Transtibial (Below Knee) Amputation

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Center of Excellence

Advanced Prosthetics is a “Center of Excellence” for limb loss rehabilitation. Our team of prosthetists provide customized, high function prosthetic devices while our staff therapists provide the most advanced limb loss physical therapy treatments available. This team works side by side to provide amputees with the quickest and best recovery possible. While most therapy companies only treat 1-2 amputees a year Advanced Prosthetics Center treats over 75 a year, and it is our primary specialty. Put your trust in a group of people who have dedicated their careers to better serving the unique needs of amputees.

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Common Terms & Definitions

Begin your rehabilitation process by learning some important terms and definitions. This information will help you better understand the information contained in this manual and it will improve your communication with your prosthetist and therapist.

APOPP: Adjustable post-operative protective prosthesis

Amputation: Removal of all or part of a limb, due to infection, disease, tumor, injury or trauma.

BK: A reference to a below the knee amputation or otherwise medically termed: Transtibial amputation.

Check Socket: Also called a test socket or diagnostic socket. These are used to “pre-fit” a prosthesis before it is made out of a stronger material that is difficult to adjust.

Contracture: This means tightening of the muscle(s). Contractures most commonly occur in the hamstrings or the muscles in the back of the thigh. If not managed properly, these muscles can quickly tighten up or become contracted, preventing full extension (straightening) of the knee. When these muscles are too tight they can greatly hinder a person’s ability to walk with their prosthesis. It is important to periodically move your knee from full flexion (knee bent) to full extension (knee straight). This will help to maintain good joint motion.

Cosmetic Covering: A cosmetic cover is a foam material that is applied to your definitive prosthesis (second or third prosthesis). This cover is shaped to look like your other leg. The size of a cosmetic cover is determined by the size of the socket, and the size of the socket is determined by the size of your residual limb, which will likely decrease in size.

CPO: Certified Prosthetist and/or Orthotist (also known as CP, or CO). This means a professional is certified through the American Board of Certification. These credentials are sometimes not enough to establish competency. Professionals that have attended an NCOPE accredited school and residency and who have also sat for the ABC exam, possess a higher level of competency.

Definitive Prosthesis: Usually this is the second prosthesis you will receive. This prosthesis employs more advanced and lighter-weight prosthetic components (feet, knees). The first definitive prosthesis usually lasts approximately one year. A cosmetic foam cover can be applied to this prosthesis.

Distal End: The very end or bottom of your residual limb (stump).

Doffing: The act of taking the prosthesis off.

Donning: The act of putting the prosthesis on.

Gait/Ambulation: Walking.
**Liner:** The padded inner most part of the socket. This can be made of various padding materials such as Pelite or gel. Many of the newer liners that you may hear about are made of various types of gels such as: silicone, urethane, or thermoplastic elastomer. Please let your Prosthetist know if you have a known allergy to any of these materials.

**Phantom Symptoms:** Phantom sensation is when you feel your amputated foot is still attached to your leg. Phantom pain is when your amputated foot or leg hurts. While for most people these symptoms subside within the first few months following the amputation, some people continue to experience these sensations for much longer. You may ask your physician about medications to treat phantom symptoms if yours are severe.

**Preparatory Prosthesis:** This is the first prosthesis you will receive. This prosthesis usually lasts only 3-6 months, or until it no longer fits properly. Less expensive, low-tech prosthetic components (feet & knees) are usually used with this prosthesis. This prosthesis is usually not equipped with a cosmetic cover and the pylon (pole) will remain visible. Applying a cosmetic cover does not permit us to make frequent alignment changes to the prosthesis as your walking improves.

**Prosthesis:** The artificial replacement of any portion of the body, (i.e. hip, knee or extremity).

**Prosthetic Components:**

- **Pyramid**
- **Locking Mechanism**
- **Locking Pin**

**Prosthetic Feet:**

- Otto Bock: Trias
- Endolite: Elite
- Ossur: Propio Foot
- Reedom: Renegade

**Prosthetic Socket or “Socket”**: The upper most part of a prosthesis that makes contact with the residual limb and transfers the forces of walking to the ground.

**Prosthetist:** (Pros-the-tist) A person who specializes in designing, fabricating and fitting artificial limbs with the following credentials: CP or CPO.
**Pylon**: A pole connecting the prosthetic socket to the foot. Alignment changes can be made at both ends of the pylon (pole) to “fine-tune” your gait.

**Residual Limb (Stump)**: The remaining part of an amputated extremity.

**Shrinker**: These are tight, stretchable garments that reduce swelling in a residual limb following surgery. Shrinkers are usually provided within the first 1-2 weeks after the amputation. People with vascular problems may have to continue wearing a shrinker long after they are fit with their preparatory prosthesis because it helps to maintain a stable residual limb volume and ensures that the prosthesis will fit properly each day. Shrinkers are not provided to every new amputee; there are other post-operative treatments available depending on physician preference.

