



Occupational
Health Clinics
for Ontario
Workers Inc.

Centres de
santé des
travailleurs (ses)
de l'Ontario Inc.

Plantar Fasciitis

Prevention Through Intervention



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What is Plantar Fasciitis?

Plantar Fasciitis (fash-e-i-tis) is one of the most common causes of heel pain, accounting for almost 15% of all foot-related complaints (Lutter, 1997), affecting the middle aged (40-50). More women than men are affected by this condition, with about 65% reported to be overweight.

It is understood to be an overuse injury to the plantar fascia and the surrounding structures, which over time cause small tears and inflammation of the tissues. Those with Plantar Fasciitis describe that is worse in the morning and after seated rest upon walking.

The condition involves inflammation of the plantar fascia (a tough fibrous band of tissue that runs along the sole of the foot with attachments to the heel bone (calcaneous) and to the base of the toes. The plantar fascia provides support to the arch of the foot and has an important role in normal walking. Tension or stress in the plantar fascia increases when weight is placed on the foot (standing) and as one pushes off on the ball of the foot and toes (walking or running).

Inflammation and pain start in the fascia either as a result of an increase in activity level (starting a walking or running program), or with the normal aging process. With aging, the fascia loses some of its normal elasticity and may become irritated with routine activities. Less commonly, Plantar Fasciitis can develop in association with medical conditions such as lupus or rheumatoid arthritis.

Anatomy of the Plantar Fascia

The plantar fascia is a structure that runs from the front of the heel bone (calcaneus) to the ball of the foot. The plantar fascia is made up of connective tissue arranged in sheets, and arises from the posteromedial portion of the calcaneal tuberosity on its inferior aspect. It consists of the central band being the strongest and thickest which passes beneath the metatarsal heads and connects into the flexor sheath, volar plate (sole), and the base of the proximal phalanx of the hallux (toe). It also inserts into the plantar skin just distal to the first metatarsal head. This dense strip of tissue helps to support the long arch of the foot, by acting similar to the string on a bow.

When the foot is on the ground a large amount of force (weight of our body) is on the plantar fascia. This can lead to stress on the plantar fascia where it attaches to the calcaneus (heel). Small tears of the tendon may result and are repaired by the body.

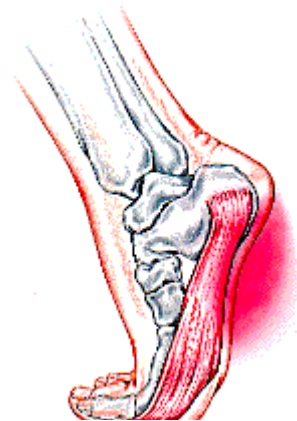


Figure 1: Location of pain
Source: Foot.com



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Anatomy of the Plantar Fascia

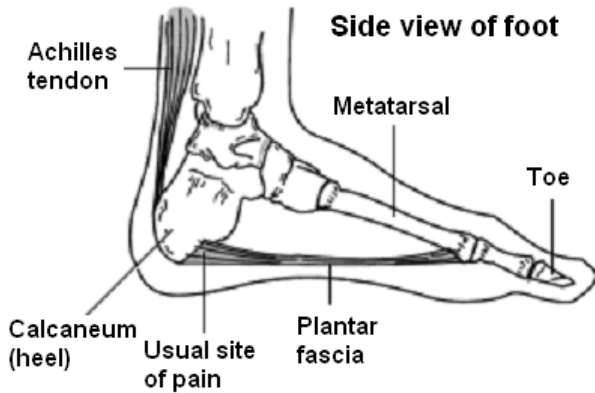


Figure 2: Anatomy of the plantar fascia
Source: www.patient.co.uk

As the healing process repeats itself over and over, a bone spur forms as the body’s response to try and firmly attach the fascia to the bone. This appears on an x-ray of the foot as a heel spur.

Function of the Plantar Fascia

The plantar fascia works during the gait (walking) cycle when the heel on one side has lifted, but the heel on the opposite foot has not yet touched the ground. During this action, the foot will experience a higher reaction force than at any other time in the gait cycle. As the heel lifts, the plantar fascia will start to tighten. The higher the heel lifts, the tighter the plantar fascia will get.

