

Lower Extremity Prostheses

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Health Equity Considerations

Health equity is the highest level of health for all individuals; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which individuals are born, grow, live, work, and age.

Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include the following: safe housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

Criteria

Initial Request (General Criteria for a Prosthetic Device)

A lower limb prosthesis is indicated when an individual with a lower extremity amputation meets all the following criteria:

- The individual is expected to reach or maintain a defined functional state within a reasonable period of time.
- The individual has the ability or potential to ambulate or transfer safely.
- The individual meets specific criteria set forth in the Additional Information set forth below.

Functional Classification Level (K Level)*	Related Codes (indicated at or above functional level, unless otherwise noted)
Functional Classification Level 1 (K1)	L5611, L5616, L5710, L5711, L5712, L5714, L5716, L5718, L5810, L5811, L5812, L5816, L5818, L5970, L5974
Functional Classification Level 2 (K2)	L5972, L5978, L5982, L5984, L5985, L5986

Functional Classification Level (K Level)*	Related Codes (indicated at or above functional level, unless otherwise noted)
Functional Classification Level 3 (K3)	L5610*, L5613*, L5614*, L5615*, L5722*, L5724*, L5726*, L5728*, L5780*, L5814*, L5822*, L5824*, L5826*, L5828*, L5830*, L5840*, L5841*, L5848*, L5856*, L5857*, L5858*, L5859, L5961, L5973*, L5976*, L5979*, L5980*, L5981*, L5987*
Functional Classification Level 4 (K4)	L5930
*Please see Definitions section for a description of each K level.	

Initial Request (Specific Components and Additions)

The following lower limb additions and/or components are indicated for an individual when medical necessity criteria has been met for the base device and the following criteria have been met:

- Hip:
 - A pneumatic or hydraulic polycentric hip joint (HCPCS L5961) is indicated for an individual at a functional level of K3 or higher.
- Knee:
 - A basic knee system or single axis constant friction knee (HCPCS L5611, L5616, L5710, L5711, L5712, L5714, L5716, L5718, L5810, L5811, L5812, L5816, L5818) is indicated for an individual at a functional level of K1 or higher.
 - An adjustable stance flexion feature (HCPCS L5845) is indicated for an individual at a functional level of K1 or higher.
 - A fluid, pneumatic, or electronic/microprocessor knee (HCPCS L5610, L5613, L5614, L5722, L5724, L5726, L5728, L5780, L5814, L5822, L5824, L5826, L5827, L5828, L5830, L5840, L5841, L5848, L5856, L5857, L5858) is indicated for an individual at a functional level of K3 or higher.
 - An endoskeletal knee-shin system (addition to a lower limb device) with powered and programmable flexion/extension assist control, including any type of motor(s) (HCPCS L5859) (e.g., Össur Power Knee™) is indicated when all of the following criteria have been met:
 - The individual has a swing and stance phase type microprocessor controlled (electronic) knee (HCPCS L5856).
 - The individual is functional level K3 only.

- The individual has a documented comorbidity of the spine and/or sound limb affecting hip extension and/or quadriceps function that impairs K3 level of function with the use of a microprocessor-controlled knee alone.
- The individual is able to safely use the device.
- A high-activity knee control frame (HCPCS L5930) is indicated for an individual at a K4 functional level.
- Foot/Ankle:
 - An external keel SACH foot (HCPCS L5970) or single axis ankle/foot (HCPCS L5974) is indicated for an individual at a functional level of K1 or higher.
 - A flexible-keel foot (HCPCS L5972), multiaxial ankle/foot (HCPCS L5978), or axial rotation unit (HCPCS L5982, L5984, L5985, L5986) is indicated for an individual at a functional level of K2 or higher.
 - A microprocessor controlled ankle foot system (HCPCS L5973), energy storing foot (HCPCS L5976), dynamic response foot with multi-axial ankle (HCPCS L5979), flex foot system (HCPCS L5980), flex-walk system or equal (HCPCS L5981), or shank foot system with vertical loading pylon (HCPCS L5987) is indicated for an individual at a functional level of K3 or higher.
- Other accessories:
 - A vacuum pump, residual limb volume management and moisture evacuation system (HCPCS L5781, L5782, L5783) is indicated for an individual at a functional level of K3 or higher.
 - A protective outer surface covering system (HCPCS L5962, L5964, L5966) is indicated when both of the following apply:
 - The individual has a need for a specialized cover for protection against unusually harsh environmental situations.
 - The specialized cover will not be used for cosmetic or convenience reasons.
- A prosthetic insert (HCPCS L5000, L5010, L5020) is indicated to provide stability for transfers and ambulation for a toe, transmetatarsal, or partial foot amputation.
- Lower extremity prosthesis, not otherwise specified (HCPCS L5999) is indicated when all of the following are met:
 - HCPCS L5999 is used to report a medically necessary component or addition to a lower limb prosthetic device in the absence of a more specific code.
 - Medical necessity criteria has been met for the base device.
 - There is medical record documentation for rationale for use of the device.
 - The most specific HCPCS code must be used when a unique code is available.
 - If HCPCS L5999 is used to bill for any features or functions already included in the code for another component, it would be considered unbundling.

Replacement and Repair

Replacement of a prosthesis, accessories, and/or components is indicated for **any** of the following:

- A change in the medical condition of the individual resulting in poor fit or function of the device or components of the device.
- Irreparable wear of the device or a part of the device.
- Loss of the device or components of the device.

Socket replacements are indicated when there is adequate documentation of functional and/physiological need including **any** of the following:

- Changes in the residual limb.
- Changes in functional need.
- Irreparable damage or wear/tear due to excessive weight or prosthetic demands of very active amputees.

Repairs to a prosthesis are covered when anatomical change or irreparable wear of the device renders the device or component non-functional and the repairs are necessary to make the prosthesis functional.

Quantity Limits and Coding Considerations

The following are accessory quantity limits unless there is documentation in the medical record which justifies the need for more than the criteria set forth below:

- Two test (diagnostic) sockets (HCPCS L5618, L5620, L5622, L5624, L5626, L5628) are indicated for an individual lower extremity prosthesis. Additional documentation in the medical record is required for more than two test sockets.
- Two or fewer socket inserts (HCPCS L5654, L5655, L5656, L5658, L5661, L5665, L5673, L5679, L5681, L5683) per individual prosthesis.
- Prosthetic sheaths/socks: quantity of 12 in 12 months.
- No more than two replacement liners per prosthesis in 12 months.

