# Transtibial (Below Knee) Exercise Manual

## Six Convenient Locations

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<tr>
<td>Southwest Location</td>
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<td></td>
<td>7735 W. Jefferson</td>
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<td>260-484-2291</td>
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<tr>
<td>North Location</td>
<td>By Parkview North Hospital</td>
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How to Use this Manual

Use one new manual for each new patient you treat; it will become their personal exercise manual that they can use as part of a home exercise program. When the patient discharges from your care, be sure to educate them on the importance of continuing this exercise program.

This guide is meant to be a starting point for new amputees. While the exercises contained in this manual are a comprehensive guide to treating a patient with the loss of a limb, they are not meant to be a guide to treating the patient as a whole. These exercises concentrate only on building the core muscles required to ambulate with a prosthesis. A skilled therapist will supplement these limb loss exercises with other case appropriate exercises/treatment to provide each patient with the individualized care they require. This means the therapist should identify any other co-morbidities that could hinder the rehabilitation progress. Examples include identifying and treating any back pain, sound limb deficits such as hip, knee or ankle pain, sound limb contractures, and more.

Contracture Management
Make sure your treatment includes oversight and management of any joint contractures; both the prevention and correction. Be sure you distinguish the difference between muscle tightness and muscle shortness. Tight muscles will show improved flexibility on the first therapy session and will only require a small amount of time before they exhibit normal range of motion (ROM). On the other hand, shortened muscles will require a minimum of four weeks of stretching before there is a noticeable improvement in ROM, if any improvement in muscle length occurs at all.

*Please Note:* Prosthetists should not accommodate for a contracture within a prosthesis unless ample time has been given to remedy a tight or shortened muscle.
Treatment Overview

1. **Functional mobility**
   - Transfers
   - Bed mobility
   - Positioning/stretching

2. **Strengthening/conditioning**
   - Prepares the patient for prosthetic ambulation

3. **Residual limb management**
   - Reduce limb swelling using a shrinker
   - Desensitization (see below)
   - Scar Mobilization (see below)

**Within 1-2 weeks of post-op**
Conduct desensitization exercises using:
   - Ice cubes
   - Pin
   - Towel
   - Deep pressure
   - Heat
   - Brush

**When incision is healed and “has only very small scabs”**
Begin to mobilize tissue around incision using:
   - Cocoa butter (or similar)

This will also supplement a stump shrinker by bolstering venous return. Plus it will loosen subcutaneous tissues so tissues move more freely. Pay particular attention to any tissue adherence to the distal tibia or distal femur. Pressures inside of a prosthesis will displace tissues on the limb and any tissues that is “hypo-mobile” can be symptomatic and can prevent the patient from making progress in their rehabilitation.
Goals of the Pre-Prosthetic Program

1. Trans-tibial patients should work towards achieving full knee extension and ideally 0-10 degrees of hip extension.

2. Patient should complete a minimum of six weeks of strength/ROM training on the primary prosthetic gait muscles outlined in this manual. The patient should be independent with the exercise program and also understand the importance of being diligent with it. Educate your patient so they understand these exercises will require a lifestyle change.

3. The patient should be able to tolerate a minimum of 30 minutes of physical activity.

4. Following sufficient soft tissue mobilization, the patient should be able to tolerate pressure and tissue displacement on the distal end and incision without pain.

5. The incision should be fully healed and good soft-tissue mobility should be established.

6. It is imperative that patients continue an independent exercise program even after prosthetic gait training has been initiated. Preferably, the patient will continue their exercises on their own outside of therapy so that therapy appointments can focus on gait training. This will encourage further muscle development that will supplement any gait training conducted during regular therapy appointments.

7. They should be independent with transfers and bed mobility. This includes the independent ability to roll prone.

What is Possible?
It is possible for a trans-tibial (below the knee) patient to achieve a natural gait using a prosthesis. In some cases, they may regain their pre-amputation level of function or better. There are exceptions, but even patients that are questionable candidates for a prosthesis can do much better than expected with the right treatment.
Important Pre-Prosthetic Consideration

Over the past 20-30 years, the standard of care for amputees has evolved into the philosophy that therapists should achieve walking with an amputated patient (single leg hopping with a walker) as quickly as possible. A patient’s pre-prosthetic measure of success has been determined by how many feet they can walk with the use of a walker, but without a prosthesis. This standard of care, compounded by the belief that there is little a therapist can do with a patient without a prosthesis, is leading to less favorable limb loss outcomes.

We support a different philosophy that we feel promotes better limb loss outcomes. The following information will provide you with an alternative method of treatment that we have found to produce better patient outcomes. This philosophy not only stems from the teachings of Robert Gailey, PhD, PT, but also from the unique experience we have gained by treating this patient population exclusively.
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 picture). By maintaining COB awareness, the patient maintains their minds inherent ability to perceive where their amputated limb is in space, or 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 is what they have learned. 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 a patient spends standing and hopping on one leg, the more difficult (if not impossible) it may become for them to get their COB over both extremities when they begin to wear a prosthesis.

2. Failing to maintain a natural COB awareness will prevent the patient from achieving their full potential. Please discourage walking until your patient receives their prosthesis. It is better for a patient to not walk at all versus single leg hopping.

Instead of single leg hopping, pre-prosthetic therapy should focus on:

- Flexibility
- Contracture management
- Both Core and lower extremity strengthening
- Bed mobility
- Health/mobility of incision
Amputee Exercises

This manual is a basic guide that will initiate pre-prosthetic training. It is important that patients develop good muscle strength and joint flexibility to promote a safe, efficient and natural prosthetic gait. The exercises contained in this section are a comprehensive guide to treating a patient’s loss of a limb. They are not meant to be a guide for treating the patient’s other deficits that may hinder rehabilitation.

These exercises should be initiated during the post-op treatment of an amputee, continued as an out-patient pre-prosthetic protocol, and then used as a home exercise program.

Exercise Instructions
After a thorough evaluation, the therapist will need to establish an initial number of repetitions per exercise for each individual patient.

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.

Repetitions
Short Arch Quadricep

Lay on your back with both legs over the roll. Straighten your leg while keeping it on the roll. Be sure to keep your foot in a neutral alignment, with your toes pointed back throughout the exercise.

Straight Leg Raise

Lay on your back with your sound leg fully extended on the ground in front of you. Place your other leg on the roll. Keeping your sound leg straight, raise it up until it is the same height as your the 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, your foot in a neutral alignment, with your toes pointed back 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 a straight line with your legs fully extended over the roll. Contract your gluteus muscles and lift your hips off 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 90° 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 of 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 hand 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 out it 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 with the 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

Lie on back. Bring both knees toward chest, placing your hands on the back side of either knee. Allowing knees to bend, pulling knees to chest. Hold stretch for 30 seconds.

Single Knee to Chest

Lie on back. Bring knee towards chest, placing you hands on the back side of knee. Allowing knee to bend, pulling 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.
Hook Lying Trunk Rotation

Lay on 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

Lie on 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.
Get on all fours, with your hands directly under your shoulders, and your knees directly under your hips. Slowly rock back, bringing your hips towards your ankles, keeping hands and knees firmly planted. Keeping arms outstretched. Hold for 30 seconds.
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.