

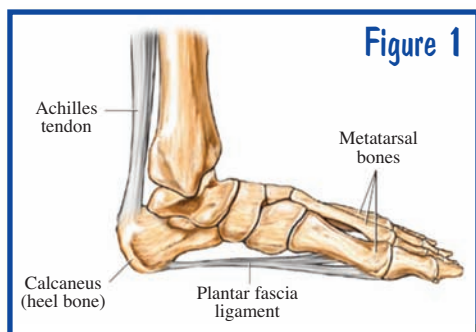
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## Plantar Fasciitis

**Introduction** Plantar fasciitis refers to an inflammation of the long band-like ligaments, collectively known as the plantar fascia, that run from the base of the heel to the toes. The plantar fascia helps maintain the complex arch system of the foot and plays a role in one's balance and during the various phases of gait. This condition is one of the most common causes of heel pain. If not addressed, repetitive strain of the plantar fascia can cause microscopic tears injuring the tissue. This can lead to weakness and moderate to severe discomfort which can alter one's gait and interfere with functional activities.

**Anatomy and Function** The plantar fascia is a thickened fibrous aponeurosis that originates from the medial aspect of the calcaneal tubercle (heel bone). It courses along the plantar surface (sole) of the foot and fans out to attach to the base of the metatarsal heads in the region of the ball of the foot (Figure 1). The plantar fascia functions to provide support for the medial and lateral longitudinal arches of the foot and to assist with shock absorption during the mid stance phase of gait.



The foot assumes two different roles during locomotion: surface adaptation and stabilization. During heel strike the foot is slightly supinated and begins to pronate (ankle rolls in) causing the arch to flatten and allowing for shock absorption. After the contact phase of gait, the foot begins to supinate (ankle rolls out) increasing the arch and locking the bones of the foot during toe-off.

The plantar fascia plays a key role in both facilitating the rigidity of the arch during supination, and the dissipation of shock during the contact phase of gait. During the

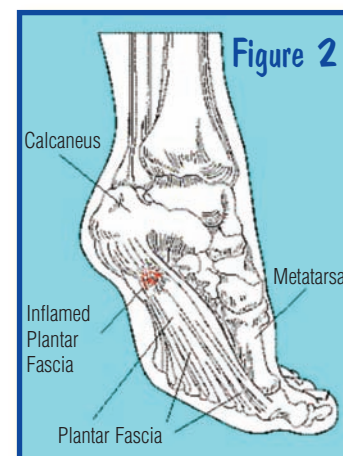
heel-off phase of gait, tension increases in the plantar fascia which acts as a store of potential energy. During the toe-off phase of gait, the plantar fascia passively contracts over the plantar surface of the base of the toes converting potential energy into kinetic energy (Figure 2) thus creating greater foot acceleration.

Due to the limited elastic qualities of the plantar fascia, the arch is slightly raised, creating the rigid lever to better sustain the forceful gastroc contraction.

**Etiology** Plantar fasciitis is usually not the result of a single event, but more commonly the result of a history of repetitive micro trauma combined with a biomechanical deficiency of the foot. There are both intrinsic and extrinsic risk factors that can predispose one to plantar fasciitis.

Extrinsic risk factors can include a rapid change in activity level (increase in distance, intensity, or duration of activity), running on poorly cushioned surfaces, running on the toes, or running up hills. Faulty equipment such as athletic shoes losing shock absorption, inappropriate footwear, or poor arch support in shoes could also increase the risk of developing plantar fasciitis.

Intrinsic risk factors can be divided into several categories. Structural factors including pes planus (flat foot), over-pronation, excessive lateral tibial torsion, leg length discrepancy, pes cavus (high arch), and femoral anteversion can all alter lower extremity biomechanics and increase the stress on the plantar fascia. Tightness and/or weakness in the gastroc/soleus muscle and Achilles tendon are functional risk factors that increase the likelihood of one developing this condition. Finally, degenerative changes that come with age, such as atrophy of the heel fat pad, may also increase one's risk.



**Symptoms** The disorder classically presents with pain that is particularly severe with the first few steps taken in the morning. Symptoms are usually noticeable at the beginning of an activity and lessen as the body warms up. Prolonged standing, walking, or the repetitive use of stairs may cause pain as well. In more severe cases, the pain may worsen toward the end of the day.

If treatment is not sought, changes in the walking pattern are made attempting to relieve pain. Alterations in gait only cause dysfunction and pain to worsen or develop in other areas such as the knee, hip or back. Without rest to the inflamed tissue, the pain in the plantar fascia can begin to limit daily activity and make sport and recreation nearly impossible.

**Assessment** Assessment and diagnosis of plantar fasciitis comes through performing a thorough physical exam, and paying close attention to the patient's history and current complaints.

Physical examination findings can include moderate to severe tenderness to palpation at the anteromedial region of the calcaneus, which is the attachment site of the plantar fascia, or general discomfort throughout the arch. Another positive finding would be increased discomfort with dorsiflexion of the toes, which adds further stretch and irritation to the plantar fascia. Also, the Achilles tendon is often found to have increased tightness compared to the uninvolved lower extremity.