Prosthesis	Non-Covered HCPCS Code
Above the knee initial or preparatory prosthesis (HCPCS L5505, L5560, L5570, L5580, L5590, L5595, L5600)	L5610, L5631, L5640, L5642, L5644, L5648, L5705, L5706, L5964, L5980, and L5710, L5711, L5712, L5714, L5716, L5718, L5722, L5724, L5726, L5728, L5780, L5790, L5795
Above the knee prefabricated prosthesis (HCPCS L5585)	L5624, L5631, L5648, L5651, L5652, L5705, L5706, L5964, L5966

Prosthesis	Non-Covered HCPCS Code
Below the knee initial or preparatory prosthesis (HCPCS L5500, L5510, L5520, L5530, L5540)	L5629, L5638, L5639, L5646, L5647, L5704, L5785, L5962, L5980
Immediate post-surgical prosthesis (IPOP)	L5400, L5410, L5420, L5430, L5450, L5460
Below the knee prefabricated prosthesis (HCPCS L5535)	L5620, L5629, L5645, L5646, L5670, L5676, L5704, L596

Prosthetic knee-shin systems coding criteria:

- HCPCS L5312, L5321, L5331, L5341 are endoskeletal prosthetic lower extremity codes that include:
 - a molded prosthetic socket
 - an endoskeletal single axis knee-shin system
 - a SACH foot
- HCPCS L5200 is an exoskeletal above knee prosthetic system that includes:
 - a molded prosthetic socket
 - an exoskeletal single axis knee-shin system
 - a SACH foot
- HCPCS L5150 or L5160 are above knee prosthetic systems that include:
 - a knee disarticulation molded prosthetic socket
 - external knee joints
 - a SACH foot
- HCPCS L5230 describes an above knee prosthesis system for a proximal femoral focal deficiency.
- HCPCS L5610, L5611, L5613, L5616, L5810, L5811, L5812, L5814, L5816, L5818, L5822, L5824, L5826, L5828, L5830, L5840, L5841) describe a complete prosthetic knee-shin system. Thus, the use of two codes would be considered incorrect coding (unbundling).
- HCPCS L5925, L5930, L5845, L5848, L5850, L5856, L5857, L5858, L5859 describe additional features and/or functions that do not describe a complete knee-shin system. These codes must be used in combination with a base knee-shin system (see above).

- HCPCS L5999 can not be used to bill for features of the knee-shin system and is considered incorrect coding (unbundling).

Prosthetic foot coding criteria:

- HCPCS L5970, L5971, L5972, L5974, L5975, L5976, L5978, L5979, L5980, L5981, L5987 describe a complete prosthetic foot and thus the use of more than one code would be considered incorrect coding (unbundling).
- HCPCS L5968, L5982, L5984, L5985, L5986, L5988, L5990 are additional features and/or functions that do not describe a complete prosthetic foot and may be used in combination with HCPCS L5970, L5971, L5972, L5974, L5975, L5976, L5978, L5979, L5980, L5981, and L5987.
- HCPCS L5981 and L5987 describe a product that can be used for either endoskeletal or exoskeletal lower limb construction. These codes include a foot cover.

Powered base items:

- HCPCS L7360, L7364, and L7367 (batteries) and/or HCPCS L7362, L7366, and L7368 (battery chargers) are included in the fee for powered base items. Thus, the use of more than one code would be considered incorrect coding (unbundling).

Infinite Socket® (LIM Innovations)®:

- The correct combination of HCPCS codes for the Infinite Socket T/F (above-knee socket) are HCPCS L5321 or L5701 with the addition of L5631, L5649, and L5950.
- The correct combination of HCPCS codes for the Infinite Socket TT-S (below-knee socket) are HCPCS L5301 or L5700 with the addition of HCPCS L5629, L5637, and L5940.

Integrated seals:

- HCPCS L7700 is a gasket or seal for use with a prosthetic socket insert. Integrated seals are included in the code for the insert. Thus, separate billing of integrated gaskets or seals as HCPCS L7700 would be considered incorrect coding (unbundling).

Additional Information

The right (RT) and left (LT) modifiers must be used with prosthesis codes.

The orthotic or prosthetic services are performed by a duly licensed and/or certified, if applicable, orthotic and/or prosthetic provider.

Not Covered

- If a prosthesis is denied as not reasonable and necessary, related additions will also be denied as not reasonable and necessary.
- The following prosthetic devices are each considered not medically necessary, not medical in nature, and/or convenience item(s):
 - A lower limb prosthetic device for an individual at a functional level of K0.

- Additions/components that are not required for the effective use of the device.
- Consumable supplies for the care of prosthetic device (e.g., cosmetics, creams, cleansers, skin barrier wipes).
- Prosthetic devices or additions/components used for participation in recreational activities (e.g., sporting activities, such as skiing or swimming).
- Back-up/duplicate prosthetic devices.
- Prosthetic devices or prosthetic components that are primarily for cosmesis.
- Repair or replacement of a prosthesis for appearance, comfort, convenience, or individual abuse, misuse, or neglect.
- Water prosthesis (designed to be used for showering, swimming, etc.).
- A user-adjustable heel height feature (HCPCS L5990).
- The following prosthetic devices are considered experimental, investigational, or unproven (EIU):
 - a microprocessor foot or ankle system addition with power assist which includes any type motor (HCPCS L5969 and L5973) (e.g., Empower®)
 - an osseo-integrated external prosthetic connector device (HCPCS L5991)
 - components/features of powered prosthetic devices (HCPCS L5828, L5845, L5848, L5856) when reported in addition to a non-covered power-assisted prosthetic device (HCPCS L5969)
 - four-bar knee rotation axis design feature (HCPCS K1014) (e.g., Allux® microprocessor-controlled polycentric hydraulic knee)

Note: For information related to EIU procedures or services, see EviCore's **Guidelines Definitions** document.

Codes

HCPCS codes addressed in this guideline

HCPCS Code	Description
L2330	Addition to lower extremity, lacer molded to patient model, for custom fabricated orthosis only
L2340	Addition to lower extremity, pre-tibial shell, molded to patient model
L2350	Addition to lower extremity, prosthetic type, (bk) socket, molded to patient model, (used for 'ptb' 'afo' orthoses)
L2500	Addition to lower extremity, thigh/weight bearing, gluteal/ ischial weight bearing, ring

HCPSC Code	Description
L2510	Addition to lower extremity, thigh/weight bearing, quadri- lateral brim, molded to patient model
L2520	Addition to lower extremity, thigh/weight bearing, quadri- lateral brim, custom fitted
L2525	Addition to lower extremity, thigh/weight bearing, ischial containment/ narrow m-l brim molded to patient model
L2526	Addition to lower extremity, thigh/weight bearing, ischial containment/ narrow m-l brim, custom fitted
L2540	Addition to lower extremity, thigh/weight bearing, lacer, molded to patient model
L2570	Addition to lower extremity, pelvic control, hip joint, clevis type two position joint, each
L2580	Addition to lower extremity, pelvic control, pelvic sling
L2627	Addition to lower extremity, pelvic control, plastic, molded to patient model, reciprocating hip joint and cables
L2628	Addition to lower extremity, pelvic control, metal frame, reciprocating hip joint and cables
L2750	Addition to lower extremity orthosis, plating chrome or nickel, per bar
L2755	Addition to lower extremity orthosis, high strength, lightweight material, all hybrid lamination/prepreg composite, per segment, for custom fabricated orthosis only
L2760	Addition to lower extremity orthosis, extension, per extension, per bar (for lineal adjustment for growth)
L2768	Orthotic side bar disconnect device, per bar
L2780	Addition to lower extremity orthosis, non-corrosive finish, per bar
L3161	Foot, adductus positioning device, adjustable
L4002	Replacement strap, any orthosis, includes all components, any length, any type
L4010	Replace trilateral socket brim
L4020	Replace quadrilateral socket brim, molded to patient model
L4030	Replace quadrilateral socket brim, custom fitted

