg*. 2019;101(18):1662-1669. doi:10.2106/jbjs.18.01385.
22. Calvert G, Wright R. The use of arthroscopy in the athlete with knee osteoarthritis. *Clin Sports Med*. 2005;24(1):133-152.
23. Camathias C, Speth BM, Rutz E, Schlemmer T, Papp K, Vavken P, Studer K., Solitary Trochleoplasty for Treatment of Recurrent Patellar Dislocation, *JBJS Essent Surg Tech*. 2018 Apr 11;8(2):e11. doi: 10.2106/JBJS.ST.17.00039. eCollection 2018 Jun 27.
24. Campbell AB, Knopp MV, Kolovich GP, et al: Preoperative MRI underestimates articular cartilage defect size compared with findings at arthroscopic knee surgery. *Am J Sports Med*. 2013;41:590-5.
25. Cavendish P, Everhart J, Peters N, Sommerfeldt M, Flanigan D. Osteochondral Allograft Transplantation for Knee Cartilage and Osteochondral Defects. *JBJS Rev*. 2019;7(6):e7. doi:10.2106/jbjs.rvw.18.00123.
26. Chalmers P, Sherman S, Raphael B, Su E. Rheumatoid Synovectomy: Does the Surgical Approach Matter?. *Clin Orthop Relat Res*. 2011;469(7):2062-2071. doi:10.1007/s11999-010-1744-3.
27. Chambers K, Schulzer M. Arthroscopic surgery for osteoarthritis of the knee. *N Engl J Med*. 2002;347:1718.
28. Chatain F, Adeleine P, Chambat P, Neyret P; Society Francaised'Arthroscopie. A comparative study of medial versus lateral arthroscopic partial meniscectomy on stable knees: 10-year minimum follow-up. *Arthroscopy*. 2003; 19(8):842-849.
29. Cohen S, Jones R. An evaluation of the efficacy of arthroscopic synovectomy of the knee in rheumatoid arthritis: 12-24 month results. *J Rheumatol*. 1987 Jun;14(3):452-5.
30. Cohen S, Sharkey B. Subchondroplasty for Treating Bone Marrow Lesions. *J Knee Surg*. 2015;29(07):555-563. doi:10.1055/s-0035-1568988.
31. Crawford DC, Safran MR. OsteochondritisDissecans of the knee. *J Am AcadOrthop Surg*. 2006; 14: 90-100.
32. Daud A, Safir O, Gross A, Kuzyk P. Outcomes of Bulk Fresh Osteochondral Allografts for Cartilage Restoration in the Knee. *J Bone Joint Surg*. 2021;103(22):2115-2125. doi:10.2106/jbjs.20.00350.
33. DeFazio MW, Curry EJ, Gustin MJ, et al. Return to Sport After ACL Reconstruction With a BTB Versus Hamstring Tendon Autograft: A Systematic Review and Meta-analysis. *Orthop J Sports Med*. 2020;8(12):2325967120964919. Published 2020 Dec 15. doi:10.1177/2325967120964919.
34. Dejour DH, Editorial Commentary: Trochleoplasty: Is It Really That Fearsome and Dangerous a Technique?, *Arthroscopy*. 2020 Aug;36(8):2246-2248. doi: 10.1016.
35. Deirmengian CA, Dines JS, Vernace JV, et al: Use of a small-bore needle arthroscope to diagnose intra-articular knee pathology: comparison with magnetic resonance imaging. *Am J Orthop*. 2018;47(2).
36. Dervin G, Stiell I, Rody K, Grabowski J. Effect of arthroscopic debridement for osteoarthritis of the knee on health-related quality of life. *J Bone Joint Surg Am*. 2003;85-A(1):10-19.

37. Diduch DR, Kandil A, Burrus MT. Lateral patellar instability in the skeletally mature patient: evaluation and surgical management. *J Am Acad Orthop Surg*. 2018;26:429-439. doi: 10.5435/JAAOS-D-16-00052.
38. Dixit S, DiFiori JP, Burton M, et al. Management of Patellofemoral Pain Syndrome. *Am Fam Physician*. 2007;75(2):194-202.