*Shrinkers only eliminate post-operative swelling.* The only way to shrink the limb once the post-operative swelling is gone, is to wear a well-fitting prosthesis. Shrinkers may be worn at night after being fit with a prosthesis to control overnight limb volume fluctuations.
After the Amputation

Almost every new amputee feels depressed immediately following an amputation surgery. This is natural. For those who have suffered intense pain for a long period of time prior to the amputation, the loss of the limb might actually be viewed as a positive step. Regardless of the nature of your limb loss, feelings of depression will soon be replaced by the will to once again resume an active lifestyle.

Depression is not the same for everybody. Some people describe depression as a feeling of emptiness and despair. Others experience an overwhelming sense of helplessness, hopelessness or anger. Some people don’t act out emotionally, but may feel apathetic or even restless.

If you are like many patients, you will struggle with the loss of your limb and may even need counseling to help you work through the 5 stages of grief. Below are the 5 stages of grief. Reading through these stages may help you understand where you are at in the acceptance of your loss.

- Denial and Isolation
- Anger
- Bargaining
- Depression
- Acceptance

If you are having trouble working through the acceptance of losing a limb and you would like help from a counselor or psychologist, please ask your therapist or prostheterist for a referral to someone who can help. How well you do during the limb loss rehabilitation process can depend a lot on your ability to accept your loss.

Post Operative Treatment

After the amputation there will most likely be some type of post operative dressing or cast applied to your residual limb. Options vary dependent upon your surgeon’s preference. A rigid cast, or soft dressing may be applied to the limb immediately following the amputation. In some cases your Prosthetist may be called in to apply this dressing. It is important that some type of dressing is applied to the limb not only to protect the incision, but also to add some compression to the limb to help facilitate blood flow and decrease healing time.
Shrinker Donning Aid
Simplify the shrinker donning process with our Shrinker Donning Aid. Within the first few weeks following amputation, this is mostly a tool for use by a nurse or caregiver. After a few weeks, patients themselves can oftentimes use this device on their own to help put on a shrinker. Eventually, once the incision site is less sensitive and the swelling has improved, you will simply be able to pull it on like a traditional sock.

A Recommended Approach
Everyone reacts to an amputation differently; some people are anxious to get their prosthesis and get back to their normal routine, while others are more comfortable with a little slower approach. Neither path is necessarily wrong but extremes in either direction can slow your progress. If you are too eager to get your prosthesis and get “back to your normal routine,” you have a higher risk of either physically hurting yourself (which can slow your rehabilitation) or not learning the fundamentals of walking (which can reduce your long-term abilities with a prosthesis). Realize your rehabilitation may take longer than you expect, but don’t take things slowly. If you get used to being in the chair, you may experience a more difficult transition to prosthetic-utilized ADLs.

How Will I Do with a Prosthesis?
How you do with a prosthesis depends on your age, weight, medical complications, residual limb (stump) length, and your motivation. The more of these above conditions you have in your favor the better you can expect to do. Keep in mind that motivation or your desire just to walk sometimes is not enough. Most people with a new limb loss will have the desire to walk again, but there will always be a few who are not capable of achieving this goal. If you are concerned about how well you will do with a prosthesis we encourage you to discuss this with your prosthetist. While we are unable to predict the future, our expertise in fitting hundreds of amputees can give you a good understanding of what you might be able to achieve.

Most people should be able to do virtually everything they did prior to the amputation once they are finished with the rehabilitation process. You will likely have to learn a different way of doing many activities, and it may take a little longer to complete a task, but most people should be able to do much of what they did prior to their amputation.
Pre-Prosthetic Considerations

1-2 Weeks After Amputation
Within the first couple of weeks following amputation you should begin to do what are called desensitization exercises. These exercises help your residual limb relearn how to tolerate different sensations while also helping control your pain. Listed below are some items that you can use to desensitize you residual limb. All of these items should be placed on your skin as tolerated. Slowly increase frequency (number of times performed) and duration (length of time performed) as tolerated of the sensations applied to your limb.

### Daily - Desensitization Exercises

- **Ice Cubes** – Rub an ice cube over the end of your limb
- **Towel** – Place your limb in the towel as you would lie in a hammock
- **Deep Pressure** – With your finger tips, apply deep pressure to your limb
- **Massage** – Start at bottom of limb working your way up your leg
- **Brush** – Move a clean, soft toothbrush across the surface of your skin