HCP Code	Description
L4040	Replace molded thigh lacer, for custom fabricated orthosis only
L5000	Partial foot, shoe insert with longitudinal arch, toe filler
L5010	Partial foot, molded socket, ankle height, with toe filler
L5020	Partial foot, molded socket, tibial tubercle height, with toe filler
L5050	Ankle, Symes, molded socket, SACH foot
L5060	Ankle, Symes, metal frame, molded leather socket, articulated ankle/foot
L5100	Below knee, molded socket, shin, SACH foot
L5105	Below knee, plastic socket, joints and thigh lacer, SACH foot
L5150	Knee disarticulation (or through knee), molded socket, external knee joints, shin, SACH foot
L5160	Knee disarticulation (or through knee), molded socket, bent knee configuration, external knee joints, shin, SACH foot
L5200	Above knee, molded socket, single axis constant friction knee, shin, SACH foot
L5210	Above knee, short prosthesis, no knee joint ('stubbies'), with foot blocks, no ankle joints, each
L5220	Above knee, short prosthesis, no knee joint ('stubbies'), with articulated ankle/foot, dynamically aligned, each
L5230	Above knee, for proximal femoral focal deficiency, constant friction knee, shin, SACH foot
L5250	Hip disarticulation, canadian type; molded socket, hip joint, single axis constant friction knee, shin, SACH foot
L5270	Hip disarticulation, tilt table type; molded socket, locking hip joint, single axis constant friction knee, shin, SACH foot
L5280	Hemipelvectomy, canadian type; molded socket, hip joint, single axis constant friction knee, shin, SACH foot
L5301	Below knee, molded socket, shin, SACH foot, endoskeletal system
L5312	Knee disarticulation (or through knee), molded socket, single axis knee, pylon, SACH foot, endoskeletal system

HCPSC Code	Description
L5321	Above knee, molded socket, open end, SACH foot, endoskeletal system, single axis knee
L5331	Hip disarticulation, canadian type, molded socket, endoskeletal system, hip joint, single axis knee, SACH foot
L5341	Hemipelvectomy, canadian type, molded socket, endoskeletal system, hip joint, single axis knee, SACH foot
L5400	Immediate post surgical or early fitting, application of initial rigid dressing, including fitting, alignment, suspension, and one cast change, below knee
L5410	Immediate post surgical or early fitting, application of initial rigid dressing, including fitting, alignment and suspension, below knee, each additional cast change and realignment
L5420	Immediate post surgical or early fitting, application of initial rigid dressing, including fitting, alignment and suspension and one cast change 'ak' or knee disarticulation
L5430	Immediate post surgical or early fitting, application of initial rigid dressing, incl. fitting, alignment and suspension, 'ak' or knee disarticulation, each additional cast change and realignment
L5450	Immediate post surgical or early fitting, application of non-weight bearing rigid dressing, below knee
L5460	Immediate post surgical or early fitting, application of non-weight bearing rigid dressing, above knee
L5500	Initial, below knee 'ptb' type socket, non-alignable system, pylon, no cover, SACH foot, plaster socket, direct formed
L5505	Initial, above knee - knee disarticulation, ischial level socket, non-alignable system, pylon, no cover, SACH foot, plaster socket, direct formed
L5510	Preparatory, below knee 'ptb' type socket, non-alignable system, pylon, no cover, SACH foot, plaster socket, molded to model
L5520	Preparatory, below knee 'ptb' type socket, non-alignable system, pylon, no cover, SACH foot, thermoplastic or equal, direct formed
L5530	Preparatory, below knee 'ptb' type socket, non-alignable system, pylon, no cover, SACH foot, thermoplastic or equal, molded to model

HCP Code	Description
L5535	Preparatory, below knee 'ptb' type socket, non-alignable system, no cover, SACH foot, prefabricated, adjustable open end socket
L5540	Preparatory, below knee 'ptb' type socket, non-alignable system, pylon, no cover, SACH foot, laminated socket, molded to model
L5560	Preparatory, above knee- knee disarticulation, ischial level socket, non-alignable system, pylon, no cover, SACH foot, plaster socket, molded to model
L5570	Preparatory, above knee - knee disarticulation, ischial level socket, non-alignable system, pylon, no cover, SACH foot, thermoplastic or equal, direct formed
L5580	Preparatory, above knee - knee disarticulation ischial level socket, non-alignable system, pylon, no cover, SACH foot, thermoplastic or equal, molded to model
L5585	Preparatory, above knee - knee disarticulation, ischial level socket, non-alignable system, pylon, no cover, SACH foot, prefabricated adjustable open end socket
L5590	Preparatory, above knee - knee disarticulation ischial level socket, non-alignable system, pylon no cover, SACH foot, laminated socket, molded to model
L5595	Preparatory, hip disarticulation-hemipelvectomy, pylon, no cover, SACH foot, thermoplastic or equal, molded to patient model
L5600	Preparatory, hip disarticulation-hemipelvectomy, pylon, no cover, SACH foot, laminated socket, molded to patient model
L5610	Addition to lower extremity, endoskeletal system, above knee, hydracandence system
L5611	Addition to lower extremity, endoskeletal system, above knee - knee disarticulation, 4 bar linkage, with friction swing phase control
L5613	Addition to lower extremity, endoskeletal system, above knee-knee disarticulation, 4 bar linkage, with hydraulic swing phase control
L5614	Addition to lower extremity, exoskeletal system, above knee-knee disarticulation, 4 bar linkage, with pneumatic swing phase control
L5615	Addition, endoskeletal knee-shin system, 4 bar linkage or multiaxial, fluid swing and stance phase control

HCP Code	Description
L5616	Addition to lower extremity, endoskeletal system, above knee, universal multiplex system, friction swing phase control
L5617	Addition to lower extremity, quick change self-aligning unit, above knee or below knee, each
L5618	Addition to lower extremity, test socket, Symes
L5620	Addition to lower extremity, test socket, below knee
L5622	Addition to lower extremity, test socket, knee disarticulation
L5624	Addition to lower extremity, test socket, above knee
L5626	Addition to lower extremity, test socket, hip disarticulation
L5628	Addition to lower extremity, test socket, hemipelvectomy
L5629	Addition to lower extremity, below knee, acrylic socket
L5630	Addition to lower extremity, Symes type, expandable wall socket
L5631	Addition to lower extremity, above knee or knee disarticulation, acrylic socket
L5632	Addition to lower extremity, Symes type, 'ptb' brim design socket
L5634	Addition to lower extremity, Symes type, posterior opening (canadian) socket
L5636	Addition to lower extremity, Symes type, medial opening socket
L5637	Addition to lower extremity, below knee, total contact
L5638	Addition to lower extremity, below knee, leather socket
L5639	Addition to lower extremity, below knee, wood socket
L5640	Addition to lower extremity, knee disarticulation, leather socket
L5642	Addition to lower extremity, above knee, leather socket
L5643	Addition to lower extremity, hip disarticulation, flexible inner socket, external frame
L5644	Addition to lower extremity, above knee, wood socket
L5645	Addition to lower extremity, below knee, flexible inner socket, external frame
L5646	Addition to lower extremity, below knee, air, fluid, gel or equal, cushion socket

