



Ballert

ORTHOPEDIC OF CHICAGO

Trans-tibial (Below-Knee) Prosthesis



This pamphlet provides trans-tibial amputees with information generally provided to them orally by their prosthetist. It contains information on what to expect at each of the appointments, how to put on and take off the prosthetic device, how to care for the residual limb (stump), how to practice good hygiene, and what to do in the event that warning signs appear. Under the proper care and with the support of prosthetic devices, amputees can achieve a high level of freedom and independence. At Ballert we are committed to providing you the highest quality appliances coupled with the best practitioner care available today. Ballert uses only licensed, certified prosthetists for the casting and fitting of the prosthesis, and for follow-up care. To receive certification, prosthetists are required to complete a postgraduate course in prosthetics and a yearlong residency program prior to being allowed to sit for certification exams and becoming certified.

Immediately Following Surgery

During the days following your amputation it is normal to feel a range of emotions because of the loss of your leg and to wonder how you will be able to get on with your life. You can be sure that all new amputees share these feelings of loss and sadness. However, these feelings of sadness or depression are usually followed by the need to resume your normal activity and developing the will to do so. During your recovery and rehabilitation it is important to set realistic goals for yourself. Immediately following your surgery these may include:

- Preventing muscle and joint tightness or contractures;
- Learning to control swelling or shrinking;
- Learning to walk using crutches or a walker; and
- Beginning a hip exercise program emphasizing hip abduction and extension.

Immediately Following Surgery

During the immediate post-surgical period, your residual limb will start to heal, and some very important things are done to prepare your limb to wear a prosthesis. Two of the most important physical goals during this time are to minimize/reduce swelling and to prevent muscle flexion contractures.

Reducing Swelling

Let's consider some of the methods for controlling the swelling associated with amputation. Your surgeon or treating medical team will decide which method to use.

Immediate Post-Surgical Fitting (IPSF) is a cast extending above the knee that is put on immediately after the amputation is completed. The cast cannot be removed and is usually worn for the first two weeks following amputation, sometimes with an aluminum pipe connecting the plaster cast to an artificial foot (*Fig. 1*). The cast prevents the limb from swelling excessively; prevents the development of a knee flexion contracture; and protects your limb from bumps or falls.

Removable Rigid Dressing (RRD) is a cast that is applied when the first IPSF is removed or when a rigid cast was not initially provided. The RRD can be removed to clean and inspect the limb daily. The RRD extends only to your knee and protects the residual limb from injury. Sometimes the RRD is used in conjunction with elastic socks to further encourage shrinkage of the limb.

Elastic Compression. Traditionally, the residual limb was wrapped with an "Ace Bandage" to control swelling and encourage shrinkage. This method still can be effective when done properly. It is recommended that the bandage be reapplied every 4-6 hours or when it is no longer snug. Another popular elastic compression system uses an elastic sock that is sized to fit your residual limb, called a shrinker sock. The most common problem with the elastic sock occurs when it hasn't been pulled up completely.

Preventing Muscle Contractures

A knee flexion contracture (muscle tightness) occurs when the muscles behind the knee are too tight to allow the knee to straighten fully. Such contractures are relatively easy to avoid by keeping your knee straight, but they are very hard to correct. The presence of a flexion contracture will limit your ability to walk properly. To help you to keep your knee straight (especially in a wheelchair), your physical therapist or prosthetist may place a board under the seat cushion of your chair to support your residual limb while keeping the knee straight. You can also help prevent contractures by lying on your stomach when in bed and keeping your knee straight.

Preparatory Prosthesis

Once your limb begins to heal, your physician may prescribe a preparatory prosthesis (*Fig. 2*). Its purpose is to help reduce the swelling by containing the limb within a well-fitted socket and through the pumping action created by walking. It also gets you up and walking as soon as possible and helps the amputation site to heal.

To allow the limb to heal fully and to reduce most of the swelling, a preparatory prosthesis is usually worn for 3-6 months. Very few below-knee amputees are able to teach themselves how to use their preparatory prosthesis. Therefore, early prosthetic training or gait (walking) training is usually provided by a physical therapist (PT). Since learning to walk again requires some weeks, amputees may continue to see their PT throughout the first few months. If a question or a problem arises, these may be addressed and changes made during regularly scheduled visits with your prosthetist.

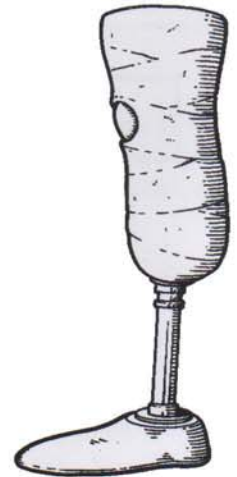


Fig. 1. IPSF—A plaster cast extending above the knee applied immediately after amputation. Shown with an aluminum pylon and foot.