2-4 Weeks After Amputation
During the healing process it is common for fluid to collect in the end of the residual limb. This oftentimes makes the skin and tissue feel hard and difficult to move. The incision can also heal to the end of the cut bone, causing pain especially during prosthetic use. It is important that the tissue and skin on the end of a residual limb remain soft and movable. Example: take your index finger and press on the skin of your forearm and move your finger back and forth. Make sure that you press hard enough to move the skin and not allow the finger to slide on the top of the skin. Notice how your skin and tissue move, it has what is called elasticity. The pressures inside of a prosthesis are similar to those that you generated on your forearm. If the tissue on your limb fails to move properly, it can cause pain during prosthetic use. To prevent this type of pain, patients can massage the tissue on the end of their limb. It is best to wait until the sutures/staples have been removed and the incision is almost completely healed. We recommend that patients use Cocoa Butter or Eucerin and your clean, bare fingers to apply moderate pressure in a circular motion to fully healed areas of you limb. When massaging close to the incision apply lighter pressure near areas that may not be fully healed. Do not apply pressure directly over open areas.
**Patient Goals**

It is important that patients develop and maintain good muscle strength and joint flexibility to support a safe, efficient and natural prosthetic gait.

1. Patients with transtibial amputations should work towards achieving full knee extension and 0-10 degrees of hip extension. The exercises provided in this manual will help you achieve these goals.

2. Patients should be able to lie on their stomach several times a day for at least 30 minutes each time. Since most patients spend much of their time sitting in chairs/recliners they can develop postural problems that can prevent them from walking correctly. Laying on your stomach will help correct postural problems caused by prolonged sitting.

3. Prior to walking, most patients should complete a minimum of 6 weeks of strength/ROM training with a well-trained therapist.

4. The patient should be independent with their exercises and understand the importance of being diligent with this program. Besides working with a good therapist, doing the proper exercises is one of the most important components of the rehab process. It is especially important to continue these exercises even after you begin walking to maintain the strength and flexibility gains made.

5. Once the tissue on the end of the limb is mobile, as reviewed earlier in this section, the patient should be able to tolerate pressure and tissue movement on the end of the limb, especially around the incision, without pain.

6. Patients need be able to roll independently in bed and transfer from their bed or a chair to their wheelchair without the assistance of another person (can use a cane or a walker). Patients that need assistance with this basic activity are typically not ready for a prosthesis.
NO SINGLE LEG HOPPING WITH A WALKER!!!

1. Puts excessive stress/strain on sound limb.
2. Puts the patients Center of Balance (COB) over sound limb (see below).

Center of Balance (COB)

Maintaining proper COB over BOTH extremities is essential for developing proper prosthetic gait (see pictures at right). By maintaining COB awareness the patient maintains their minds inherent ability to “perceive” where their amputated limb is in space or what is called proprioception. Walking (hopping) and standing with a walker automatically requires the patient to shift their COB over their sound foot. This begins to teach the patient that this is the only limb they can rely on for safe ambulation. Once the patient has received their prosthesis they will naturally continue this habit, because it’s what they’ve performed for weeks (or even months). Alternatively, if the patient never experiences repeated COB positioning over their sound limb, they retain awareness of their amputated leg. This awareness is automatically recruited when they begin to use a prosthesis.

1. The more time you spend standing and hopping on one leg the more difficult it is for you to get your COB over both extremities when you receive a prosthesis.
2. Failing to maintain a natural COB awareness will prevent you from achieving your full potential. Please avoid walking as much as possible until you receive your prosthesis; no walking is better for you than single leg hopping.
The Fitting & Rehabilitation Process

There are several factors that determine when you are ready to be fit with your first prosthesis. Your limb will need to be almost completely healed with no drainage before you can be cast for a prosthesis. Even when your limb is completely healed you still may not be quite ready for your first fitting. It is very important that you have sufficient strength and joint range of motion in both your legs in order to walk correctly with a prosthesis. Your physician, therapist and prosthetist may all be involved in determining when you are ready for your first fitting. The following pages talk about what you can expect over the first 2 years after your amputation.

Residual Limb Shrinkage
Amputation is very traumatizing to the body. The natural defense of your body is to send blood to your residual limb (stump) to heal the area. While this natural response starts the healing process, too much blood can actually slow healing and hinder your rehabilitation. Shrinking your residual limb is important because it reduces phantom sensation, phantom pain, jump starts the healing process and prepares your residual limb for a prosthesis. Your physician may have prescribed one of several early post-operative dressing treatments that will help your residual limb heal and prepare you for a prosthesis. All of the treatments share a common goal: to shrink and heal your residual limb. Once your physician has removed all stitches/staples and your limb is free of any large scabs you may be ready for prosthetic fitting. The pictures showing typical limb shrinkage over a 12 month period.

Prosthetic use causes residual limb shrinkage.

Casting 6 months 12 months

The Prosthetic Fitting Process
Once you are ready for a prosthesis, you will enter into an exciting phase of your rehabilitation. This is where you will be fit with what is called a preparatory prosthesis (also called a temporary prosthesis). This first prosthesis is called a preparatory or temporary prosthesis because it usually lasts only 3-6 months. The pressure from your body’s weight, applied to your residual limb by the prosthetic socket, causes your residual limb to shrink. Significant shrinkage,
The Fitting & Rehabilitation Process

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within the first 3-6 months, will require either a prosthetic socket replacement or a whole new prosthesis.