HCP Code	Description
L5647	Addition to lower extremity, below knee suction socket
L5648	Addition to lower extremity, above knee, air, fluid, gel or equal, cushion socket
L5649	Addition to lower extremity, ischial containment/narrow m-l socket
L5650	Additions to lower extremity, total contact, above knee or knee disarticulation socket
L5651	Addition to lower extremity, above knee, flexible inner socket, external frame
L5652	Addition to lower extremity, suction suspension, above knee or knee disarticulation socket
L5653	Addition to lower extremity, knee disarticulation, expandable wall socket
L5654	Addition to lower extremity, socket insert, Symes, (kemblo, pelite, aliplast, plastazote or equal)
L5655	Addition to lower extremity, socket insert, below knee (kemblo, pelite, aliplast, plastazote or equal)
L5656	Addition to lower extremity, socket insert, knee disarticulation (kemblo, pelite, aliplast, plastazote or equal)
L5658	Addition to lower extremity, socket insert, above knee (kemblo, pelite, aliplast, plastazote or equal)
L5661	Addition to lower extremity, socket insert, multi-durometer Symes
L5665	Addition to lower extremity, socket insert, multi-durometer, below knee
L5666	Addition to lower extremity, below knee, cuff suspension
L5668	Addition to lower extremity, below knee, molded distal cushion
L5670	Addition to lower extremity, below knee, molded supracondylar suspension ('pts' or similar)
L5671	Addition to lower extremity, below knee / above knee suspension locking mechanism (shuttle, lanyard or equal), excludes socket insert
L5672	Addition to lower extremity, below knee, removable medial brim suspension

HCPSC Code	Description
L5673	Addition to lower extremity, below knee/above knee, custom fabricated from existing mold or prefabricated, socket insert, silicone gel, elastomeric or equal, for use with locking mechanism
L5676	Additions to lower extremity, below knee, knee joints, single axis, pair
L5677	Additions to lower extremity, below knee, knee joints, polycentric, pair
L5678	Additions to lower extremity, below knee, joint covers, pair
L5679	Addition to lower extremity, below knee/above knee, custom fabricated from existing mold or prefabricated, socket insert, silicone gel, elastomeric or equal, not for use with locking mechanism
L5680	Addition to lower extremity, below knee, thigh lacer, nonmolded
L5681	Addition to lower extremity, below knee/above knee, custom fabricated socket insert for congenital or atypical traumatic amputee, silicone gel, elastomeric or equal, for use with or without locking mechanism, initial only (for other than initial, use code L5673 or L5679)
L5682	Addition to lower extremity, below knee, thigh lacer, gluteal/ischial, molded
L5683	Addition to lower extremity, below knee/above knee, custom fabricated socket insert for other than congenital or atypical traumatic amputee, silicone gel, elastomeric or equal, for use with or without locking mechanism, initial only (for other than initial, use code L5673 or L5679)
L5686	Addition to lower extremity, below knee, back check (extension control)
L5692	Addition to lower extremity, above knee, pelvic control belt, light
L5696	Addition to lower extremity, above knee or knee disarticulation, pelvic joint
L5697	Addition to lower extremity, above knee or knee disarticulation, pelvic band
L5699	All lower extremity prostheses, shoulder harness
L5700	Replacement, socket, below knee, molded to patient model
L5701	Replacement, socket, above knee/knee disarticulation, including attachment plate, molded to patient model

HCP Code	Description
L5702	Replacement, socket, hip disarticulation, including hip joint, molded to patient model
L5703	Ankle, Symes, molded to patient model, socket without solid ankle cushion heel (SACH) foot, replacement only
L5704	Custom shaped protective cover, below knee
L5705	Custom shaped protective cover, above knee
L5706	Custom shaped protective cover, knee disarticulation
L5707	Custom shaped protective cover, hip disarticulation
L5710	Addition, exoskeletal knee-shin system, single axis, manual lock
L5711	Additions exoskeletal knee-shin system, single axis, manual lock, ultra-light material
L5712	Addition, exoskeletal knee-shin system, single axis, friction swing and stance phase control (safety knee)
L5714	Addition, exoskeletal knee-shin system, single axis, variable friction swing phase control
L5716	Addition, exoskeletal knee-shin system, polycentric, mechanical stance phase lock
L5718	Addition, exoskeletal knee-shin system, polycentric, friction swing and stance phase control
L5722	Addition, exoskeletal knee-shin system, single axis, pneumatic swing, friction stance phase control
L5724	Addition, exoskeletal knee-shin system, single axis, fluid swing phase control
L5726	Addition, exoskeletal knee-shin system, single axis, external joints fluid swing phase control
L5728	Addition, exoskeletal knee-shin system, single axis, fluid swing and stance phase control
L5780	Addition, exoskeletal knee-shin system, single axis, pneumatic/hydra pneumatic swing phase control
L5781	Addition to lower limb prosthesis, vacuum pump, residual limb volume management and moisture evacuation system

HCP Code	Description
L5782	Addition to lower limb prosthesis, vacuum pump, residual limb volume management and moisture evacuation system, heavy duty
L5783	Addition to lower extremity, user adjustable, mechanical, residual limb volume management system
L5785	Addition, exoskeletal system, below knee, ultra-light material (titanium, carbon fiber or equal)
L5790	Addition, exoskeletal system, above knee, ultra-light material (titanium, carbon fiber or equal)
L5795	Addition, exoskeletal system, hip disarticulation, ultra-light material (titanium, carbon fiber or equal)
L5810	Addition, endoskeletal knee-shin system, single axis, manual lock
L5811	Addition, endoskeletal knee-shin system, single axis, manual lock, ultra-light material
L5812	Addition, endoskeletal knee-shin system, single axis, friction swing and stance phase control (safety knee)
L5814	Addition, endoskeletal knee-shin system, polycentric, hydraulic swing phase control, mechanical stance phase lock
L5816	Addition, endoskeletal knee-shin system, polycentric, mechanical stance phase lock
L5818	Addition, endoskeletal knee-shin system, polycentric, friction swing, and stance phase control
L5822	Addition, endoskeletal knee-shin system, single axis, pneumatic swing, friction stance phase control
L5824	Addition, endoskeletal knee-shin system, single axis, fluid swing phase control
L5826	Addition, endoskeletal knee-shin system, single axis, hydraulic swing phase control, with miniature high activity frame
L5827	Endoskeletal knee-shin system, single axis, electromechanical swing and stance phase control, with or without shock absorption and stance extension damping
L5828	Addition, endoskeletal knee-shin system, single axis, fluid swing and stance phase control