An analysis of the patient in standing and walking is necessary. This will allow visualization of any predisposing factors such as abnormally pronated (flat) feet, excessively supinated (high arch) feet, abnormal alignment of the calcaneus (inversion/turned in or eversion/turned out), and rotation of the tibia and femur.

It is also important to consider differential diagnoses that may have similar exam finding as those of plantar fasciitis. In order to rule out an S1 radiculopathy, the straight leg raise test, Achilles tendon reflex, and calf strength assessment with toe/heel walking can be performed. Tarsal tunnel syndrome can also be ruled out by percussing over the tarsal tunnel posterior to the medial malleolus. This test produces no pain in the patient with plantar fasciitis. Reproduction of pain in the forefoot by compressing the metatarsal heads together suggests the presence of a Morton's neuroma and is not a typical finding in plantar fasciitis. Morton neuroma is due to the entrapment of the common digital nerve between the metatarsal heads.

**Treatment** Initial treatment for plantar fasciitis is usually conservative and consists of rest (to reduce stress on the plantar fascia), activity modification, and physical therapy.

Heel pain can be very aggravating, especially when taking those first steps in the morning. The key to decreasing and possibly eliminating heel pain is to stretch the heel cord and plantar fascia. The goal of stretching is to lengthen the tissue and in turn reduce stress and pain experienced in the arch. There are a number of ways to stretch the plantar fascia and Achilles tendon/gastroc-soleus muscle. You can stretch your heel cords as shown in (Figures 3A-C) and your plantar fascia as shown in (Figure 3D). Each stretch should be pain free and held for 30 seconds. Complete five repetitions of the stretches three to four times each day. Other techniques of stretching the Achilles tendon include nighttime ankle foot orthoses to keep the feet in neutral at night. The plantar fascia also can be stretched by having the patient sit and roll a foam roller between the sole and the floor.

The physical therapist can perform manual stretching of not only the heel cord but also the forefoot and toe joints which often contribute to tightness. Soft tissue and transverse friction massage are utilized to reduce irritation, relax tension and improve circulation to the area.

As the patient progresses, strengthening exercises are introduced to improve intrinsic and extrinsic muscles that support the arches of the foot and stabilize the ankle. A comprehensive program also includes endurance, balance and proprioceptive exercises.

Application of ice is an important part of the treatment process to reduce pain and inflammation. Ice should be applied after exercise and may be performed either as an ice massage for 5 minutes or by applying an ice pack for 15-20 minutes.

The physical therapist may also recommend other modalities such as ultrasound, electrical stimulation, phonophoresis, or iontophoresis to assist further with pain relief and reduction of inflammation. Ultrasound is useful in providing deep stimulation of the tissue to promote healing and reduction of inflammation. Electrical stimulation can relax the tissue and provide pain relief. In more involved or severe cases, medication can be delivered directly to the involved tissue. Phonophoresis is a technique in which ultrasound is used to enhance delivery of an anti-inflammatory or analgesic medication such as hydrocortisone into the tissues. Iontophoresis is another therapeutic technique that utilizes a direct electric current to transfer ions into the body's tissues. Dexamethasone is a common medication used to help reduce inflammation. The above modalities may facilitate the resolution of plantar fasciitis.

Two relatively new modalities, anodyne therapy and extra corporeal shock-wave therapy (ESWT), are proving to aide in improvement and possibly quicken the recovery from plantar fasciitis. Anodyne therapy is an FDA approved, non-invasive treatment that utilizes monochromatic infrared photo energy (MIRE), initially approved

for use with diabetic neuropathy. The treatment is administered through the use of multiple diodes which provide the infrared light. Flexible pads are applied lightly over the affected area and secured gently with straps. Treatment time typically lasts 30 minutes. Research specific to its use with plantar fasciitis is limited; however, studies of anodyne use for diabetic neuropathy in conjunction with a comprehensive therapy program reported 87% reduction in foot and leg pain in 252 participants. Anodyne therapy has little to no side effects, no drug interaction and can be utilized in patients with pacemakers, defibrillators and metal implants. A typical treatment frequency would be three times a week for four weeks.

Extracorporeal shock-wave therapy (ESWT), also called Orthotripsy, is another non-surgical treatment for plantar fasciitis. ESWT was recently approved for use in the specifically for the treatment of plantar fasciitis. ESWT was derived from the use of lithotripsy, the use of sound waves to break up renal stones. ESWT uses shock waves or pulsed sound waves to repeatedly stimulate the plantar fascia, purportedly to improve circulation and even promote new tissue and blood vessel growth.

Candidates for ESWT include those suffering from chronic plantar fasciitis for a period greater than six months. Studies have found that three treatments with 1000 low energy shock-wave impulses is an effective treatment for plantar fasciitis and allows avoidance of surgical procedures. Compared to surgery, the patients can return to ADL's and recreation within 1-2 days after treatment with minimal side effects.

