



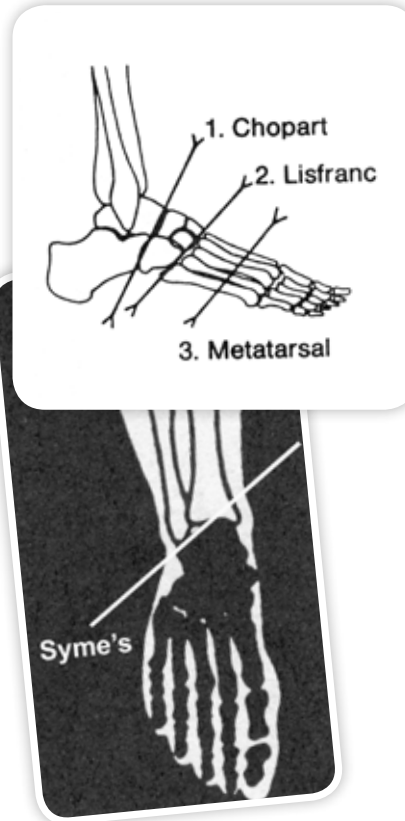
Partial Foot and Syme's Amputation

As with all levels of amputation, amputees who are missing a part of or their whole foot have specific prosthetic considerations unique to the exact level of their amputation.

Partial foot and foot amputations are often referred to by different names, such as transmetatarsal, Chopart, Lisfranc, Syme's, and ankle disarticulation. These names refer to where the actual amputation occurs on the foot with some named for the surgeons who first performed them (Chopart, Lisfranc and Syme's).

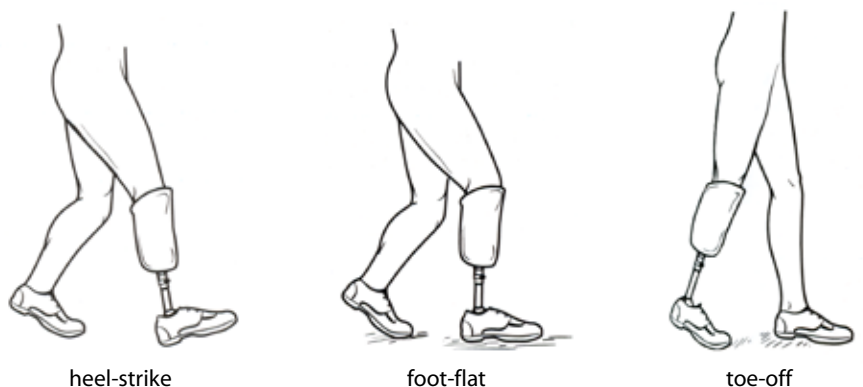
Normal human walking is a complex series of motions with three distinct parts: heel-strike, foot-flat and toe-off. First, at heel-strike the heel absorbs the shock of impact; next at foot-flat the weight of the body begins to roll over the axis of the ankle and onto the front of the foot; and finally at toe-off the front of the foot pushes the body onto the other foot's heel strike and gives forward thrust.

The loss of normal foot function after amputation is in direct relation to how much of the foot is amputated, with the greater the amputation, the more severe the loss of function. The extent of the loss relates to three primary aspects of foot function: load or weight bearing capacity, stability, and dynamic function (which is provided by the many joints in the foot and ankle).



When the front portion of the foot is missing, you lose the push off provided by that part of your foot as well as the balance that keeps your momentum going forward. Instead of weight bearing on that padded part of the foot the weight concentrates on the end of the cut part of the bones, the worst place it could be. In order to avoid putting pressure on this usually tender part of the foot, the amputee may avoid bearing weight there and shuffle the foot along instead. This creates a limping, shuffling gait pattern that will cause damage if left untreated. In addition, the end of the amputated foot is subject to pressures that can cause breakdown of the skin.