39. Dozin B, Malpeli M, Cancedda R, et al. Comparative evaluation of autologous chondrocyte implantation and mosaicplasty: A multicentered randomized clinical trial. *Clin J Sport Med*. 2005;15(4):220-226.
40. Duif C, Koutah MA, Ackermann O, et al. Combination of autologous chondrocyte implantation (ACI) and osteochondral autograft transfer system (OATS) for surgical repair of larger cartilage defects of the knee joint. A review illustrated by a case report. *Technol Health Care*. 2015;23(5):531-537.
41. Dwyer T, Whelan D, Shah P, Ajrawat P, Hoit G, Chahal J. Operative Versus Nonoperative Treatment of Femoroacetabular Impingement Syndrome: A Meta-analysis of Short-Term Outcomes. *Arthroscopy*. 2020;36(1):263-273. doi:10.1016/j.arthro.2019.07.025.
42. Ebert JR, Fallon M, Smith A, et al. Prospective Clinical and Radiologic Evaluation of Patellofemoral Matrix-Induced Autologous Chondrocyte Implantation. *Am J Sports Med*. 2015;43(6):1362-1372.
43. Ebert JR, Schneider A, Fallon M, Wood DJ, Janes GC. A Comparison of 2-Year Outcomes in Patients Undergoing Tibiofemoral or Patellofemoral Matrix-Induced Autologous Chondrocyte Implantation. *Am J Sports Med.* 2017 Dec;45(14):3243-3253. doi: 10.1177/0363546517724761. Epub 2017 Sep 14.
44. Englund M, Guermazi A, Roemer FW, et al. Meniscal tear in knees without surgery and the development of radiographic osteoarthritis among middle-aged and elderly persons: The multicenter osteoarthritis study. *Arthritis Rheum*. 2009;60(3):831-9.
45. Englund M, Roos E, Lohmander L. Impact of type of meniscal tear on radiographic and symptomatic knee osteoarthritis: a sixteen-year follow-up of meniscectomy with matched controls. *Arthritis Rheum*. 2003;48(8):2178-87.
46. Erggelet C, Vavken P. Microfracture for the treatment of cartilage defects in the knee joint–A golden standard?. J Clin Orthop Trauma. 2016;7(3):145-152. doi:10.1016/j.jcot.2016.06.015.
47. Erickson BJ, Strickland SM, Gomoll AH. Indications, Techniques, Outcomes for Matrix-Induced Autologous Chondrocyte Implantation (MACI). *Oper Tech Sports Med.* 2018;26(3):175-182. doi:10.1053/j.otsm.2018.06.002.
48. Familiari F, Cinque ME, Chahla J, et. al. Clinical outcomes and failure rates of osteochondral allograft transplantation in the knee. *Am J Sports Med*. 2018;46(14):3541-3549. doi: 10.1177/0363546517732531.
49. Farina E, Lowenstein N, Chang Y, Arant K, Katz J, Matzkin E. Meniscal and Mechanical Symptoms Are Associated with Cartilage Damage, Not Meniscal Pathology. *J Bone Joint Surg*. 2021;103(5):381-388. doi:10.2106/jbjs.20.01193.
50. Farr J. Autologous Chrondrocyte Implantation Improves Patellofemoral Cartilage Treatment Outcomes. *CORR*. 2007;463:187-194.
51. Feeley BT, Lau BC. Biomechanics and Clinical Outcomes of Partial Meniscectomy*. J Am Acad Orthop Surg*. 2018;26(24):853-863. doi:10.5435/jaaos-d-17-00256.
52. Felson D, Buckwalter J. Debridement and lavage for osteoarthritis of the knee. *N Engl J Med*. 2002;347:132-3.
53. Felson D. Osteoarthritis of the knee. N Engl J Med. 2006;354:841-8.
54. Filardo G, Kon E, Andriolo L, Di Martino A, Zaffagnini S, Marcacci M. Treatment of "patellofemoral" cartilage lesions with matrix-assisted autologous chondrocyte transplantation: a comparison of patellar and trochlear lesions. *Am J Sports Med*. 2014 Mar;42(3):626-34.