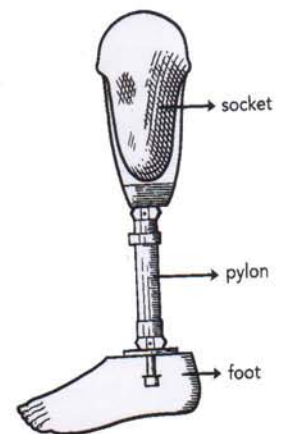


Fig. 2. Preparatory prosthesis.

Generally the preparatory prosthesis is made in such a way that it is easily adjustable. Therefore, this device usually doesn't look like a natural leg. This means the socket will simply be connected to the foot by an aluminum pipe (pylon) (Fig. 1). This construction allows the prosthetist to easily adjust the alignment (relationship of the socket to the foot) as your walking (gait) improves.

Definitive Prosthesis

After most of the shrinking has occurred in your residual limb, your physician will prescribe a definitive or long-term prosthesis. You will typically need a new definitive prosthesis every 3-5 years.

There are two primary types of design for a definitive prosthesis.

Exoskeletal designs include a hard shell often made of laminate or fiber reinforced plastic. This shell of "skin" is rigid and durable (Fig. 2). This type of prosthesis is not readily adjustable after it has been finished. Its primary advantage is durability and its ability to transfer the weight from the socket to the foot. The acrylic lamination often used for the prosthetic shell allows a high-impact surface with excellent load bearing capabilities. When an amputee requires great durability in a prosthesis, such as that needed for farming or other element-involving or heavy-duty occupations, an exoskeletal design may be a good choice.

Endoskeletal/Modular designs include an anatomically-shaped, soft foam cover designed to look and feel like skin (Fig. 3). This soft material covers the internal structure of the prosthesis and is removable to allow the prosthetist to make adjustments and changes to the prosthetic system when necessary. Connectors with an aluminum, titanium or carbon pylon connect the socket with the foot. The soft covering on an endoskeletal prosthesis is somewhat fragile and requires careful attention to prevent damage. The primary advantage of this design is that it is adjustable and lightweight. In addition, most of the technologically-advanced knees are compatible with endoskeletal designs.

There are four main parts to any below-knee prosthesis: prosthetic interface (socket), suspension system, knee and foot.

Prosthetic Interface (socket). The prosthetic interface is the part of the prosthesis into which your residual limb fits. It is the interface between the residual limb and the prosthesis. Each socket designed by your prosthetist represents a particular amputee's needs and the prosthetist's efforts to treat those needs. Sockets may be hard or soft and can be made from one of many different materials. In addition, the socket may include a liner of foam, leather, silicone or other materials.

To design an appropriate socket, the prosthetist usually first makes a cast of your residual limb. From this cast, the prosthetist will create a model of your limb and shape it for proper weight distribution. A rigid plastic socket will be fabricated over the model of your leg. As you walk on the prosthesis, the prosthetist will adjust the alignment in order to provide you with the most comfortable and natural gait. Once this is accomplished, the prosthesis will be finished either with a rigid external finish (exoskeletal) or with a soft foam cover (endoskeletal) shaped to match your sound side leg as much as possible.

The socket interface may be made of foam, silicone, urethane or even mineral oil to help cushion your limb from the forces experienced during walking. Other sockets use what is called a hard socket. This socket

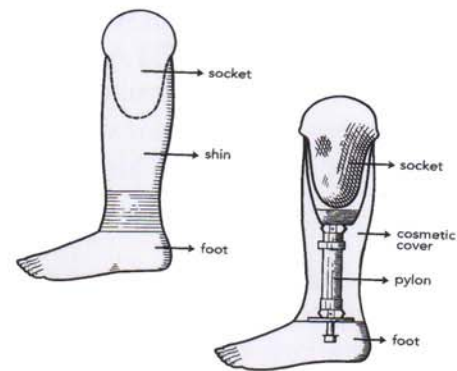


Fig. 3. Exoskeletal Below-knee Prosthesis

Fig. 4. Endoskeletal Below-knee Prosthesis

does not have a liner; it is worn with only prosthetic socks between your leg and the plastic of the socket.

