ASTON

THE WAY WE CARE

Lower Extremity Prosthetic Solutions

Lower Extremity Functional Classifications:
Prosthetic components and design elements are selected based on the patient's functional level (or "K" Levels 0 to 4). Functional level is determined by the reasonable expectations of the prosthetist and the ordering physician.

Considering factors include, but are not limited to:
The patient's past history (including prior prosthetic use, if applicable).
The patient's current and *potential* abilities and condition including the status of the residual limb and the nature of other medical problems.
The patient's desire to ambulate Clinical assessments of a patient's functional level are based on these classification levels:

Level 0: Does not have the *ability or potential* to ambulate or transfer safely without assistance and a prosthesis does not enhance quality of life or mobility.

Level 1: Has the *ability or potential* to use a prosthesis for transfers or ambulation on level surfaces at fixed cadence. Typical of the limited and unlimited household ambulatory.

Level 2: Has the *ability or potential* for ambulation with the ability to traverse low level environmental barriers such as curbs, stairs or uneven surfaces. Typical of the limited community ambulatory.

Level 3: Has the *ability or potential* for ambulation with variable cadence. Typical of the community ambulatory who has the ability to traverse most environmental barriers and may have vocational, therapeutic or exercise activity that demands prosthetic utilization beyond simple locomotion.

Level 4: Has the *ability or potential* for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress or energy levels. Typical of the prosthetic demands of the child, active adult or athlete.

Note: Bilateral amputees often cannot be strictly bound by functional level classifications.

Activity level Considerations for Prosthetic Feet

Mobility Class Indicators For Prosthetic Feet

K – 1 Level : Indicators

For those with the most limited mobility, prosthetic feet designed for maximum stability help maintain balance when standing or taking short, cautious steps at minimal speed on level floors. With safety as a priority, opt for these characteristics in a prosthetic foot:

1. Lightweight
2. A secure stance area upon heel contact that allows user to safely shift their weight onto the foot
3. Allows walking without bending the knee.

K – 3 Level : Indicators

If the user can walk at varying speeds while also negotiating uneven terrain and similar barriers, look for these features in a prosthetic foot:

1. A smooth rollover as the prosthetic foot transitions from heel strike to toe-off.
2. Good energy efficiency.
3. Ability to adapt to uneven ground.

K – 2 Level : Indicators

To walk for a limited time and limited speed and be able to negotiate obstacles like curbs or uneven ground, the user would benefit from a prosthetic foot that offers stability and comfort, meaning it protects the joints and residual-limb tissue.

Look for a prosthetic foot that features:

1. Shock absorption at heel strike
2. A light rollover during walking
3. A dynamic transition from standing into swing phase (taking a step).
4. Moderate multi-axial functionality, if the user is expecting to walk on uneven ground

K – 4 Level : Indicators

For the highest level of mobility, including walking for unlimited time and distance plus demanding work, recreational or athletic activities, user needs a prosthetic foot that can withstand shock, tension and torsion and that responds when the user changes walking speed or start running. (For certain activities, you might consider additional specialty feet for sports or swimming.) For everyday use, look for a prosthetic foot with:

1. An easy rollover and good forefoot support
2. Excellent energy efficiency. Consider a carbon-fibre foot with more stiffness for support and energy storage.
3. Ability to adapt to uneven ground

Types of Prosthetic Feet

The basics

Designing prosthetic foot systems is challenging. It's very difficult to reproduce the complex workings of the human foot and ankle. Ideally the foot will be light because its weight is added to the rest of the prosthesis. If the foot is too heavy, the suspension system may be affected and with it the connection to the socket and the residual limb will get impacted.

A good prosthetic foot should also be strong, as it will be taking on huge force and torque as the user walks and runs. Feet must also be small enough to fit within a foot shell, a cosmetic covering for the prosthetic foot, and thus fit within a shoe. Being light, strong, and small, and yet functional and durable is the challenge. .