Since your first prosthesis only lasts for a short period of time, less expensive, low-tech components (feet and knees, etc.) are usually used. At this point, most new amputees are unable to fully use the more advanced components that may be used on your definitive or next prosthesis. These less expensive components also help us keep the cost of the prosthesis low for you and your insurance company.

Once you have been wearing your preparatory prosthesis for 3-6 months, and you are wearing between 8-15 ply of sock, you may be ready for your second prosthesis. Your second prosthesis is called a definitive prosthesis. While the definitive prosthesis may use a prosthetic socket design that is similar to your preparatory prosthesis, it will usually be equipped with more advanced components (feet, shock absorbers, etc). These more high-tech components are sometimes made out of lighter-weight materials and usually have more advanced features.

Your definitive prosthesis will likely last about a year because your residual limb will continue to shrink. Usually, residual limbs continue to shrink for three years after an amputation, with most of the shrinkage occurring within the first 18 months. When your first definitive prosthesis (or socket) is in need of replacement, we usually try to reuse your existing components. Once you reach this point, you should require a new prosthesis every 2-4 years.

While the above explanation is a good guide for you to follow, every individual is different and may require more or less prosthetic services based on their individual needs.

How Long Will It Take to Get a Prosthesis?
The process of providing a prosthesis is quite involved, it requires an evaluation, casting appointment, fabrication time, a test socket fitting (when necessary) and final fitting. If you are a new amputee and receiving your first prosthesis, we try to deliver a finished product within 1-2 weeks. However, there are instances where more time is required because of unexpected fitting difficulties, annual holidays, illnesses, etc.

For socket replacements and definitive prostheses, we prefer to take a little more time. We like our clients to wear a test socket for at least one week and sometimes up to several months before we completely finish the prosthesis. If you are dissatisfied with any part of this “test prosthesis” it is much easier for us to make modifications. We believe this extra step helps us to ensure that you are receiving the best fitting prosthesis possible.
Putting on a Below-Knee Prosthesis with a Pin-Locking Gel Liner

**Step 1:** Roll the gel liner on the residual limb, eliminating any air from being trapped between the skin and the liner.

If air gets trapped within the liner, it can cause irritation and possible problems with skin breakdown. This is a very important step in wearing this type of prosthesis.

**Step 2:** The pin on the distal end of the liner should run directly off the long axis of the limb. This will allow proper engagement into the locking mechanism in the socket.

At this point, you must be sure that the pin is not directed at an angle off the end of the limb. If the pin does not seem to be in the correct position, remove the liner and try rolling it on the limb again to ensure proper placement.

**Step 3:** Once the liner is on the residual limb, and the pin is positioned properly, the patient will push the limb into the socket, while still seated. In some cases the pin will engage while sitting, however in most cases the patient will need to stand in order to engage the pin by putting weight into the prosthesis.

The patient should feel the pin engage, or in some locking mechanisms there will be an audible sound that will ensure the pin has began to engage into the lock. Once the pin has clicked at least twice the patient is safe to step forward or put more weight through the prosthesis to further engage the pin in the lock.

**Step 4:** Once the limb is all the way into the socket, the patient is ready to begin walking. To remove the prosthesis, push the button on the end of the prosthesis. The pin will release allowing the patient to pull their limb out of the prosthesis.
Putting on a Below-Knee Prosthesis with a Cushion Gel Liner with Suction Suspension Sleeve

**Step 1:** Roll the gel liner on the residual limb, eliminating any air from being trapped between the skin and the liner.

*If air gets trapped within the liner, it can cause irritation and possible problems with skin breakdown. This is a very important step in wearing this type of prosthesis.*

**Step 2:** Once the liner is on the residual limb, you can push your limb into the socket, while still seated. Depending on how your prosthesis fits, you may need to stand up and gently push your limb into the prosthesis to achieve the correct fit.

**Step 3:** Once the limb is all the way into the socket you can “palm” (NOT PULL) or “roll up” the outer suspension sleeve up your thigh. Make sure you have at least 3-4 inches of contact between the sleeve and the skin on your thigh as the inner liner and socks will prevent a proper seal.
Gait Training

The importance of good gait training can not be overstated. Some new amputees believe that learning to walk with their prosthesis will be easy and there will be no need to see a physical therapist for strengthening and gait training. While no one should challenge a person’s positive attitude towards their abilities, some new amputees should understand that it may not be as easy as they assume. In reality, most new amputees require months of practice with their prosthesis. Oftentimes, repetitive gait training and precise refinements are necessary before a person’s gait is smooth, stable, and most importantly safe. Also, it typically takes 3-9 months for a patient to regain the strength and flexibility in their leg. You, your therapist, and your prosthetist will work as a team to make your rehabilitation as quick and successful as possible.