HCP Code	Description
L5830	Addition, endoskeletal knee-shin system, single axis, pneumatic/ swing phase control
L5840	Addition, endoskeletal knee/shin system, 4-bar linkage or multiaxial, pneumatic swing phase control
L5841	Addition, endoskeletal knee-shin system, polycentric, pneumatic swing, and stance phase control
L5845	Addition, endoskeletal, knee-shin system, stance flexion feature, adjustable
L5848	Addition to endoskeletal knee-shin system, fluid stance extension, dampening feature, with or without adjustability
L5850	Addition, endoskeletal system, above knee or hip disarticulation, knee extension assist
L5855	Addition, endoskeletal system, hip disarticulation, mechanical hip extension assist
L5856	Addition to lower extremity prosthesis, endoskeletal knee-shin system, microprocessor control feature, swing and stance phase, includes electronic sensor(s), any type
L5857	Addition to lower extremity prosthesis, endoskeletal knee-shin system, microprocessor control feature, swing phase only, includes electronic sensor(s), any type
L5858	Addition to lower extremity prosthesis, endoskeletal knee shin system, microprocessor control feature, stance phase only, includes electronic sensor(s), any type
L5859	Addition to lower extremity prosthesis, endoskeletal knee-shin system, powered and programmable flexion/extension assist control, includes any type motor(s)
L5910	Addition, endoskeletal system, below knee, alignable system
L5920	Addition, endoskeletal system, above knee or hip disarticulation, alignable system
L5925	Addition, endoskeletal system, above knee, knee disarticulation or hip disarticulation, manual lock
L5926	Addition to lower extremity prosthesis, endoskeletal, knee disarticulation, above knee, hip disarticulation, positional rotation unit, any type

HCPSC Code	Description
L5930	Addition, endoskeletal system, high activity knee control frame
L5940	Addition, endoskeletal system, below knee, ultra-light material (titanium, carbon fiber or equal)
L5950	Addition, endoskeletal system, above knee, ultra-light material (titanium, carbon fiber or equal)
L5960	Addition, endoskeletal system, hip disarticulation, ultra-light material (titanium, carbon fiber or equal)
L5961	Addition, endoskeletal system, polycentric hip joint, pneumatic or hydraulic control, rotation control, with or without flexion and/or extension control
L5962	Addition, endoskeletal system, below knee, flexible protective outer surface covering system
L5964	Addition, endoskeletal system, above knee, flexible protective outer surface covering system
L5966	Addition, endoskeletal system, hip disarticulation, flexible protective outer surface covering system
L5968	Addition to lower limb prosthesis, multiaxial ankle with swing phase active dorsiflexion feature
L5969	Addition, endoskeletal ankle-foot or ankle system, power assist, includes any type motor(s)
L5970	All lower extremity prostheses, foot, external keel, SACH foot
L5971	All lower extremity prosthesis, solid ankle cushion heel (SACH) foot, replacement only
L5972	All lower extremity prostheses, foot, flexible keel
L5973	Endoskeletal ankle foot system, microprocessor controlled feature, dorsiflexion and/or plantar flexion control, includes power source
L5974	All lower extremity prostheses, foot, single axis ankle/foot
L5975	All lower extremity prosthesis, combination single axis ankle and flexible keel foot
L5976	All lower extremity prostheses, energy storing foot (seattle carbon copy ii or equal)
L5978	All lower extremity prostheses, foot, multiaxial ankle/foot

HCP Code	Description
L5979	All lower extremity prosthesis, multi-axial ankle, dynamic response foot, one piece system
L5980	All lower extremity prostheses, flex foot system
L5981	All lower extremity prostheses, flex-walk system or equal
L5982	All exoskeletal lower extremity prostheses, axial rotation unit
L5984	All endoskeletal lower extremity prosthesis, axial rotation unit, with or without adjustability
L5985	All endoskeletal lower extremity prostheses, dynamic prosthetic pylon
L5986	All lower extremity prostheses, multi-axial rotation unit ('mcp' or equal)
L5987	All lower extremity prosthesis, shank foot system with vertical loading pylon
L5988	Addition to lower limb prosthesis, vertical shock reducing pylon feature
L5990	Addition to lower extremity prosthesis, user adjustable heel height
L5991	Addition to lower extremity prostheses, osseointegrated external prosthetic connector
L5999	Lower extremity prosthesis, not otherwise specified
L7360	Six volt battery, each
L7362	Battery charger, six volt, each
L7364	Twelve volt battery, each
L7366	Battery charger, twelve volt, each
L7367	Lithium ion battery, rechargeable, replacement
L7368	Lithium ion battery charger, replacement only
L7700	Gasket or seal, for use with prosthetic socket insert, any type, each

Evidence Discussion

A prosthesis is designed to replace portions of an extremity to improve function, mobility, and quality of life. A lower extremity prosthesis is comprised of many different components that must be specified in a prescription, including the socket, socket

interface, suspension, pylon, and systems for knee and foot/ankle joints. Prosthetic component options are determined by an individual's characteristics, such as age, pre-amputation functional status, comorbidities, and rehabilitation goals. Thus, prescription of components for a given prosthesis depends on the clinical status and the anticipated functional capacity of the individual.¹²³

Lower limb prosthetic devices may be preparatory or permanent. A preparatory device is a prosthesis made soon after an amputation (approximately four weeks) as a temporary method of retraining a person to walk and balance while shrinking the residual limb. Immediate postoperative prosthesis (IPOP) placement allows individuals to begin ambulation and rehabilitation on postoperative day one, which may be of significant physiologic and psychological benefit. A permanent prosthesis is recommended when an individual has used a prosthetic device full time for a period of approximately six months, and when the limb volume has stabilized to a point where the socket fit remains relatively consistent for two to three weeks.¹²³

For individuals with transfemoral (above knee) amputation, there are anatomic differences between prosthetic wearers and able-bodied individuals. The typical transfemoral gait has an asymmetrical step length and slower cadence. As such, available evidence reports a 65% increased energy cost with ambulation for above-knee amputees as compared to able-bodied individuals. For individuals with transtibial (below knee) amputation, prosthesis wearers also exhibited kinematic differences from individuals with a nonprosthetic gait. The typical transtibial gait demonstrates a longer swing time and shorter stance time.¹²³

The prosthetic foot is also an integral component of any lower extremity prosthesis. Individuals who require greater stability during weight acceptance because of weak knee extensors or poor balance may consider a single-axis foot. Moreover, those with elevated risks for overuse injury to the sound-side lower limb and lower back or those capable of variable speed and/or community ambulation are indicated for energy storing and return prosthetic (ESAR) feet.¹²³

Definitions

Prosthesis

A prosthesis is an artificial device used to replace a missing body part and restore function.

¹ VA/DoD Clinical Practice Guideline for Rehabilitation of Individuals with Lower Limb Amputation. VA/DoD Evidence Based Practice [Internet] U.S. Department of Veteran Affairs and the Department of Defense. Version 2; 2017, <https://www.healthquality.va.gov/> (Accessed August 12, 2025).

² Edelstein JE and Moroz A; Lower-Limb Prosthetics and Orthotics: Clinical Concepts. 2011. Pages 19-32.

³ Bae TS, Choi K, Hong D, Mun M. Dynamic analysis of above-knee amputee gait. Clin Biomech; 2007; 25:250-258.