Early designs for prosthetic feet were often a solid piece of wood. A similar design, the SACH (solid-ankle-cushioned-heel) is still in use because of its sturdy function, especially useful for individuals with lower activity levels. A SACH foot typically has a rigid inner structure (wood or plastic) surrounded by a compressible foam cosmetic shell.

Today's more sophisticated feet, which add more functions, are secured inside a cosmetic shell. Most people never see their prosthetic foot without this exterior shell. The cosmetic shell, which stretches around the foot prosthesis and is held in place and serves the purpose of making the prosthesis look like with an anatomical foot and it also fills the space in the shoe.

What's inside the shell can vary dramatically. Prosthetic feet are designed to meet the needs that fit the lifestyle and activity level of the users. Here are some factors to consider.

Materials : The materials in a prosthetic foot differ by activity level. Wood, plastic and foam are usually found in feet designed for individuals who have low activity levels and require stability. Carbon fibre feet meet the functional needs for shock absorption and energy efficiency, and are lightweight as well.

Comfort : A prosthetic foot has to feel good and to meet all the activity goals. Comfort allows the user to be more active, and the function of the prosthetic foot directly affects comfort.

Function : Prosthetic feet are designed to mimic a human foot at a specific activity level. For people who cannot walk, the function is largely cosmetic. For those who are most active, a prosthetic foot must mimic a normal foot during the act of walking. It must act as a shock absorber as they strike their heel to the ground, adapt to uneven terrain, provide a smooth rollover from heel to toe, and provide a rigid lever for propelling forward when they finish their step ("toe-off").

Multi-axial motion: Some prosthetic feet are designed to mimic the ankle, which allows the foot to move in multiple planes. Multi-axial capability in a foot allows you to raise and lower the forefoot; move the forefoot to the left and right; and roll the foot slightly to the inside and to the outside. Multi-axial motion is needed to walk comfortably and confidently on uneven ground, when your foot must adapt to whatever it encounters.

Energy storage : A foot made with carbon fiber for energy storage literally gives you a spring in your step. The carbon fiber acts as a spring, compressing as you apply weight and propelling you forward as your foot rolls, returning energy to your step as the spring releases. Some prostheses have one spring in the heel and a second spring in the forefoot: just what you need for walking at various speeds, running, climbing hills or descending stairs with a secure, confident stride. With carbon fiber, the longer the spring, the more energy it can store and the more responsive the foot will be.

Other Factors to be considered while choosing a prosthetic foot



Body weight: Prosthetic feet are designed for a specific weight range. To ensure that a prosthetic foot performs well for the user, choose the one suited to their body weight class.

Shoe clearance: When the user stands, a prosthesis fills the space between the residual limb and the floor. It is designed to add only the length needed to equate or balance the other leg. Most prosthetic feet are 2 to 7 inches in height. Consequently, a limb loss near the ankle may limit some options to low-profile prosthetic feet.

Preferred Foot shell and the Colours: Shells can be ordered in colors to match the skin tone, in a range of sizes and often with a split toe for wearing sandals. Low-end shells may lack detail, such as toes, and may be attached to the prosthetic foot. At the high end, the toes and skin colors are more realistic. If the activity level is 3 or 4, one needs to look for a foot with a shell that can be replaced once it’s worn out completely due to high end, impact levels and usage.

Price: The price of prosthetic feet generally rises with the activity level because additional functionality translates to more structure and more expensive materials. Before making a final selection, make sure the prosthetic foot of choice t will enable the end user to increase or maintain their activity level, work a longer day and lead an active and dynamic Life.

Prosthetic Socket with Flexi-comfort technology

Built-in relief for concentrated pressure points with totally flexible brim and back.
An aggressive, more intimate fit of the pelvic bone in cases of above knee prosthetic socket designs.
Improved side-to-side control with increased front-to-back stability.
Reduced socket rotation on the residual limb with better command and alignment of the thigh bone.
Anatomically correct channels & grooves increases muscle tone in residual limb
This type of prosthesis can be cosmetically finished with a natural or custom appearance.