Techniques to Walking
There are a few very important and simple techniques you should know before you can safely and naturally walk with a prosthesis. It is very important that you take the time to learn these basic fundamentals so that you develop good gait habits.

- **Beginning a Step** - Each time you stand to walk you want to always begin by taking a step with your sound/intact leg first and your second step will be with your prosthesis.
- **Descending Stairs** - Lead with your prosthesis. In other words place your prosthesis on the step below first, followed by your sound leg.
- **Ascending Stairs** - Lead with your sound (good) leg. A phrase that may help you is “up with the good and down with the bad.” This does not mean your prosthetic limb is “bad,” just that most amputees consider their sound side leg their “good” leg.

Proper Weight Transfer
Another technique that is very important for you to learn is the proper transfer of your body-weight on to the prosthesis. When you put your full body weight on the prosthesis you’ll need to confidently shift your body towards your prosthesis; this is called weight transfer. We emphasize confidence because for some new amputees it is difficult for them to shift their full weight onto a prosthesis; they don’t feel secure with their prosthesis just yet. Proper transfer of your body weight is important for good walking. The comfort of the prosthesis should never prevent you from putting full weight onto the prosthesis. If you have pain or discomfort that prevents you from fully using your prosthesis you should contact your prosthetist immediately.

Troubleshooting
Advancements in technology have brought a lot of exciting materials to the prosthetic industry. Materials such as acrylic resins, carbon fiber, titanium, silicone and urethane have made prostheses stronger, lighter and more comfortable. Even though callous formation is no longer a common occurrence, fitting problems still occur. While some of your socket fitting problems will require a visit by your Prosthetist, you should first try to fix problems yourself. Table 1: Troubleshooting Tips lists common socket-fitting problems along with some possible solutions. If these suggestions don’t help your problem, call your Prosthetist.
Table 1: Troubleshooting Tips

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution(s)</th>
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<tbody>
<tr>
<td>Pressure on the bottom, front-end of your bone?</td>
<td>• Try adding a one or two ply sock.</td>
</tr>
<tr>
<td>(Anterior distal end of your limb)</td>
<td>• Did you recently change shoes? Try one with a lower heel.</td>
</tr>
<tr>
<td>Pressure on the bottom of your knee cap?</td>
<td>• Try adding a one or two ply sock.</td>
</tr>
<tr>
<td></td>
<td>• Did you recently change shoes? Try one with a higher heel.</td>
</tr>
<tr>
<td>Feel like you’re walking down a hill?</td>
<td>• Did you recently change shoes? Try one with a lower heel.</td>
</tr>
<tr>
<td>Pain on the bottom-back of your calf?</td>
<td>• Try adding a one or two ply of sock.</td>
</tr>
<tr>
<td>Feel like you’re walking up a hill?</td>
<td>• Did you recently change shoes? Try one with a higher heel.</td>
</tr>
<tr>
<td>Pressure on the sides of the knee?</td>
<td>• Try removing one or two ply of sock. You may need to have a pad added to</td>
</tr>
<tr>
<td></td>
<td>the inside of the socket.</td>
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</tbody>
</table>

Remember, the most common remedy to most socket-fitting problems is adding or removing socks. Prosthetic socks play an important role in keeping your residual limb comfortably seated within the prosthesis. If your prosthesis is uncomfortable, four out of five times it is because you are not wearing the proper amount of prosthetic socks. Vary your sock ply until the prosthesis feels better. If this does not fix the problem, contact your Prosthetist.

Cautions

- It is very important that you avoid quick fix remedies to your socket-fitting problems. Trimming your liner or putting tissue in the bottom of your socket is not recommended. These home remedies may cause harm to your residual limb.
- Do not cut, grind or structurally modify your prosthesis in any way. Direct modification to the socket will void warranties unless they are done by a qualified Prosthetist.
- Never attempt to make alignment changes to your prosthesis by adjusting the allen screws on the ends of the pylon. If done improperly, it can result in not only an unstable walking alignment but possible component failure as well.
- If you experience any socket fitting problems that cannot be fixed by the suggestions listed above please contact your prosthetist immediately. Sometimes, simply discussing a problem with your prosthetist can result in a quick resolution.

Find more specific fitting information at www.betterlimbs.com
Sock Management

The socket portion of your prosthesis is made from a mold and/or measurements of your residual limb. However, as your residual limb shrinks, the shape of the socket remains the same. To accommodate for these changes, and to keep the socket tight and comfortable, you will be required to wear prosthetic socks. When prosthetic socks are no longer able to compensate for your residual limb shrinkage, and discomfort persists, a new socket or prosthesis is required.

Besides wearing socks, the only other way to maximize the life of a prosthetic socket is to add pads to the inside of the prosthesis. These special pads, applied only by an experienced prosthetist, serve the same purpose as socks but with greater accuracy.