Postoperative Prosthesis (IPOP)	An immediate postoperative prosthesis (IPOP) is applied at the time of surgery to facilitate proper shaping of the residual limb and facilitate weight-bearing.
Preparatory (temporary) Prosthesis	An initial or is typically used temporarily for the first three to six months following an amputation to assess the individual's acceptance and tolerance to the prosthetic components, allow for weight-bearing, and reduce edema
Definitive Prosthesis	The definitive prosthesis is requested once the residual limb has stabilized in shape and size, as early as three months; however, fitting a definitive prosthesis may be deferred based on functional progression and tolerance.
Powered Base Items	Powered base items are those that contain the power source (battery).
Powered Prosthetic Devices	Powered prosthetic devices use signals from muscle activity in the residual limb to process data and control movement and power of the knee. Powered knee devices control the transition from a bent knee to an extended knee, support the individual's full body weight at heel strike, and can help lift above-knee amputees out of a chair to a standing position. Powered foot-ankle devices use a combination of processors, sensors, motors, and springs that allow the user a powered push-off with taking steps.
Functional Assessment	A functional assessment measures an individual's level of function and ability to perform specific tasks on a safe and dependable basis over a defined period.
Functional Classification Levels	Functional Classification Levels are used to aid in the selection of components for a hip, knee, ankle, or foot prosthesis.
Functional Classification Level 0 (K0)	The individual does not have the ability or potential to ambulate or transfer safely with or without assistance, and a prosthesis does not enhance his/her quality of life or mobility.

Functional Classification Level 1 (K1)	The individual has the ability or potential to use a prosthesis for transfers or ambulating on level surfaces at a fixed cadence; typical of the limited and unlimited household ambulator.
Functional Classification Level 2 (K2)	The individual has the ability or potential to ambulate with the ability to traverse environmental barriers such as curbs, stairs, or uneven surfaces; typical of the limited community ambulator.
Functional Classification Level 3 (K3):	The individual has the ability or potential to ambulate with variable cadence; typical of the community ambulator who has the ability to traverse most environmental barriers and may have vocational, therapeutic, or exercise activity that demands prosthetic utilization beyond simple locomotion.
Functional Classification Level 4 (K4)	The individual has the ability or potential for prosthetic ambulating that exceeds basic ambulating skills, exhibiting high impact, stress, or energy levels; typical of the prosthetic demands of the child, active adult, or athlete.
Hip Disarticulation or Hemipelvectomy prosthesis	A hip disarticulation amputation is a resection through the hip joint that leaves the pelvic bone intact while removing the entire lower limb. A hemipelvectomy is the removal of the entire limb and a portion of the pelvic bone. Major prosthetic parts include the socket, hip system, knee system, shank, and foot-ankle system.
Above Knee (transfemoral) Prosthesis	Major prosthetic parts include the socket, knee system, shank, and foot-ankle system.
Below Knee (transtibial) Prosthesis	Major prosthetic parts include the socket, shank, and foot.

Partial Foot, Foot, and Symes (ankle disarticulation) Prosthesis

Major prosthetic parts vary by level of amputation and may include a socket with a toe filler, a socket with a foot component, or a foot component alone. A Symes amputation incorporates ankle disarticulation, typically with removal of the malleoli of the tibia and fibula and attachment of the heel pad to the weight bearing surface. A Chopart amputation is a disarticulation of the forefoot at the midtarsal joint, with the calcaneus, talus, and other parts of the tarsus being retained. A Lisfranc amputation is a disarticulation at the tarsometatarsal joint.

Mechanical Suspension Systems

Mechanical suspension systems involve the use of belts, straps, or sleeve.

Suction-type Suspension Systems

Includes vacuum suspension systems, they function due to a negative pressure created between the socket and insert/liner. The devices have been proposed for individuals with non-healing skin ulcerations located on the stump and/or when other socket systems have failed to provide a secure fit.

Osseointegrated Prosthetic Device

Consists of a fixture and abutment screw that is surgically implanted into bone. Primary concerns with the osseointegration techniques are periprosthetic fracture and infection leading to osteomyelitis

Socket Interface

The socket interface between the prosthesis and residual limb is one component of a successful and comfortable socket fit. Various mediums are available for the interface, including foam, silicone, and active or passive suspension devices. The combination of socket type, liner, and suspension must compensate for the daily fluctuations in residual limb volume

Suspension Systems	Suspension systems exist between the socket and the residual limb. Suspension systems serve to keep the prosthesis in place and manage residual limb volume fluctuation, and as a result, reduce skin breakdown and improve gait. Suspension may rely on anatomic shape, active or passive suction, harnesses, or a combination of these. The suspension system is critical to further reduce the movement between the socket and residual limb. Mechanical suspension systems involve the use of belts, straps, or sleeve. Suction-type suspension systems, including vacuum suspension systems, function due to a negative pressure created between the socket and insert/liner. The devices have been proposed for individuals with non-healing skin ulcerations located on the stump and/or when other socket systems have failed to provide a secure fit.
Transfemoral Sockets	Quadrilateral socket is a total contact design where the majority of weight bearing is through the ischial tuberosity as well as the gluteal musculature. This design has a wide mediolateral dimension. There may be increased energy cost with quadrilateral sockets. Ischial containment socket is a total contact design narrower mediolateral dimensions and partial to full containment of the ischium. Ischial containment socket design may reduce the energy cost compared to quadrilateral sockets. Subischial sockets have lower proximal trimlines distal to the ischial tuberosity. A proximal seal is obtained through a variety of design options.
Infinite Socket® (LIM Innovations®, San Francisco, CA)	An Infinite Socket® (LIM Innovations®, San Francisco, CA) is an open-socket design that has distinct below knee and above knee products. These sockets are custom-fabricated from a model of the individual's residual limb, and utilize struts that extend from a base to an adjustable brim enclosing an inner shell to form the primary structure of the socket.
Gel Liners	Gel liners are used to reduce shear on the skin or limb. They are often used with skin conditions and grafts, and they also protect the limb during high-impact activities.

Gasket or Seal for Use with a Prosthetic Socket	A gasket or seal for use with a prosthetic socket insert (HPCPS L7700) describes a stand-alone (i.e., not integrated into or a part of a prosthetic socket insert) sealing ring that is added to a socket insert to assist in providing or maintaining negative pressure for socket suspension.
Pylon	A pylon is a connection between the residual limb and the prosthetic joint. Inappropriate length of the pylon can lead to increased gait deviations and back pain.
Prosthetic Knee	The performs three functions: it provides support during the stance phase of ambulation, produces smooth control during the swing phase, and maintains unrestricted motion for sitting and kneeling. The prosthetic knee may have a single axis with a simple hinge and a single pivot point, or it may have a polycentric axis with multiple centers of rotation, which is more similar to the anatomic human knee. Basic lower extremity prostheses include a single axis, constant friction knee. Other prosthetic knees are considered for coverage based upon functional classification. Microprocessor control of the prosthetic knee has optimized the swing phase and added stance-phase control that allows the prosthetic knee to respond automatically to varying conditions of stair and ramp ascent and descent, as well as uneven terrains, which are challenging conditions for most people with high-level lower limb amputations.
Microprocessor-controlled Knee Prosthetics	Microprocessor-controlled knee prosthetics are sensor-equipped devices designed to detect step time and alter knee extension level to suit walking speed. In an individual with a transfemoral amputation, the microprocessor controlled knee has been shown to potentially decrease effort involved in walking; improve gait symmetry; increase confidence by the individual in the prosthesis; provide more natural movement, including on stairs, inclines, and uneven terrain; and assist in the avoidance of falls.
Prosthetic Ankle Components	Prosthetic ankle components include an axial rotation unit (i.e., torque absorption) and hydraulic ankle mechanisms.