Lower Extremity Prosthetics Prescriptions

The prescription and design of a prosthesis is based on the patient's level of amputation, functional level (K0 to K4) classification, and stage of healing (preparatory or definitive). Multiple descriptors are used to specify all the required elements of an appropriate prosthesis specific to each amputee. The most important part of any prosthesis is a comfortable socket.

Usually Associated Prescription Terms

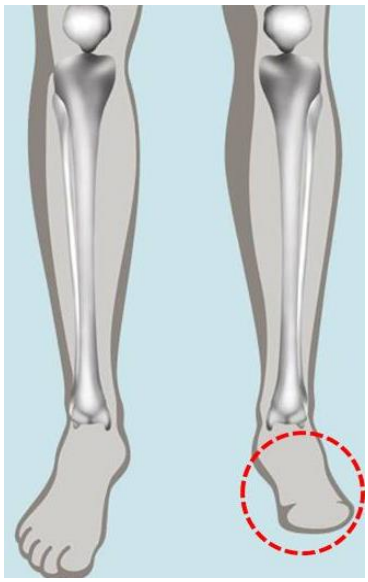
Test Socket(s)—Used to diagnosis socket fit before final fabrication
Total Contact—Technique for preparing the socket to prevent skin problems
Alignable System—Allows for alignment adjustments and the interchange of comments
Ultra-Light Material—Increases material strength without adding weight
Acrylic Socket—Allows socket to be adjusted after fitting
Flexible Inner Socket, External Frame—Permits muscle movement.
Suction Socket—Provides enhanced suspension
Gel Socket Inserts (locking or non-locking)—Provides comfort, skin protection, suspension
Locking Mechanism or Suspension Sleeve—Provides suspension.
Foot—Based on patient's potential functional level and expected activities
Knee—Based on patient's potential functional level and expected activities
Custom Shaped Cover—Cosmesis and protection of internal components
Flexible Outer Surface Cover (skin)—Provides moisture protection
Sheaths—Used by patient to make fine adjustments to socket fit
Socks—Used by patient to make adjustment to socket fit
Shrinkers—Edema control and limb shaping

Specialty Prescription Terms

Microprocessor control—Improves stability and function
Replacement Socket—Required for changes in the size or shape of residual limb.
Elevated Vacuum System—Optimal suspension socket fit and reduced perspiration
Axial Rotation Unit—Allows lower limb to rotate at the knee for sitting and dressing
Repairs—Regular follow-up necessary to ensure optimal function

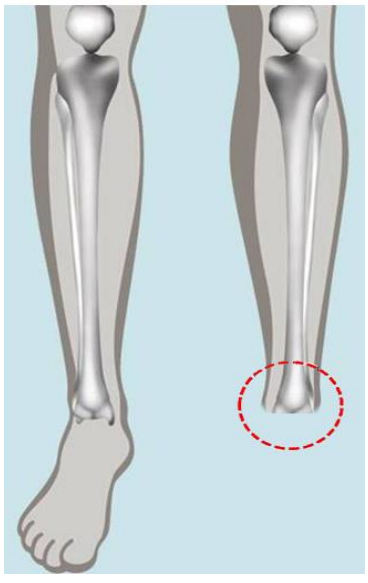
Amputation Level: Partial Foot

This type of amputation can have a dramatic effect on gait due to the loss of lever arm (toes and metatarsals). Depending on the length of the remaining foot, a variety of prosthetics may be used from a toe filler to a tibial height prosthesis. Patient may require the addition of a carbon or steel plate to the plantar surface of the orthotic to stiffen the shoe.



Amputation Level: Symes

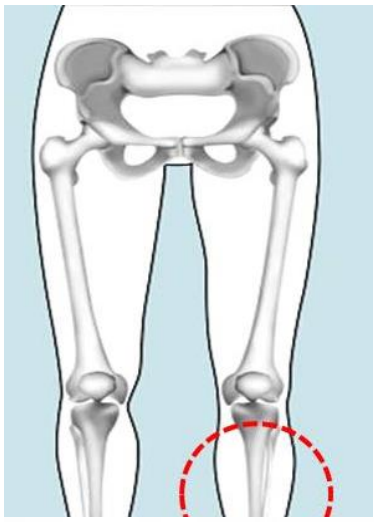
This amputation level, which is an ankle disarticulation, requires a prosthetics socket which usually extends to the knee due to increased forces on the residual limb. Utilizes an expandable wall or removable window to allow entry and suspension of the bulbous distal end. A low profile foot is used usually to match the height of the opposite side.