55. Fond J, Rodin D, Ahmad S, Nirschl R. Arthroscopic debridement for the treatment of osteoarthritis of the knee: 2- and 5-year results. *Arthroscopy*. 2002;18(8):829-834.
56. Forster M, Straw R. A prospective randomised trial comparing intra-articular Hyalgan injection and arthroscopic washout for knee osteoarthritis. *Knee*. 2003;10(3):291-293.
57. Fowler P, Lubliner J. The predictive value of five clinical signs in the evaluation of meniscal pathology. *Arthroscopy*. 1989;5(3):184-186. doi:10.1016/0749-8063(89)90168-0.
58. Gee M, Peterson C, Zhou M, Bottoni C. Anterior Cruciate Ligament Repair: Historical Perspective, Indications, Techniques, and Outcomes. *J Am Acad Orthop Surg*. 2020;28(23):963-971. doi:10.5435/jaaos-d-20-00077.
59. Getgood AMJ, Bryant DM, Litchfield R, et al. Lateral Extra-articular Tenodesis Reduces Failure of Hamstring Tendon Autograft Anterior Cruciate Ligament Reconstruction: 2-Year Outcomes From the STABILITY Study Randomized Clinical Trial. *Am J Sports Med*. 2020;48(2):285-297. doi:10.1177/0363546519896333.
60. Getgood A, Hewison C, Bryant D et al. No Difference in Functional Outcomes When Lateral Extra-Articular Tenodesis Is Added to Anterior Cruciate Ligament Reconstruction in Young Active Patients: The Stability Study. *Arthroscopy*. 2020;36(6):1690-1701. doi:10.1016/j.arthro.2020.02.015.
61. Gigante A, Enea D, Greco F, Bait C, Denti M, Schonhuber H, Volpi P. Distal realignment and patellar autologous chondrocyte implantation: mid-term results in a selected population. *Knee Surg Sports Traumatol Arthrosc*. 2009 Jan;17(1):2-10.
62. Gill TJ, Safran M, Mandelbaum B, et al: A prospective, blinded, multicenter clinical trial to compare the efficacy, accuracy, and safety of in-office diagnostic arthroscopy with magnetic resonance imaging and surgical diagnostic arthroscopy. *Arthroscopy*. 2018;34:2429-35.

63. Gillogly SD, Arnold RM. Autologous Chondrocyte Implantation and Anteromedialization for Isolated Patellar Articular Cartilage Lesions. *Am J Sports Med*. 2014;42(4):912-920.
64. Gobbi A, Kon E, Berruto M, et al. Patellofemoral Full-Thickness Chondral Defects Treated with Second-Generation Autologous Chondrocyte Implantation. *Am J Sports Med*. 2009;37(6):1083-1092.
65. Gomoll AH, Gillogly SD, Cole BJ, Farr J, Arnold R, Hussey K, Minas T. Autologous chondrocyte implantation in the patella: a multicenter experience. *Am J Sports Med.* 2014 May;42(5):1074-81.
66. Gomoll AH, Yoshioka H, Watanabe A, et al: Preoperative management of cartilage defects by MRI underestimates lesion size. *Cartilage*. 2011;2:389-93.
67. Graf K, Sekiya J, Wojitys E. Long-term results after combined medial meniscal allograft transplantation and anterior cruciate ligament reconstruction: Minimum 8.5-year follow-up study. *Arthroscopy*. 2004:20(2):129-140.
68. Guenther D, Irrarrazaval S, Bell KM, Rahnemai-Azar AA, Fu FH, Debski RE, Musahl V. The role of extra-articular tenodesis in combined ACL and anterolateral capsular injury. *J Bone Joint Surg Am*. 2017 Oct 4; 99(19): 1654-60.
69. Haasper C, Zelle B, Knobloch K, et al. No mid-term difference in mosaicplasty in previously treated versus previously untreated individuals with osteochondral lesions of the talus. *Arch Orthop Trauma Surg*. 2008;128(5):499-504.