As the heel lifts, the plantar fascia will tighten and pull the heel toward the forefoot. This will heighten the arch and resist the increasing body weight from flattening the foot.

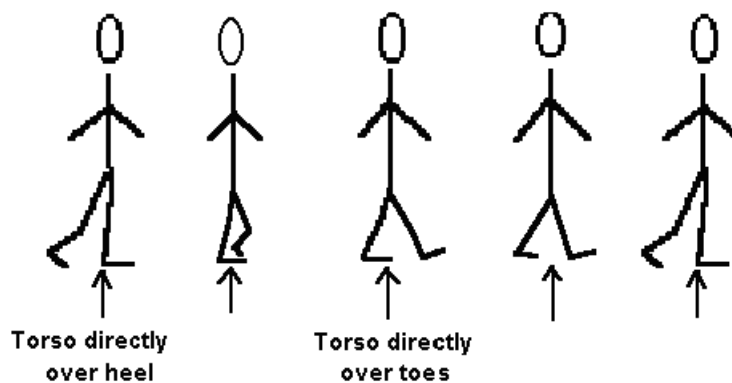


Figure 3: Typical gait (walking) cycle
Source: Heelspurs.com



With premature heel lift from tight calf muscles, the plantar fascia will not properly raise the arch and resist the body weight from flattening the foot. This elongation will put tension on the fascia, at its' attachment. Over time, symptoms of overuse will occur.

Symptoms of Plantar Fasciitis

The main symptom of Plantar Fasciitis is pain in the center of the heel with weight bearing. This is usually worse in the morning when the foot is first placed on the floor.

The pain associated with Plantar Fasciitis is gradual in onset and is usually located over the inner aspect of the heel. Pain may also occur in the arch area of the foot. Occasionally, the pain will be sudden in onset, occurring after missing a step or after jumping from a height. This condition causes what is known as "first-step pain." The degree of discomfort can sometimes lessen with activity during the course of the day or after "warming-up", but can become worse with prolonged or vigorous activity. The pain may also be more severe in bare feet, in shoes with little or no padding at the sole, and slippers.

Causes of Plantar Fasciitis

Plantar Fasciitis has been linked to excessive stress placed on the tissue as a result of athletic activity, muscle weakness or tightness, improper shoes, increase in body weight, aging, inadequate footwear and occupation.

Age

As we age, the fat pad that makes up the fleshy portion of the heel becomes thinner. This leads to inadequate padding on the heel and chronic pain in this area.

Trauma

The primary cause is some degree of microtrauma and tearing at the site of plantar fascia insertion.

Obesity

Being overweight places a lot of stress on this area and may be a causative factor. Obesity is a cause and initiator of heel pain and Plantar Fasciitis/calcaneal spur and that improper footwear aggravates the condition (Sadat-Ali 1998). Individuals who spend the majority of their workday on their feet and those whose body-mass index is $>30 \text{ kg/m}^2$ are also at increased risk for the development of Plantar Fasciitis (Riddle et al. 2003).

Flat Foot

Flat foot is the leading cause of Plantar Fasciitis. Over-pronation occurs in the walking process, when a person's arch collapses, causing the plantar fascia to be stretched away from the heel bone.



Pronated foot types are predisposed to increased stress on the plantar fascia with reduced ankle dorsiflexion appearing to be the most important risk factor.” Based on this information gait testing should be performed on all clients diagnosed with Plantar Fasciitis/heel spurs.

High Arches

The most common cause of Plantar Fasciitis relates to faulty structure of the foot. For example, people who have problems with their arches—either overly flat feet or high-arched feet—are more likely to develop Plantar Fasciitis (FootPhysicians.com 2004).

Flooring and Footwear

The harder the floor, the higher the force subjected to the feet. Newton’s third law states that “for every action there is an equal and opposite reaction”. When walking on a hard floor, the foot strikes the floor, but the floor also strikes back equally resulting in injury to the base of the foot.

Poor cushioning can often be found in footwear with a high heel, hard sole, poor support, inadequate size, and inadequate width.

Stiff shoes require more flexibility in the calf muscles by increasing the length of the foot which requires the foot to bend back further when walking. If the foot cannot bend back that far it results in increased tension on the plantar fascia.