Prosthetic Foot	The has five basic functions: to provide a stable weight-bearing surface, to absorb shock, to replace lost muscle function and biomechanics of the foot, to replicate the anatomic joints of the ankle and foot, and to restore cosmetic appearance. Basic lower extremity prostheses include a SACH foot. Other prosthetic feet are considered for coverage based upon functional classification.
SACH (solid ankle, cushion heel) Foot	The SACH (solid ankle, cushion heel) foot consists of a rigid keel covered by a semi-noncompressible foam and a synthetic rubber heel wedge. Because the keel is rigid, the SACH foot does not provide dorsiflexion; this limits its usefulness on uneven surfaces.
Flexible Keel	A flexible keel is a shock absorption mechanism that is incorporated into the foot and that stores energy to be used during toe off.
Multiaxial Prosthetic Feet	Multiaxial Prosthetic Feet permit movements in any direction: plantar flexion, dorsiflexion, inversion, eversion, and a slight amount of rotation around a vertical axis.
Microprocessor-controlled Ankle-foot Prosthetics	Microprocessor-controlled Ankle-foot Prosthetics (e.g., Proprio Foot®, Össur, Iceland; Elan®, Blatchford®, UK) are designed to promote a more symmetrical and balanced gait. In addition, the device adjusts for ankle angle during swing phase and identifies sloping gradients and ascent or descent of stairs, allows the user to place both feet behind their knees when rising from a chair, or automatically gives a toe-lift allowing sufficient ground clearance when walking.
Microprocessor-controlled Knee-ankle/foot Prosthetics	Microprocessor-controlled knee-ankle/foot prosthetics for transfemoral amputees integrate both a microprocessor knee and the ankle/foot device (e.g., LiNX®, Blatchford®, UK). The device is intended for use by individuals who are Medicare Functional Classification Level 3 (K3) or higher.

ReWalk® and Indego® Exoskeletons

The ReWalk® and Indego® exoskeletons are designed for persons with a spinal cord injury (SCI) who retain upper-limb strength and mobility to manage stabilizing crutches. The ReWalk® system includes a set of computer-controlled, motorized leg braces that restore the ability to walk with crutches to patients with paraplegia who retain the ability to use their hands and shoulders for walking with crutches, and who have good bone density and cardiovascular health. The Indego® exoskeleton incorporates four motors for powered movement of bilateral hip and knee joints in the sagittal plane, in addition to built-in ankle-foot-orthoses (AFOs) at both ankle joints to provide ankle stability and transfer the weight of the exoskeleton to the ground.

References

1. Medicare Local Coverage Determination (LCD): Lower Limb Prostheses (L33787) / LCA (A52496) <https://www.cms.gov/medicare-coverage-database/view/lcd.aspx?LCDId=33787>
2. Hoellwarth JS, Tetsworth K, Rozbruch SR, Handal MB, Coughlan A, Al Muderis M. Osseointegration for amputees: current implants, techniques, and future directions. *JBJS Rev.* 2020;8(3):e0043. doi: 10.2106/JBJS.RVW.19.00043
3. Esquenazi A, Talaty M, Packel A, Saulino M. The ReWalk powered exoskeleton to restore ambulatory function to individuals with thoracic-level motor-complete spinal cord injury. *Am J Phys Med Rehabil.* 2012;91(11):911-921. doi: 10.1097/PHM.0b013e318269d9a3
4. FDA allows marketing of first wearable, motorized device that helps people with certain spinal cord injuries to walk. United States Food and Drug Administration (FDA); June 26, 2014. Accessed September 1, 2023. <https://wayback.archive-it.org/7993/20170112222846/http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm402970.htm>
5. Ziegler-Graham K, MacKenzie EJ, Ephraim PL, Trivison TG, Brookmeyer R. Estimating the prevalence of limb loss in the United States: 2005 to 2050. *Arch Phys Med Rehabil.* 2008;89(3):422-429. doi: 10.1016/j.apmr.2007.11.005
6. National Limb Loss Resource Center. Limb Loss Statistics. Amputee Coalition. Accessed August 30, 2023. <https://www.amputee-coalition.org/resources/limb-loss-statistics/>
7. Ephraim PL, Dillingham TR, Sector M, Pezzin LE, Mackenzie EJ. Epidemiology of limb loss and congenital limb deficiency: a review of the literature. *Arch Phys Med Rehabil.* 2003;84(5):747-761. doi: 10.1016/s0003-9993(02)04932-8
8. The Rehabilitation of Individuals with Lower Limb Amputation Work Group, The Office of Quality Safety and Value (US Department of Veterans Affairs), Office of Evidence Based Practice (US Army Medical Command). VA/DoD Clinical Practice Guideline for Rehabilitation of Individuals with Lower Limb Amputation. Version 2.0: United States Department of Veterans Affairs, United States Department of Defense; 2017.
9. Edelstein J, Moroz A. *Lower-Limb Prosthetics and Orthotics: Clinical Concepts*. 1st ed. CRC Press; 2010.
10. FDA Approves Prosthetic Implant for Above-the-Knee Amputations. December 18, 2020. Accessed 14 October 2024. <https://www.fda.gov/news-events/press-announcements/fda-approves-prosthetic-implant-above-knee-amputations>
11. Bae TS, Choi K, Hong D, Mun M. Dynamic analysis of above-knee amputee gait. *Clin Biomech (Bristol, Avon)*. 2007;22(5):557-566. doi:10.1016/j.clinbiomech.2006.12.009