70. Halbrecht JL, Jackson DW: Office arthroscopy: a diagnostic alternative. *Arthroscopy*. 1992;8:320-6.
71. Hangody L, Vásárhelyi G, Hangody L, et al. Autologous osteochondral grafting-technique and long-term results. *Injury*. 2008;39 Suppl 1:S32-S39.
72. Harner C, Waltrip R, Bennett C, et al. Surgical management of knee dislocations. *J Bone Joint Surg Am*. 2004;86-A(2):262-73.
73. Harris JD, Siston RA, Pan X, et al. Autologous chondrocyte implantation: a systematic review. *J Bone Joint Surg Am*. 2010;92(12):2220-33.
74. Henderson I, Tuy B, Connell D, et al. Prospective clinical study of autologous chondrocyte implantation and correlation with MRI at three and 12 months. *J Bone Joint Surg Br*. 2003;85(7):1060-1066.
75. Heyse T, Chong L, Davis J, Haas S, Figgie M, Potter H. MRI Diagnosis of Patellar Clunk Syndrome Following Total Knee Arthroplasty. *HSS Journal®*. 2012;8(2):92-95. doi:10.1007/s11420-011-9258-4.
76. Hunt S, Jazrawi L, Sherman O, Arthroscopic management of osteoarthritis of the knee. *J Am AcadOrthop Surg*. 2002;10(5):356-63.
77. Hurley E, Colasanti C, Anil U et al. Management of Patellar Instability: A Network Meta-analysis of Randomized Control Trials. *Am J Sports Med*. 2021:036354652110200. doi:10.1177/03635465211020000.
78. Jackson R, Dieterichs C. The results of arthroscopic lavage and debridement of osteoarthritic knees based on the severity of degeneration: A 4- to 6-year symptomatic follow-up. *Arthroscopy*. 2003;19(1):13-20.
79. Jakob R, Franz T, Gautier E, Mainil-Varlet P. Autologous osteochondral grafting in the knee: Indication, results, and reflections. *Clin Orthop*. 2002;(401):170-184.
80. Johnson LL. Arthroscopic abrasion arthroplasty: a review*. Clin Orthop Relat Res*. 2001 Oct;(391 Suppl):S306-17.
81. Jurgensmeier K, Jurgensmeier D, Kunz D, Fuerst P, Warth L, Daines S. Intra-articular Injections of the Hip and Knee With Triamcinolone vs Ketorolac: A Randomized Controlled Trial. *J Arthroplasty*. 2021;36(2):416-422. doi:10.1016/j.arth.2020.08.036.
82. Kalson N, Borthwick L, Mann D et al. International consensus on the definition and classification of fibrosis of the knee joint. *Bone Joint J*. 2016;98-B(11):1479-1488. doi:10.1302/0301-620x.98b10.37957.
83. Karataglis D, Green M, Learmonth D. Autologous osteochondral transplantation for the treatment of chondral defects of the knee. *Knee*. 2006;13(1):32-35.
84. Karataglis D, Learmonth D. Management of big osteochondral defects of the knee using osteochondral allografts with the MEGA-OATS technique. *Knee*. 2005;12(5):389-393.
85. Katz JN, Wright J, Spindler KP et al. Predictors and outcomes of crossover to surgery from physical therapy for meniscal tear and osteoarthritis: a randomized trial comparing physical therapy and surgery. *J Bone Joint Surgery Am*. 2016 Nov 16; 98(22):1890-1896.
86. Kelly M. Role of arthroscopic debridement in the arthritic knee. *J Arthroplasty*. 2006;21:Suppl 1:9- 10.
87. Kirkley A, Birmingham T, Litchfield R, et al. A Randomized Trial of Arthroscopic Surgery for Osteoarthritis of the Knee. *N Engl J Med*. 2008; 59:1097-1107,1169-1170.
88. Kise NJ, Risberg MA, Stensrud S, et al. Exercise therapy versus arthroscopic partial meniscectomy for degenerative meniscal tear in middle aged patients: randomized control trial with two year follow-up. *BMJ*. 2016;354:i3740.
89. Kocher MS, Logan CA, Kramer DE. Discoid Lateral Meniscus in Children: Diagnosis, Management, and Outcomes. *J Am Acad Orthop Surg*. 2017;25:736-743.