Gender

If women gain weight in their thighs and hips and men gain weight in their chest and belly, then a woman's lowered center of gravity could help explain why women are 6 times more likely than men to have heel pain. The combination of women's shoes and being overweight could have a combined negative effect on the plantar fascia.

Prolonged Weight Bearing

Occupations requiring prolonged weight bearing have been considered *a risk* for Plantar Fasciitis due to the repetitive tensile load placed on the fascia (Riddle et al. 2003).

Fat Pad Atrophy

Atrophy or shrinking of the fat pad results in the loss of the natural shock absorption of the heel resulting in increased stress being applied to the plantar fascia.

Other Conditions

Conditions such as reduced dorsiflexion, Equinus, shortened Achilles tendon, leg length discrepancies, tarsal coalition, weak plantar flexor muscles, rear foot varus, forefoot valgus weak intrinsic muscles of the foot, and excessive subtalar joint pronation can also contribute to the development of Plantar



Fasciitis. In addition, systemic inflammatory disorders, such as rheumatoid arthritis, lupus, Reiter's syndrome and psoriasis, may produce Plantar Fasciitis.

Diagnosis

Plantar Fasciitis is diagnosed during a history and physical examination by a doctor. There are several conditions that may cause heel pain, and Plantar Fasciitis must be considered.

An X-ray may be taken to determine if a stress fracture of the heel bone is present and to see if a bone spur is causing problems. Laboratory investigation may be necessary in some cases to rule out other illnesses that can cause the heel pain, such as rheumatoid arthritis, Reiter's syndrome, or ankylosing spondylitis. These are diseases that affect the entire body but can show up at first as pain in the heel.

Treatment

Nonsurgical Treatment

Many patients get better with the help of non-medical treatments. Stretches for the calf muscles take tension off the plantar fascia and is one of the most effective treatments.

A night splint may be worn while sleeping which keeps the foot from bending downward, and places a mild stretch on the calf muscles and the plantar fascia. Symptoms seem to get better faster when using a night splint.

Supporting the arch with well fitted orthotics, may also help reduce pressure on the plantar fascia. Using a special type of insert into the shoe, called a heel cup, can also reduce the pressure on the area and add padding to a heel that has lost some of the fat pad through the aging process.

Shock wave therapy is a newer form of non-surgical treatment and applies shock wave pulses to the sore area. Patients receive the treatment once each week for up to three weeks.

Anti-inflammatory medications are also used to decrease the inflammation in the fascia. Cortisone injections into the area of the fascia has also been shown to be of benefit. Cortisone should be used carefully since it may contribute to the process of degeneration of the fat pad, making the problem worse.

Surgical Treatment

Surgery should only be done as a last resort. Possible surgeries can include:

- removal of the bone spur (if present)
- release of the plantar fascia (must be done)
- release pressure on the small nerves in the area



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Treatment

Usually the procedure is done through a small incision on the inside edge of the foot often using an endoscope. An endoscope is a small camera that can be inserted into a joint or under the skin to allow the surgeon to see the structures involved in the surgery. This allows the surgeon to complete the process with a smaller incision.

Surgery usually involves identifying the area where the plantar fascia attaches to the heel and partially releasing the fascia from the bone. If a bone spur is present this is removed. The small nerves that travel under the plantar fascia are identified and released from anything that seems to be causing pressure on the nerves.

Rehabilitation

Nonsurgical Rehabilitation

Patients with Plantar Fasciitis will often undergo physical therapy. Therapists design exercises to improve flexibility in the calf muscles and the plantar fascia.

Treatments directed to the area help control pain and swelling (ultrasound, ice packs, and soft-tissue massage). Therapy sessions sometimes include a mild electrical current to push anti-inflammatory medicine to the sore area.

A customized foot orthotic may be designed to support the arch of the foot and to help cushion the heel or the therapist may recommend the use a heel cup.

A night splint may also be required while sleeping.

After Surgery

It will take several weeks before the tissues are well healed. The incision is protected with a bandage or dressing for about one week after surgery and crutches will likely be required. The stitches are generally removed in 10 to 14 days. Physiotherapy may then be advised.



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