Suspension System. The term “suspension” refers to how your prosthesis is held onto your residual limb. This can be done several ways, and sometimes a prosthesis will use more than one suspension method. A prosthesis can be suspended by straps, sleeves, wedges or suction (*Fig. 5*). All of these methods can work effectively, and each has advantages and disadvantages that your prosthetist will consider when choosing the right type of suspension for you.

Foot. The prosthetic foot provides the necessary support to keep the knee stable while you stand on the prosthesis. There are a variety of types of prosthetic feet.

For many years the standard foot was the Sach foot, pronounced “SATCH” which stands for Solid Ankle Cushion Heel. As the name implies, the Sach foot is solid, produces only simulated motion, and is lightweight, durable, relatively inexpensive, and provides nice smooth foot action when walking. Another option is the single-axis foot. This articulated foot allows ankle motion which assists in making the knee stable.

Recently a great deal of research has produced feet with flexible heels, which allow amputees to “spring” on and off the foot as they walk. These feet bend when walking and because of their design, the materials store and release energy like a spring. These feet are sometimes referred to as “energy storing” or dynamic response feet. Some of these energy-storing feet have been shown to actually save energy for the amputee as he/she walks.

Your prosthetist will detail the many foot operations and will further explain any special considerations in dealing with your individual situation. Shock absorbers and torque absorbers, for example, both act to reduce forces on your limb.

Syme’s Amputations

The Syme’s amputation is an amputation at the ankle joint. This means the foot is removed, but the heel pad is preserved and is positioned on the end of the remaining limb. This amputation is functionally very good, but presents problems with regard to appearance. For the Syme’s amputee, the end of the limb can support the majority of the body weight.

The Syme’s prosthesis differs from the conventional below-knee prosthesis in that the socket, by necessity, is attached directly to the prosthetic foot. Also, due to the bulbous shape of the end of the limb, the prosthesis is usually self-suspending. Other issues are mainly concerned with the ease of putting the prosthesis on (donning) or taking it off (doffing). The socket may have a window cut over the narrow part of the ankle or this area may be built up during the fabrication process to allow the bulbous end to fit into the socket.

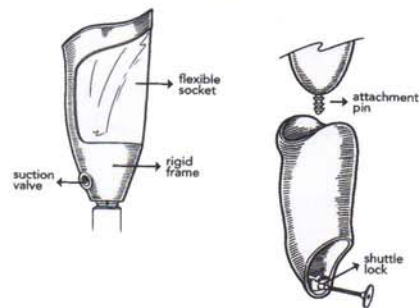


Fig. 5. The suction socket with flexible walls (left) compared to the Silicone sock worn over the residual limb (right). The silicone sock has

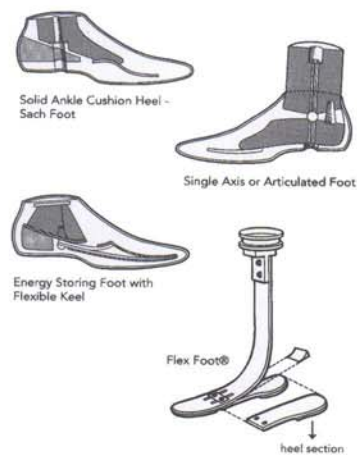


Fig. 7. Types of Feet.

WHAT TO EXPECT ON YOUR VISITS TO BALLERT

At your **first appointment** following surgery, you will complete a patient information sheet, a certified prosthetist will examine you and evaluate your condition, and, depending on the outcome, you will be casted for your prosthesis. Your prosthetist may assess the strength and range of motion of both hips as well as evaluate your sound side limb (non-amputated limb). You will be given this patient instruction brochure and a second visit will be scheduled for approximately one week later. The entire visit should last less than one hour.

Your physician and prosthetist will decide which type of prosthesis will be best for you. The prosthetist will then design, fabricate and fit a prosthesis custom made to meet your particular needs. He/she will work closely with the other members of your treatment team, your physician and physical therapist (PT), to ensure that you receive the maximum benefits from your prosthetic care. You will continue to see your prosthetist over your lifetime for adjustments, repairs and replacement of your prosthesis.

At the **second appointment**, your certified prosthetist will check the fit and alignment of the socket. Often with the help of a temporary pylon and foot, the prosthetist will evaluate the socket's ability to bear weight and the patient's ability to stand and to walk in the device. The prosthetist will answer any questions that the patient may have. Patients are usually asked to bring a pair of shoes to this visit, which can last from 30 minutes to one hour. At the end of this visit, a third appointment will be scheduled for approximately one week later.