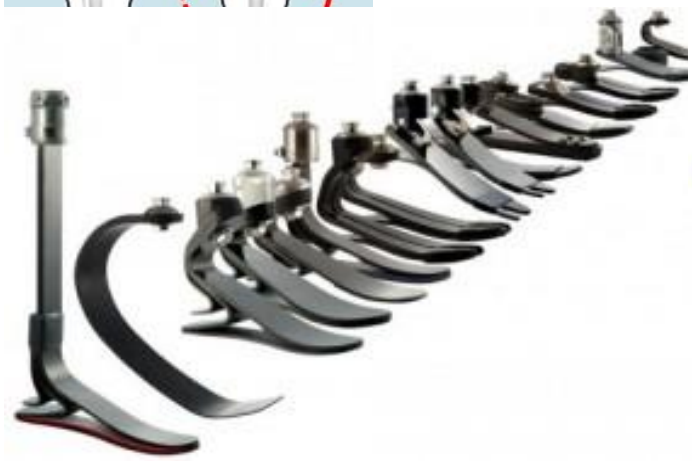


Amputation Level: Transtibial / Below the knee

The below knee unit uses several different style socket configurations with the attachment of a foot and/or ankle component:

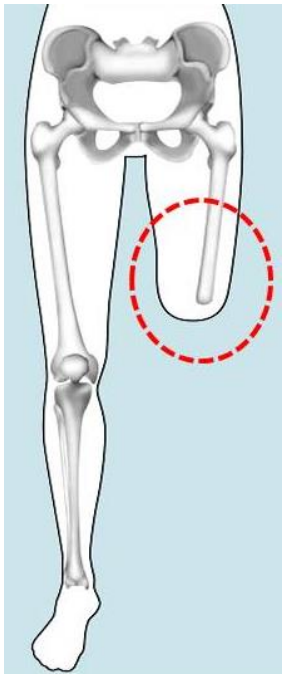
1. Options are numerous and must be determined by a complete evaluation.
2. Considerations on selection include diagnosis and past medical history, the shape and length of the residual limb, activity level, surgical issues, and goals of the patient.
3. Socket and suspension options are numerous and include, sleeve, suction with expulsion valve, suction with pin and locking mechanism or Vacuum Assisted Suction Suspension (VASS) or supracondylar for short limbs.
4. Foot componentry ranges from stable, for the less active patient to dynamic for active and athletic individuals.
5. Single axis, solid ankle cushion heel (SACH), flexible keel, multiaxial, energy-storing and vertical shock feet are just some of the many options.





Amputation Level: Transfemoral / Above Knee & Knee Disarticulation / Through Knee

1. The above knee prosthetic system consists of a socket, knee joint and foot/ankle complex. Options are numerous for componentry and must be determined by a complete evaluation.
2. Considerations for componentry selection relies on past medical history, length of residual limb, activity level, surgical issues and goals of the patient.
3. Socket configurations range from the innovative total contact sockets with flexi-brim technology system to ischial containment and quadrilateral shaped designs.
4. Knee options range from microprocessor-controlled such as the C-Leg to hydraulic swing and stance phase control, to safety knees with extension assist and manual locking for stability control.
5. Feet options are numerous as in Transtibial (BK) and include energy storing, multiaxial, flexible heel, solid ankle cushion heel (SACH) and single axis feet.



Amputation Level: Hip Disarticulation & Hemipelvectomy

Socket is designed around a total contact shell that uses the opposite side for suspension and stabilization. The hip joint provides the connection between the proximal assembly and the Knee joint. The knee joint options are limited to stability enhanced designs. This type of prosthesis can be cosmetically finished with a natural or custom appearance. Choices in feet are similar to the more distal levels.