Once you are regularly wearing your prosthesis, you may find that your residual limb will shrink throughout the day, causing your prosthesis to feel loose and uncomfortable. The only way for you to restore a comfortable fit is by adding a sock, one ply at a time. If adding or removing socks doesn’t work, call your prosthetist.

As a general rule, if you experience any discomfort with your prosthesis add or remove socks until the discomfort goes away. Four out of five times, an uncomfortable socket can be attributed to not wearing enough prosthetic socks. If you are unable to resolve the problem by varying sock ply, contact your prosthetist.

Types of Socks
There are two types of socks: (1) single ply and (2) multiple ply.

- Single ply socks are the thinnest. They have a single thickness.
- Multiple ply socks are socks that have the thickness of either 2, 3, 4 or 5 one-ply socks. For example, wearing a two-ply sock is like wearing 2 one-ply socks. Wearing a three-ply sock is like wearing 3 one-ply socks.

Managing Prosthetic Socks

- The reason for wearing multiple ply socks is to minimize the number of one-ply socks you have to apply. It is easier to apply two 5 ply socks than 10 one-ply socks.
- Prosthetic socks must be applied carefully to avoid wrinkles. Always be sure there are no wrinkles in a sock, especially in the back of your leg.
- You should use only socks that are clean and dry. Dirty socks harbor bacteria that can cause skin rash and wet socks can cause skin maceration (the softening and breaking down of skin resulting from prolonged exposure to moisture).
- You may have to change your socks in the middle of the day during warm, humid weather. Socks will absorb sweat and dirt, making the socket not fit correctly.
How to wash your prosthetic socks

- Socks should be machine-washed warm with mild soap and warm water. Let air dry to avoid shrinking.
- Most manufacturers recommend socks be rotated on at least a three-or four-day schedule to allow the fibers to retain their original position.

Can I Wear a Regular Sock On the Foot of My Prosthesis?
Absolutely! Wear what ever you want on the prosthesis. For individuals with a preparatory prosthesis (with the pylon showing and no shaped cover) some individuals wrap a towel around the pylon and an ace bandage around the towel to hold it on. This helps to fill in your pant leg while adding a small measure of shape to the prosthesis.

Your Comfort is Key
The comfort of the prosthesis should never prevent you from putting full weight onto the prosthesis. If you have pain or discomfort that prevents you from fully using your prosthesis you should contact your prosthetist immediately.

Maintaining a Constant Body Weight
If you have been fit with a prosthesis that stays on your leg (suspends) with suction, it is very important to maintain a relatively constant body weight. Weight fluctuations or weight gain, should be kept to a minimum; as they can cause many socket-fitting problems.

- **Weight Gain/Loss** - Your residual limb will continue to shrink for the first three years after your amputation. However, weight gain is the “grim reaper” of a well-fitting prosthesis. Gaining weight will quickly cause your prosthesis to be too tight and uncomfortable. Prosthetic sockets can accommodate up to 5-10 lbs of weight gain without too much discomfort. It is very important to be aware of your diet and eating habits so that you can keep your weight relatively constant.

- **Diet Considerations** - The amount of water your body retains is directly related to your diet and eating habits. Eating foods rich in sugar and salt may cause you to retain water, potentially making your prosthesis feel tighter.
Prosthetic Feet & Shoe Selection

As you probably already know, a prosthetic foot will not move like a natural foot. With the exception of 1-2 feet on the market, prosthetic feet are manufactured with a non-adjustable heel height. Therefore, if one of these (non-adjustable) feet is chosen for your prosthesis, you and your Prosthetist should discuss what heel height will work best for the type of shoes you commonly wear.

If you are interested in a foot that has an adjustable feature, talk to your prosthetist before you select a foot. These feet are very convenient but they do have their limitations.

Non-Adjustable Feet
If your prosthesis has a non-adjustable foot (98% will have this type of foot) and you would like to continue wearing shoes with different heel heights (some low heel and some high heel) it will be important for you to learn how your shoe selection can negatively affect the stability of your prosthesis.

Shoe Selection
To determine whether a particular shoe is right for your prosthesis you will need to apply the shoe, set it on a level surface (a table or the floor) and look at it from the side. Here is what you are looking for:

- If the pylon (pole) of the prosthesis is tilting backwards then the shoes heel is too low. This will cause you to feel as though you are “walking up a hill.”
- If the pylon (pole) of the prosthesis is tilting forward then the shoes heel is too high. This will cause you to feel as though you are “walking down a hill.”
- While it is acceptable to wear a shoe with an incorrect heel height, you will need to adjust your gait to compensate for the change in alignment. Be very careful though, this rule is true only with subtle differences in heel heights. Extremes in either direction, heel height that is too high or too low, may cause your gait to be not only uncomfortable but unsafe as well.

Heel Lifts
A heel lift is used to accommodate for a shoe with a heel that is too low. (If you have not already been given a heel lift and you feel you might need one, ask your Prosthetist.)