Sometimes, taping of the plantar fascia can help to decrease stress on the fascia and enable the patient to tolerate activity better. Taping techniques are used to distribute force away from the stressed and irritated fascia and provide some relief of discomfort with weight-bearing activities.

Shoe inserts and heel pads are typically considered part of the initial treatment. These prefabricated orthotic devices are available at most pharmacies and surgical supply stores and are relatively inexpensive. The heel insert can be made of silicone, rubber, gel, or felt. Custom made orthotic arch supports have also been advocated to improve symptoms. These orthotic devices can support the bony arch, control abnormal pronation and decrease

the stress on the plantar fascia (Figure 4).

Non steroidal anti-inflammatory drugs (NSAIDs) are oral medications that are frequently used to help decrease pain and inflammation associated with plantar fasciitis. Various NSAIDs can be used. There are no particular drugs of choice. Though, there is some controversy as to whether or not NSAIDs actually assist the physiological healing process, they can be useful as an adjunct to control pain.

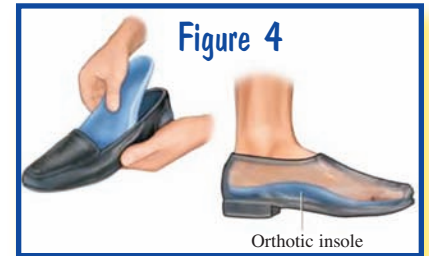
Corticosteroid injection can be considered for plantar fasciitis in the relatively small percentage of patients who do not respond to conservative treatment. Although studies have reported a 70 percent success rate, there are potential risks including plantar fascia rupture and fat pad atrophy. Symptom relief is reported to last 3-6 weeks but often wears off. If a series of injections does not relieve symptoms then other treatment should be considered.

Surgery is usually not necessary in 95 percent of cases. However, for cases that do not respond to conservative treatment, a surgical release of the plantar fascia could be considered. This may be an option if a person's daily activities are restricted, quality of life has been reduced secondary to pain, or symptoms persist for longer than six to twelve months. The procedure involves cutting the plantar fascia; thereby, reducing tension on the ligaments, thus reducing inflammation.

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**Conclusion** The goals of treatment for plantar fasciitis are to:

- Relieve inflammation and pain in the heel.
- Allow small tears in the plantar fascia ligament to heal.
- Improve strength, flexibility, and correct biomechanical foot problems to decrease stress on the plantar fascia.
- Allow patients to resume normal activities.
- The majority of cases of plantar fasciitis go away in time if one regularly stretches, wears proper shoes, and allows adequate rest and recovery time.



A. Sit with your legs straight in front of you. Wrap a towel around the ball of your foot and hold the loose ends in each hand. Pull the ends of the towel toward you until you feel a gentle stretch in the back of your calf.



**Figure 3**

B. Stand on an incline box with the higher edge toward the wall. With your heel on the floor and knee straight, lean toward the wall until you feel a gentle stretch in your calf.



C. Stand about an arm's length from a wall with one foot in front of the other. Bend the front knee and put your hands on the wall. Lean forward until you feel a gentle stretch in the calf of your back leg.

Next, bring your back leg closer to the wall and bend both knees. Lean forward until you feel a gentle stretch in the heel cord of your back leg.

D. Sit with one leg over the other. Pull your toes up, especially the big toe, until you feel a stretch along the bottom of your foot (plantar fascia).





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## NEWS *briefs*

OSPTA would like to thank Mr. Mike Phillips, PT and Ms. Lauren Nahas, PT for their contribution to the plantar fasciitis newsletter.

OSPTA would like to congratulate Mr. Ryan Ridley, PTA on passing his PA State Board of Licensure Examination.

For the 3rd quarter of 2006, OSPTA's patient satisfaction rating was 99%. Clinical pathways were met 65.49% of the time with an average of 10.16 visits/diagnosis. Pain was reduced by 63%, function improved by 68% for an overall improvement of 76%.

Please call any of the locations to schedule an appointment that is convenient to you. OSPTA and VOR provide day and evening hours.

In addition, OSPTA@Home provides home health services consisting of nursing, physical therapy, occupational therapy, and speech therapy.

Belle Vernon	724-929-5774
Bethel Park	412-835-2259
Brownsville	724-785-5262
California	724-938-0310
Carmichaels	724-966-2709
Carnegie	412-279-7700
Charleroi	724-483-4886
Clairton/ Jefferson Medical	412-466-8811
Connellsville	724-626-3320
Elizabeth	412-751-0040
Perryopolis	724-736-7415
Uniontown	724-439-6294
Upper St. Clair/ Mt. Lebanon	412-276-6637
Washington	724-223-1207
White Oak	412-672-2352
<b>OSPTA@Home</b>	<b>724-483-4859</b>
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Speers	724-489-8111