At the **third appointment**, your certified prosthetist will fit the definitive socket for alignment of height and gait. Depending upon the outcome of this fit, the patient may be given the device to wear for up to two weeks even though it lacks a cosmetic cover. (It is mechanically finished and safe.) At this appointment, the prosthetist will instruct the patient in how to don and doff the prosthesis, together with instructions on how to clean and take care of the device. Additionally, a schedule for wearing the device will be tailored to the abilities of each individual patient. This appointment can last from 30 minutes to one hour.

Appointments are made at weekly or biweekly intervals until all the adjustments have been made and the device fits the patient comfortably.

Follow-up appointments. Regular follow-up appointments may be scheduled to check the fit and alignment of the device. At a minimum, you should visit your prosthetist for an evaluation every six months to one year.

If for some reason you cannot make your appointment or are running late, please call us at (773) 878 -2445.

Donning the Suction Socket

A number of methods of donning the suction socket have been devised over the years. Each amputee needs to experiment to determine the method that seems easiest for him or her.

The three most popular methods are:

1. Use of a nylon stocking or a single layer of tubular stockinette over the residual limb and removing it through the valve hole as the residual limb is "pumped" into the socket.
2. Use of tubular stockinette that has been doubled over the residual limb and removing the stockinette by pulling the end of the outer layer through the valve hole as the residual limb is "pumped" into the socket.
3. Use of an elastic bandage that has been wrapped tightly around the upper half of the residual limb and then pulled through the valve hole as the residual limb is "pumped" into the socket.

Maintenance of the Prosthesis

When a non-articulating foot is used, there is very little maintenance required for the above-knee prosthesis other than keeping it clean inside and out. Articulated feet generally need to be lubricated at regular intervals.

The heel height of the shoe is an important factor in the alignment of the prosthesis. Therefore, when shoes are changed, it is important that the effective heel height be the same as the ones used previously. The effective heel height is obtained by subtracting the thickness of the sole of the shoe from the apparent heel height. For the same reason, heels of the shoes should be replaced frequently so that wear will not result in alignment changes. Also, a badly worn shoe will increase the wear on a prosthetic foot.

Your prosthesis should not be worn without shoes. Not only will it cause excessive stress on the stump and knee joint, but the wear on the foot will result in permanent misalignment. Most prostheses are water-resistant but few are waterproof. If the foot becomes wet, the shoe should be removed as soon as possible to facilitate drying.

If the amputee has any doubt about the fit, alignment, or condition of the prosthesis or residual limb, he or she should consult his prosthetist immediately. Maintenance requirements for knee units vary. Prosthetists will give instructions for maintenance except for hydraulic units which must be taken care of by the prosthetist or manufacturer. An exchange unit can be provided when a hydraulic unit has to be removed for repair.

Cleaning and Inspecting the Residual Limb

Daily Cleaning

1. Remove the liner by unrolling it off your residual limb so that the gel side is facing out.
2. Clean the gel side of the liner thoroughly with hot tap water and a soap that does not irritate the skin. For best results use a soap that is free of colors and perfumes (e.g., Palmolive Clear). Apply the soap by hand or with a clean, soft cloth.
3. Rinse thoroughly to ensure that all the soap residue is off the liner.
4. Dry the gel side of the liner with a lint-free cloth or paper towel.
5. Continue by washing your residual limb.
6. Cleansing may be required more than once a day during the hot summer months, or if heavy perspiration occurs.

Weekly Disinfection

1. Place a small amount of isopropyl alcohol (no more than 2 Tbs.) on a clean, soft cloth.
2. Lightly wipe the gel side of the liner (the surface that is against your skin) for 2 minutes.
3. Rinse off excess alcohol, and ensure that the liner is dry before reapplying. Alcohol that may remain on the liner surface can cause minor skin burns if trapped against the skin inside the liner.
4. Do not use excessive amounts of alcohol. Extended contact will stiffen the liner.

Daily Inspection

You should inspect your liners on a daily basis. Unusual wear of the fabric or gel may indicate changes in the prosthetic fit. Rotate your liners daily; wear one while the other is being cleaned and dried. Contact your prosthetist at the first signs of wear or a tear. When the liners are not in use they should be placed on the drying stands and stored in a cool, dry place. Proper cleaning and rotation of liners will allow fresh mineral oil to flow to the surface and extend the life of your liners.

ABOUT BALLERT

Ballert is an ABC certified facility. ABC certification means that Ballert meets all of the professional and quality standards set by the American Board for Certification in Orthotics and Prosthetics, Inc. These standards provide you with the finest orthotic and prosthetic devices. Whether your doctor prescribes an off-the-shelf or custom designed and manufactured device, you are assured that Ballert will stand behind its products and will work with you and your doctor to assure the proper balance between function and comfort.