Unfortunately, nothing can be done for a shoe with a very high heel height, except applying a new foot.

To avoid this, it is very important for you to share your shoe wear needs with your Prosthetist before making a selection about a foot.
Wearing Schedule

Although a new prosthesis may be comfortable when you first get it, this may not be the case after you begin wearing it for an extended period of time. We strongly encourage you to gradually increase your wearing time with your prosthesis. Following the wearing schedule below (especially if your amputation is related to vascular problems or your strength and endurance are in need of improvement) will gradually guide you to successful, full-time use. If wearing time is excessive there is a good chance that you will develop skin breakdown with the potential for infection. Skin problems will prevent you from wearing the prosthesis. Ask your Prosthetist or therapist; you may be able to skip this wearing schedule and move a little quicker.

**Recommended Wearing Schedule**

- **DAY 1-3:** Wear 3 times a day for 30 minutes each session, sitting with intermittent standing
- **DAY 4-6:** Wear 3 times a day for 60 minutes, sitting with intermittent standing
- **DAY 7-9:** Wear 4 times a day for 2 hours, sitting with intermittent standing

For individuals with vascular related amputation, check your skin after every use. If red marks are present (especially on bony areas) and persist longer than 30 minutes, alter your sock ply and try it again. If the redness persists, contact your prosthetist. You may increase wearing time based on your comfort level and tolerance of the prosthesis. Eventually, you should be able to tolerate wearing the prosthesis all day, if you choose.

**Sitting Comfortably While Wearing Your Prosthesis**

There are several factors that determine how much you can bend your knee while you sit with your prosthesis; not everyone can bend their knee the same amount. Ideally, you should be able to bend your knee to at least 90 degrees, which for most people is a relatively comfortable sitting position. However, for some individuals this is not enough. If you are uncomfortable when you sit, discuss the matter with your prosthetist, he or she may be able to make improvements. If not, he or she will at least explain why additional improvement is not possible. Keep in mind that a well fitting prosthesis is made to be comfortable and stable when walking and standing.
Cleaning & Maintenance

Care of Your Residual Limb (Stump) and Your Prosthesis

- We recommend that you wash your residual limb every day, but only at night. Be sure to rinse and dry completely to avoid leaving soap residue on your skin. Soap left on your residual limb can cause skin irritation when you wear your prosthesis.

- If you wish to apply lotion to your residual limb, be sure to apply it at night only. This allows the lotion to penetrate your skin completely, leaving your skin moisturized and relatively free of excess lotion. Lotion on your skin is another common cause of skin irritation when wearing a prosthesis.

- It is also important that you routinely wash the inside of your prosthesis on a daily basis using mild hand soap and a damp cloth, especially the liner (if you have one). The inside of a prosthesis can harbor harmful bacteria that may irritate your skin.

- Always apply clean socks to your residual limb. Once again, dirty socks harbor bacteria that cause skin irritation.

Nightly Cleaning Routine

Keeping both your liner and limb clean is essential. Failing to adhere to a regular cleaning routine can cause serious skin irritations from bacteria and fungus buildup. Follow the steps above every night to ensure a clean prosthesis and healthy limb.

Clean and Inspect your limb. If necessary, apply lotion*.

* The only time to do so is immediately following nightly cleaning. This allows the lotion to soak in over night and ensures that no lotion is on your skin when you apply your prosthesis the next morning.
Amputee Exercises

Quad Set

Lay on your back with your residual limb propped on a towel roll. Tighten your quadriceps muscle and straighten out your knee until it is fully extended. Hold this position for a count of 3 seconds. Relax and repeat.

Short Arch Quadricep

Lay on your back with both legs over the roll. Straighten your leg while keeping it on the roll.
**Straight Leg Raise**

Lay on your back with your residual limb fully extended on the ground in front of you. Place your other leg on the roll. Keeping your residual limb straight, raise it up until it is the same height as your leg over the roll. Hold this position for a count of 3 seconds before returning to the starting position. Relax the quadricep for a count of 2 seconds and repeat. Be sure to keep your knee straight throughout the exercise.

**Bridging Over Bolster**

Lay on your back with your legs over the roll. Contract your gluteus muscles and straighten your legs to lift your hips off the ground. Be sure to lift both hips equally using gluteus muscles – NOT your back muscles.
Single Leg Bridging

Lay on your back with one leg on the roll while extending the other leg in the air. Contract your gluteus muscles and straighten your legs to lift your hips off the ground. Be sure to lift both hips equally using gluteus muscles – NOT your back muscles.