90. Kohn M, Sassoon A, Fernando N. Classifications in Brief: Kellgren-Lawrence Classification of Osteoarthritis. *Clin Orthopaed and Rel Res®*. 2016;474(8):1886-1893. doi:10.1007/s11999-016-4732-4.
91. Kreuz P, Steinwachs M, Erggelet C, et al. Mosaicplasty with autogenoustalarautograft for osteochondral lesions of the talus after failed primary arthroscopic management: A prospective study with a 4-year follow-up. *Am J Sports Med*. 2006;34(1):55-63.

92. Kurosaka M, Yagi M, Yoshiya S, Muratsu H, Mizuno K. Efficacy of the axially loaded pivot shift test for the diagnosis of a meniscal tear. *Int Orthop*. 1999;23(5):271-274. doi:10.1007/s002640050369.
93. Lahav A, Burks R, Greis P, et al. Clinical outcomes following osteochondral autologous transplantation (OATS). *J Knee Surg*. 2006;19(3):169-173.
94. Laupattarakasem W, Laopaiboon M, Laupattarakasem P, Sumananont C. Arthroscopic debridement for knee osteoarthritis. *Cochrane Database Syst Rev*. 2008;(1):CD005118.
95. Lee D, Park Y, Song S, Hwang S, Park J, Kang D. Which Technique Is Better for Treating Patellar Dislocation? A Systematic Review and Meta-analysis. *Arthroscopy*. 2018;34(11):3082-3093.e1. doi:10.1016/j.arthro.2018.06.052.
96. Linko E, Harilainen A, Malmivaara A, Seitsalo S. Surgical versus conservative interventions for anterior cruciate ligament ruptures in adults. *Cochrane Database Syst Rev*. 2005 Apr 18;(2):CD001356.
97. Ma H, Hung S, Wang S, et al. Osteochondralautografts transfer for post-traumatic osteochondral defect of the knee-2 to 5 years follow-up. *Injury*. 2004;35(12):1286-1292.
98. MACI (autologous cultured chondrocytes on porcine collagen membrane) Product Insert revised 06/2017.
99. MACI prescribing information (December 2016). U.S. Food and Drug Administration.
100. Macmull S, Jaiswal PK, Bentley G, et al. The role of autologous chondrocyte implantation in the treatment of symptomatic chondromalacia patellae. *Int Orthop:SICOT*. 2012;36:1371-1377.
101. Marcacci M, Kon E, Zaffagnini S, et al. Multipleosteochondral arthroscopic grafting (mosaicplasty) for cartilage defects of the knee: Prospective study results at 2-year follow-up. *Arthroscopy*. 2005;21(4):462-470.
102. Marx R. Arthroscopic surgery for osteoarthritis of the knee? *N Engl J Med*. 2008;359(11):1169-1170.
103. McMillan S, Schwartz M, Jennings B, et al: In-office diagnostic needle arthroscopy: understanding the potential value for the US healthcare system. *Am J Orthop*. 2017;46:252-6.
104. Minas T, Bryant T. The Role of Autologous Chondrocyte Implantation in the Patellofemoral Joint. CORR. 2005;436:30-39.
105. Mistovich RJ, Urwin JW, Fabricant PD, et. al. Patellar tendon-lateral trochlear ridge distance. A novel measurement of patellofemoral instability. *Am J of Sports Med*. 2018;46(14):3400-3406. doi: 10.1177/0363546518809982.
106. Mohindra M, Jain J. *Fundamentals Of Orthopedics*. Jaypee Brothers Medical Publishers (P) Ltd; :358.
107. Moseley J, O'Malley K, Petersen N, et al. A controlled trial of arthroscopic surgery for osteoarthritis of the knee. *N Engl J Med*. 2002;347:81-88.
108. Murray M, Fleming B, Badger G et al. Bridge-Enhanced Anterior Cruciate Ligament Repair Is Not Inferior to Autograft Anterior Cruciate Ligament Reconstruction at 2 Years: Results of a Prospective Randomized Clinical Trial. *Am J Sports Med*. 2020;48(6):1305-1315. doi:10.1177/0363546520913532.