Although partial foot and foot amputees have an advantage over below knee amputees in that they can carefully get around on their residual limb without their prosthesis, going without a prosthesis for extended periods is not recommended. Normal human gait requires that push-off of the front of the foot and, when that is



missing, it will cause an imbalance in the amputee's walking, and over time it can cause damage to the rest of the skeletal system.

Considering all of the above, it is clear why it is important for partial foot and foot amputees to be fitted with an appropriate and properly-fitting prosthesis.

Partial foot devices

Devices used for partial foot amputations are frequently referred to as both prostheses and orthoses. Many designs incorporate principles used in foot orthoses or ankle-foot orthoses (AFOs) as well as in lower limb prostheses. Shoe modifications are also commonly provided for these levels of loss, so pedorthic principles come into play too.

Partial foot devices come in many different designs ranging from:

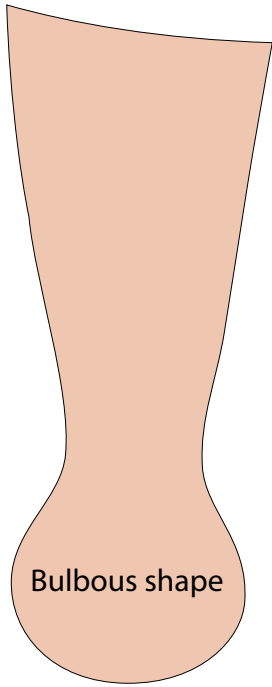
- a simple insert that is placed inside a shoe (1)
- a slip-on foot prosthesis (2)
- a more rigid device that encapsulates the ankle and/or extends up the lower leg (3)

The design of the prosthesis depends upon how much of the foot is remaining and the condition of the skin at the end of the foot. The longer the residual limb and the better the skin, the less need to stabilize the foot. If the residual limb is short and/or the skin is in poor shape, a more rigid supporting device is necessary.

Syme's prosthesis

Amputations of the entire foot require a prosthesis that provides good stability. Usually this means a full socket that the residual limb fits into. Syme's amputation, named for the surgeon who first performed it, refers to amputation of the entire foot at the ankle with the skin and tissue of the heel being preserved and used to create a heel pad at the bottom of the residual limb.





Because the bones of the lower leg are not cut and there is a cushion provided by the heel pad, amputees are able to bear their weight on the end of the residual limb. This is an advantage of this amputation. Sometimes because amputees can bear their weight on the end of the limb, the top rim of the artificial limb can be cut lower down below the knee, and this provides a freer range of knee movement – another advantage. However, it is not possible for all Syme's amputees to bear all their weight on the end of the residual limb, so some of the weight must be born

elsewhere in the prosthesis, such as at the patella at the knee. A final benefit of a Syme's amputation is that there is a long residual limb that provides a long lever arm that helps with swinging the prosthesis forward.

A Syme's amputation does present challenges as well. The bulbous shape that is common at the end of the residual limb has to be accommodated in a fitting. A "window" that is opened to allow the bulbous end of the residual limb to pass through the narrower calf of the socket is used. Sometimes, however, the bulbous end can be accommodated in the inner socket or liner and, thus, no window is needed in the outer socket. Another challenge is the small amount of space between the end of the residual limb and the ground. The space available limits the type of foot components that can be used in Syme's prostheses. However, on a positive note, in recent years more and more responsive artificial feet options have been designed for Syme's fittings.



One example of a prosthetic foot for a Syme's fitting

(Editor's note: please note that the Syme's prosthetic fitting we refer to here is not that of the type done with a Syme's amputation for Proximal Femoral Focal Deficiency where the resulting prosthesis is an above knee one.)

Article sources:

- Atlas of Amputations and Limb Deficiencies, Surgical, Prosthetic, and Rehabilitation Principles, Third Edition edited by Douglas G. Smith, MD, John W. Michael, MEd, CPO, John H. Bowker, MD
- Limb Prosthetics 6th Edition by A. Bennett Wilson, Jr.
- Living With a Below-Knee Amputation, a Unique Insight From a Prosthetist/Amputee by Richard Lee Riley, CP, BS