Side Lying Hip Abduction - Modified

Lay on your side. Make sure your body is in a straight line with your legs fully extended over the roll. Contract your gluteus muscles and lift your hips off of the bed. Hold your hips off the ground for a count of 3 seconds and return to the starting position. Be sure to stay on your side throughout the exercise without rolling forward or backward.
Side Lying Hip Abduction - Advanced

Lay on your side. Make sure your body is in a straight line. Fully extend your bottom leg over the roll, while elevating your top leg directly above it. Contract your gluteus muscles and lift your hips off the ground for a count of 3 seconds before returning to the starting position. Your top leg should remain elevated over the bottom leg for the duration of the exercise. Be sure to stay on your side throughout the exercise without rolling forward or backward.

Prone Knee Flexion

Lay on your stomach with your legs fully extended behind you. Bend your knee as far back as you can without lifting your hip or arching your back. Then lower your leg back down to starting point in a controlled motion. Be careful to keep your knee pointed straight into the mat without rotating your lower leg. Repeat on both sides.
**Prone Hip Extension**

Lay on your stomach with your knee bent at a 90º angle. Keeping your knee bent, lift your leg off the ground. Be sure to keep your body flat on the ground throughout the exercise and do not arch your back. Only lift your leg as high as you can without raising your hip off the ground.

**Prone Adductor Squeeze**

Lay on your stomach with your legs fully extended behind you. Place the roll between your legs and squeeze for a count of 5 seconds. Relax and repeat.
Abdominal Curl-up

Lay on your back with your legs fully extended in front of you. Raise your arms straight in front of your chest. In a controlled manner, roll up to sitting position until you reach the end of your physical range. Return to the starting position in a controlled manner, one vertebrae at a time. Repeat.

Push-ups

Lay on your stomach with your knees on the ground. Place your hands down in front of you (shoulder-width apart). Lower yourself to the ground and pause. Extend your arms to lift your upper body back to the starting position and repeat. Keep your hips down and stomach tight throughout the exercise. Do not arch your back.
Tall Kneeling Horizontal Rotation 1

Stand up on your knees (shoulder-width apart). Placing equal weight on both knees, maintain an upright posture with hips forward and shoulders and head back. Balance in this position.

Tall Kneeling Horizontal Rotation 2

Stand up on your knees (shoulder-width apart). Placing equal weight on both knees, grasp a weighted ball with both hands and hold it out in front of you. Rotate from side to side in a controlled manner while maintaining an upright posture. Be sure to shift your weight equally from side to side as you rotate.
Tall Kneeling Horizontal Rotation 3

Stand up on your knees (shoulder-width apart). Placing equal weight on both knees, grasp a weighted ball in both hands and hold it down near your hip. From this position, raise your arms across your body and above your head, pause, and return to the starting position in a controlled manner. Repeat on both sides.

Bosu Head Turns

Sit on the bosu, place your hands in your lap, and balance in an upright position. Once balanced, rotate your head to the right, pause, return to the starting position. Repeat on both sides.
**Bosu Trunk Rotations**

Sit on the bosu and balance in an upright position. Grasp a weighted ball with both hands and hold it out in front of you. Once balanced, rotate side to side while keeping the ball extended out in front of you. Be sure to maintain an upright posture throughout the exercise. Do not use your sound side leg to balance on the ground.

**Double Knee to Chest**

Lay on your back. Bring both knees toward chest, placing your hands on the back side of either knee. Allowing knees to bend, pull knees to chest. Hold stretch for 30 seconds.
**Single Knee to Chest**

Lay on your back. Bring knee towards chest, placing your hands on the back side of knee. Allowing knee to bend, pull knee to chest. Making sure other leg remains flat on mat, and keep knee pointed up in neutral position. Hold stretch for 30 seconds. Repeat the same as above to the other side.

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**Hook Lying Trunk Rotation**

Lay on your back with knees bent in the hook lying position, with legs together roll to one side until you feel a stretch, grab the upper leg with hand on same side rotate head the opposite direction. Hold stretch for 30 seconds. Repeat the same as above to the other side.
Hamstring Stretch

Lay on your back. Bring knee towards chest, placing your hands on the back side of the knee, straighten knee until a stretch is felt in the backside of the leg. Make sure other leg stays flat, keeping knee rotated to a neutral position. Hold stretch for 30 seconds, repeat above to other leg.

Quadruped Rocking Back Stretch

Get on all fours, with you hands directly under your shoulders, and your knees directly under your hips. Slowly rock back, bringing your hips towards you rankles, keeping hands and knees firmly planted. Keeping arms outstretched. Hold for 30 seconds.
Quadruped Arm and Leg Lift

Get on all fours, with your hands directly under your shoulders, and your knees directly under your hips. Keeping your body still, pull your belly button towards your spine and hold. Keep your back flat.

(1) Raise one arm to shoulder height hold for a count of 3 return to starting position then alternate arms. There should be no trunk movement throughout.

(2) Raise a single leg behind you until leg is equal with back height. Hold for a count of 3 then return to starting position. There should be no trunk movement throughout.

(3) Raise opposite arm and leg while maintaining stability in the trunk. Hold position for count of 3 return to starting position. Alternate to opposite side. There should be no trunk movement throughout.