109. Nawaz SZ, Bentley G, Briggs TW, Carrington RW, Skinner JA, Gallagher KR, Dhinsa BS. Autologous chondrocyte implantation in the knee: mid-term to long-term results. *J Bone Joint Surg Am.* 2014 May 21;96(10):824-30.
110. Niemeyer P, Steinwachs M, Erggelet C, Kreuz PC, Kraft N, Köstler W, Mehlhorn A, Südkamp NP. Autologous chondrocyte implantation for the treatment of retropatellar cartilage defects: clinical results referred to defect localisation. *Arch Orthop Trauma Surg*. 2008 Nov;128(11):1223-31.
111. Nomura E, Horiuchi Y, Inoue M. Correlation of MR imaging findings and open exploration of medial patellofemoral ligament injuries in acute patellar dislocations. *Knee*. 2002;9(2):139-143. doi:10.1016/s0968-0160(02)00002-9.
112. Noyes F, Barber-Westin S, Rankin M. Meniscal transplantation in symptomatic individuals less than fifty years old. *J Bone Joint Surg Am*. 2005;87 Suppl 1(Pt.2):149-165.
113. Pareek A, Reardon PJ, Macalena JA, Levy BA, Stuart MJ, Williams RJ 3rd, Krych AJ. Osteochondral autograft transfer versus microfracture in the knee: a meta-analysis of prospective comparative studies at midterm. A*rthroscopy*. 2016 Oct; 32(10): 2118-30. doi:10.1016/j.arthro.2016.05.038.
114. Pagliazzi G, Napoli F, Previtali D, Filardo G, Zaffagnini S, Candrian C. A Meta-analysis of Surgical Versus Nonsurgical Treatment of Primary Patella Dislocation*. Arthroscopy*. 2019;35(8):2469-2481. doi:10.1016/j.arthro.2019.03.047.
115. Pascual-Garrido C, Slabaugh MA, L'Heureux DR, et al. Recommendations and treatment outcomes for patellofemoral articular cartilage defects with autologous chondrocyte implantation: prospective evaluation at average 4-year follow-up. *Am J Sports Med*. 2009;37 Suppl 1:33S-41S.
116. Patel KA, Hartigan DE, Makovicka JL, et al: Diagnostic evaluation of the knee in the office setting using small-bore needle arthroscopy. *Arthrosc Tech*. 2018;7:e17-e21.
117. Pauyo T, Park JP, Bozzo I, Bernstein M. Patellofemoral Instability Part I: Evaluation and Nonsurgical Treatment. *JAAOS*. 2022;30(22):e1431-e1442. doi:10.5435/jaaos-d-22-00254.
118. Pearse E, Craig D. Partial meniscectomy in the presence of severe osteoarthritis does not hasten the symptomatic progression of osteoarthritis. *Arthroscopy*. 2003;19(9):963-968.
119. Peterson L, Minas T, Brittberg M, Lindahl A. Treatment of osteochondritisdissecans of the knee with autologous chondrocyte transplantation. *J Bone Joint Surg Am*. 2003;85(Suppl 2):17-24.
120. Peterson L, Vasiliadis HS, Brittberg M, Lindahl A. Autologous chondrocyte implantation: a long-term follow-up.

Am J Sports Med. 2010 Jun;38(6):1117-24.
121. Peterson R, Shelton W, Bomboy A. Allograft versus autograft patellar tendon anterior cruciate ligament reconstruction: A 5-year follow-up. *Arthroscopy*. 2001;17(1):9-13.
122. Puzzitiello R, Waterman B, Agarwalla A et al. Primary Medial Patellofemoral Ligament Repair Versus Reconstruction: Rates and Risk Factors for Instability Recurrence in a Young, Active Patient Population. Arthroscopy. 2019;35(10):2909-2915. doi:10.1016/j.arthro.2019.05.007
123. Rahardja R, Zhu M, Love H, Clatworthy MG, Monk AP, Young SW. Effect of Graft Choice on Revision and Contralateral Anterior Cruciate Ligament Reconstruction: Results From the New Zealand ACL Registry. *Am J Sports Med*. 2020;48(1):63-69. doi:10.1177/0363546519885148.