12. Flynn K, Alligood E, Adams E. *Computerized Lower Limb Prostheses*. 2000. VA Technology Assessment Program Short Report. https://www.research.va.gov/resources/pubs/docs/ta_short_3_00.pdf
13. Ali MM, Loretz L, Shea A, et al. A contemporary comparative analysis of immediate postoperative prosthesis placement following below-knee amputation. *Ann Vasc Surg*. 2013;27(8):1146-2253. doi: 10.1016/j.avsg.2012.10.031
14. Wong CK, Chihuri ST, Santo EG, White RA. Relevance of medical comorbidities for functional mobility in people with limb loss: retrospective explanatory models for a clinical walking measure and a patient-reported functional outcome. *Physiotherapy*. 2020;107:133-141. doi: 10.1016/j.physio.2020.01.002
15. Starholm IM, Mirtaheri P, Kapetanovic N, et al. Energy expenditure of transfemoral amputees during floor and treadmill walking with different speeds. *Prosthet Orthot Int*. 2016;40(3):336-342. doi: 10.1177/0309364615588344
16. van Schaik L, Geertzen JHB, Dijkstra PU, Dekker R. Metabolic costs of activities of daily living in persons with a lower limb amputation: a systematic review and meta-analysis. *PLoS One*. 2019;14(3):e0213256. doi: 10.1371/journal.pone.0213256
17. Jeans KA, Browne RH, Karol LA. Effect of amputation level on energy expenditure during overground walking by children with an amputation. *J Bone Joint Surg Am*. 2011;93(1):49-56. doi: 10.2106/JBJS.I.01557
18. Gholizadeh H, Abu Osman NA, Eshraghi A, Ali S, Razak NA. Transtibial prosthesis suspension systems: systematic review of literature. *Clin Biomech (Bristol, Avon)*. 2014;29(1):87-97. doi: 10.1016/j.clinbiomech.2013.10.013
19. Safari MR, Meier MR. Systematic review of effects of current transtibial prosthetic socket designs-part 1: qualitative outcomes. *J Rehabil Res Dev*. 2015;52(5):491-508. doi: 10.1682/JRRD.2014.08.0183
20. Hafner BJ, Halsne EG, Morgan SJ, Morgenroth DC, Humbert AT. Effects of prosthetic feet on metabolic energy expenditure in people with transtibial amputation: a systematic review and meta-analysis. *PM R*. 2022;14(9):1099-1115. doi: 10.1002/pmrj.12693
21. Trallesi M, Delussu AS, Fusco A, et al. Residual limb wounds or ulcers heal in transtibial amputees using an active suction socket system. A randomized controlled study. *Eur J Phys Rehabil Med*. 2012;48(4):613-623.
22. Baumann M, Price C, Brousseau L, et al. The relationship between residual limb health, motion within the socket, and prosthetic suspension. *PM R*. 2023;15(4):510-521. doi: 10.1002/pmrj.12899
23. Samitier CB, Guirao L, Costea M, Camós JM, Pleguezuelos E. The benefits of using a vacuum-assisted socket system to improve balance and gait in elderly transtibial amputees. *Prosthet Orthot Int*. 2016;40(1):83-88. doi: 10.1177/0309364614546927
24. Darter BJ, Sinitski K, Wilken JM. Axial bone-socket displacement for persons with a traumatic transtibial amputation: the effect of elevated vacuum suspension at progressive body-weight loads. *Prosthet Orthot Int*. 2016;40(5):552-557. doi: 10.1177/0309364615605372
25. Thibaut A, Beaudart C, Maertens DE Noordhout B, Geers S, Kaux JF, Pelzer D. Impact of microprocessor prosthetic knee on mobility and quality of life in patients with lower limb amputation: a systematic review of the literature. *Eur J Phys Rehabil Med*. 2022;58(3):452-461. doi: 10.23736/S1973-9087.22.07238-0
26. Hahn A, Bueschges S, Prager M, Kannenberg A. The effect of microprocessor controlled exo-prosthetic knees on limited community ambulators: systematic review and meta-analysis. *Disabil Rehabil*. 2022;44(24):7349-7367. doi: 10.1080/09638288.2021.1989504
27. Carse B, Scott H, Brady L, Colvin J. Evaluation of gait outcomes for individuals with established unilateral transfemoral amputation following the provision of microprocessor controlled knees in the context of a clinical service. *Prosthet Orthot Int*. 2021;45(3):254-261. doi: 10.1097/PXR.000000000000016
28. Colas-Ribas C, Martinet N, Audat G, Bruneau A, Paysant J, Abraham P. Effects of a microprocessor-controlled ankle-foot unit on energy expenditure, quality of life, and postural stability in persons with transtibial amputation: an unblinded, randomized, controlled, cross-over study. *Prosthet Orthot Int*. 2022;46(6):541-548. doi: 10.1097/PXR.0000000000000187.
29. Weber EL, Stevens PM, England DL, Swilley VD, Wurdeman SR. Microprocessor feet improve prosthetic mobility and physical function relative to non-microprocessor feet. *J Rehabil Assist Technol Eng*. 2022;9:20556683221113320. doi: 10.1177/20556683221113320
30. Ernst M, Altenburg B, Schmalz T, Kannenberg A, Bellmann M. Benefits of a microprocessor-controlled prosthetic foot for ascending and descending slopes. *J Neuroeng Rehabil*. 2022;19(1):9. doi: 10.1186/s12984-022-00983-y

31. Gardinier ES, Kelly BM, Wensman J, Gates DH. A controlled clinical trial of a clinically-tuned powered ankle prosthesis in people with transtibial amputation. *Clin Rehabil.* 2018;32(3):319-329. doi: 10.1177/0269215517723054
32. Montgomery JR, Grabowski AM. Use of a powered ankle-foot prosthesis reduces the metabolic cost of uphill walking and improves leg work symmetry in people with transtibial amputations. *J R Soc Interface.* 2018;15(145):20180442. doi: 10.1098/rsif.2018.0442
33. Kim J, Wensman J, Colabianchi N, Gates DH. The influence of powered prostheses on user perspectives, metabolics, and activity: a randomized crossover trial. *J Neuroeng Rehabil.* 2021;18(1):49. doi: 10.1186/s12984-021-00842-2
34. Kunutsor SK, Gillatt D, Blom AW. Systematic review of the safety and efficacy of osseointegration prosthesis after limb amputation. *Br J Surg.* 2018;105(13):1731-1741. doi: 10.1002/bjs.11005
35. Diaz Balzani L, Ciuffreda M, Vadalà G, Di Pino G, Papalia R, Denaro V. Osseointegration for lower and upper-limb amputation a systematic review of clinical outcomes and complications. *J Biol Regul Homeost Agents.* 2020;34(4 Suppl. 3):315-326.
36. Black GG, Vaeth AM, Chen Y, et al. Osseointegration for lower limb amputation: understanding the risk factors and time courses of soft tissue complications. *Ann Plast Surg.* 2023;90(6S Suppl 5):S452-S456. doi: 10.1097/SAP.0000000000003477
37. Hoellwarth JS, Tetsworth K, Rozbruch SR, Handal MB, Coughlan A, Al Muderis M. Osseointegration for amputees: current implants, techniques, and future directions. *JBJS Rev.* 2020;8(3):e0043. doi: 10.2106/JBJS.RVW.19.00043
38. Vernice NA, Askinas CA, Black GG, et al. Osseointegration for lower-extremity amputees: operative considerations from the plastic surgeon's perspective. *JBJS Rev.* 2022;10(11):e22.00125. doi: 10.2106/JBJS.RVW.22.00125
39. Stevens PM, Rheinstein J, Wurdeman SR. Prosthetic foot selection for individuals with lower-limb amputation: a clinical practice guideline. *J Prosthet Orthot.* 2018;30(4):175-180. doi: 10.1097/JPO.0000000000000181
40. Louer CR Jr, Scott-Wyand P, Hernandez R, Vergun AD. Principles of amputation surgery, prosthetics, and rehabilitation in children. *J Am Acad Orthop Surg.* 2021;29(14):e702-e713. doi: 10.5435/JAAOS-D-20-01283