124. Richter D, Schenck R, Wascher D, Treme G. Knee Articular Cartilage Repair and Restoration Techniques. *Sports Health: A Multidisciplinary Approach*. 2015;8(2):153-160. doi:10.1177/1941738115611350.
125. Roos E, Ostenberg A, Roos H, et al. Long-term outcome of meniscectomy: symptoms, function, and performance tests in individuals with or without radiographic osteoarthritis compared to matched controls. *Osteoarthritis Cartilage*. 2001;9(4):316-24.
126. Roos E, Roos H, Ryd L, Lohmander L. Substantial disability 3 months after arthroscopic partial meniscectomy: A prospective study of individual-relevant outcomes. *Arthroscopy*. 2000;16(6):619- 26.
127. Rosenstiel N, Praz C, Ouanezar H, et al. Combined Anterior Cruciate and Anterolateral Ligament Reconstruction in the Professional Athlete: Clinical Outcomes From the Scientific Anterior Cruciate Ligament Network International Study Group in a Series of 70 Patients With a Minimum Follow-Up of 2 Years. *Arthroscopy*.. 2019;35(3):885-892. doi:10.1016/j.arthro.2018.09.020.
128. Rossi, R., Dettoni, F., Bruzzone, M. et al. Clinical examination of the knee: know your tools for diagnosis of knee injuries. *BMC Sports Sci Med Rehabil*. 2011; 3(25) https://doi.org/10.1186/1758-2555-3-25.
129. Ruano-Ravina A, Jato Diaz M. Autologous chondrocyte implantation: a systematic review. *Osteoarthritis Cartilage*. 2006;14(1):47-51.
130. Ryu R, Dunbar V, Morse G, Meniscal allograft replacement: a 1-year to 6-year experience, *Arthroscopy*. 2002;18(9):989-994.
131. Saris D, Price A, Widuchowski W, et al on behalf of the SUMMIT Study Group. Matrix-Applied Characterized Autologous Cultured Chondrocytes Versus Microfracture: Two-Year Follow-up of a Prospective Randomized Trial. *Am J of Sports Med*. 2014;42(6): 1384-94.
132. Sanders T, Morrison W, Singleton B, Miller M, Cornum K. Medial Patellofemoral Ligament Injury Following Acute Transient Dislocation of the Patella: MR Findings with Surgical Correlation in 14 Patients. *J Computer Assisted Tomography*. 2001;25(6):957-962. doi:10.1097/00004728-200111000-00021.
133. Sanders TL, Pareek A, Johnson NR, Stuart MJ, Dahm DL, Krych AJ. Patellofemoral arthritis after lateral patellar dislocation: a matched population-based analysis. *Am J Sports Med*. 2017 Apr; 45(5): 1012-7.
134. Seitlinger G, Scheurecker G, Hogler R, et al. Tibial tubercle-posterior cruciate ligament distance: A new measurement to define the position of the tibial tubercle in patients with patellar dislocation. *Am J Sports Med*. 2012;40(5): 1119-25. doi: 10.1177/0363546512438762.
135. Sekiya J, Giffin J, Irrgang J, et al. Clinical outcomes after combined meniscal allograft transplantation and anterior cruciate ligament reconstruction. *Am J Sports Med*. 2003;31(6):896-906.
136. Sharpe J, Ahmed S, Fleetcroft J, Martin R. The treatment of osteochondral lesions using a combination of autologous chondrocyte implantation and autograft: Three-year follow-up. *J Bone Joint Surg Br*. 2005;87(5):730-735.
137. Sherman SL, Garrity J, Bauer K, Cook J et al. Fresh osteochondral allograft transplantation for the knee: current concepts. *J Am AcadOrthop Surg*. 2014;22(2):121-33.
138. Siemieniuk RA, Harris IA, Agoritsas T, et al. Arthroscopic surgery for generative knee arthritis and meniscal tears: a clinical practice guideline. *BMJ*. 2017;357:j1982.
139. Sihvonen R, Paavola M, Malmivaara A, et al. FIDELITY (Finnish Degenerative Meniscal Lesion Study) Investigators. Arthroscopic partial meniscectomy versus placebo surgery of a degenerative meniscus tea: a 2-year follow-up of the randomized controlled trial. *Ann Rheum Dis*. 2018 Feb; 77(2): 188-95.
140. Solomon D, Avorn J, WarsiAet al. Which individuals with knee problems are likely to benefit from nonarthroplasty surgery? Development of a clinical prediction rule. *Arch Intern Med*. 2004;164(5):509-513.
141. Sonnery-Cottet B, Siatha A, Cavalier M, Kajetanek C, Temponi EF, Daggestt M, Helito CP, Thaunat M. Anterolateral ligament reconstruction is associated with significantly reduced ACL graft rupture rates at a minimum of follow-up of 2 years: a prospective comparative study of 502 patients from the SANTI study Group. *Am J Sports Med*. 2017 Jun; 45(7): 1547-57.
142. Spindler KP, Hutson LJ, Zajichek A, et al. MOON Knee Group. Anterior cruciate ligament reconstruction in high school and college athletes: does autograft choice influence anterior cruciate ligament reconstruction rates? *Am J Sports Med*. 2020 Feb; 48(2): 298-309.
143. Stuart M, Lubowitz J. What, if any, are the indications for arthroscopic debridement of the osteoarthritic knee? *Arthroscopy*. 2006;22(3):238-239.
144. Szachnowski P, Wei N, Arnold WJ, et al: Complications of office-based arthroscopy of the knee. *J Rheumatol*. 1995;22:1722-5.

145. Thorlund JB, Juhl CB, Roos EM, et al. Arthroscopic surgery for degenerative knee: systematic review and meta-analysis of benefits and harms. *BMJ*. 2015;350:h2747. doi: 10.1136/bmj.h2747.
146. Tibbo M, Limberg A, Salib C et al. Acquired Idiopathic Stiffness After Total Knee Arthroplasty. *J Bone Joint Surg*. 2019;101(14):1320-1330. doi:10.2106/jbjs.18.01217.
147. Trinh TQ, Harris JD, Siston RA, Flanigan DC. Improved outcomes with combined autologous chondrocyte implantation and patellofemoral osteotomy versus isolated autologous chondrocyte implantation. *Arthroscopy.* 2013 Mar;29(3):566-74.
148. van de Graaf VA, Noorduyn JCA, Willigenburg NW, et al. Effect of early surgery vs physical therapy on knee function among patients with nonobstructive meniscal tears. *JAMA*. 2018;320(13):1328-1337. doi: 10.1001/jama.2018.13308.
149. Voigt JD, Mosier M, Huber B: Diagnostic needle arthroscopy and the economics of improved diagnostic accuracy: a cost analysis. *Appl Health Econ Health Policy*. 2014;12:523-35.
150. von Keudell A, Han R, Bryant T, Minas T. Autologous Chondrocyte Implantation to Isolated Patella Cartilage Defects. *Cartilage.* 2017 Apr;8(2):146-154.
151. Wang D, Jones KJ, Eliasberg CD, et al. Condyle-Specific Matching Does Not Improve Midterm Clinical Outcomes of Osteochondral Allograft Transplantation in the Knee. *J Bone Joint Surg Am*. 2017;99:1614-20.
152. Yeung M, Leblanc MC, Ayeni OR, et al. Indications for Medial Patellofemoral Ligament Reconstruction: A Systematic Review. J Knee Surg. 2015; 29(7):543-554.
153. Zamborsky R, Danisovic L. Surgical Techniques for Knee Cartilage Repair: An Updated Large-Scale Systematic Review and Network Meta-analysis of Randomized Controlled T
154. Zhang G, Zheng L, Ding H, Li E, Sun B, Shi H. Evaluation of medial patellofemoral ligament tears after acute lateral patellar dislocation: comparison of high-frequency ultrasound and MR. *Euro Radiol*. 2015;25(1):274-281.
155. Zhang W, Moskowitz R, Nuki Get al. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008;16(2):137-162.

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