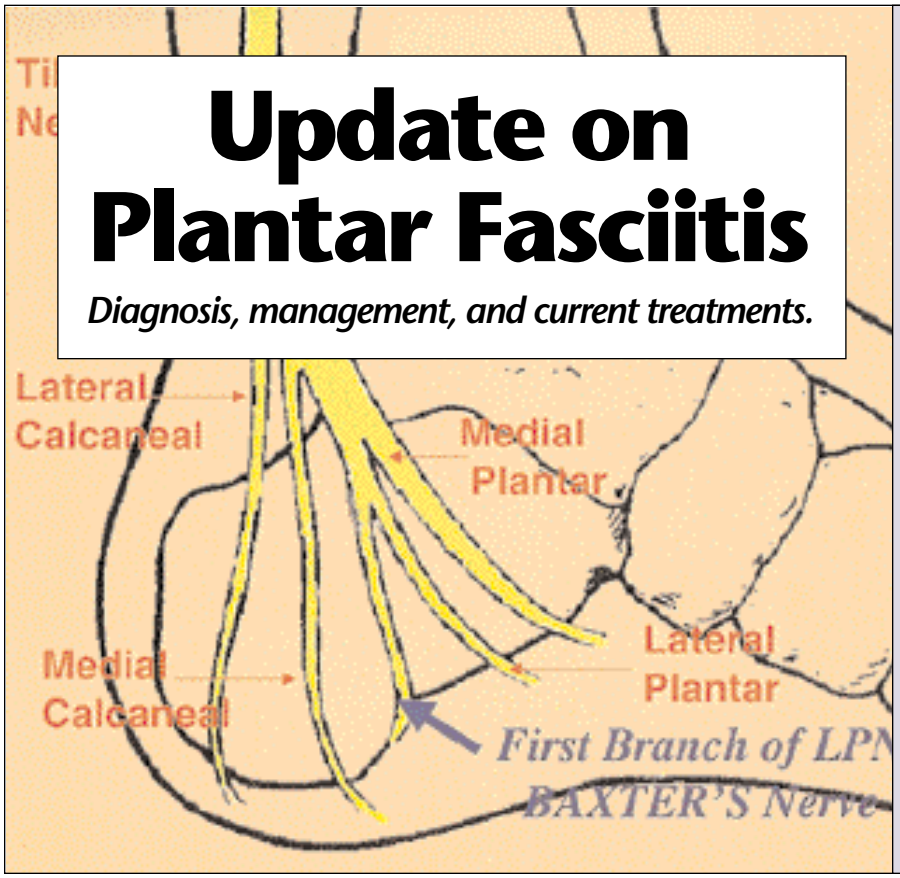
Continuing Medical Education



Update on Plantar Fasciitis

Diagnosis, management, and current treatments.

Objectives

1) To know the etiology of plantar fasciitis.

2) To be able to describe the clinical presentation of plantar fasciitis.

3) To be familiar with the epidemiology of plantar fasciitis, including the age group, gender, physical attributes, foot type, and occupation.

4) To know the significance of heel spurs on radiographic findings.

5) To be able to diagnose plantar fasciitis in adult patients.

6) To be familiar with the differential diagnosis of plantar fasciitis.

7) To be able to manage adult patients with plantar fasciitis and know the results of the latest studies testing heel pads, foot orthoses, physical therapy, injection therapy, night splints, and below knee casts.

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*Following this article, an answer sheet and full set of instructions are provided (p. 114).—**Editor***

By Ellen Sobel, D.P.M., Ph.D. and Steven J. Levitz, D.P.M.

Plantar fasciitis is the most common cause of heel pain. Other terms for plantar heel pain include calcaneodynia, heel pain syndrome, and subcalcaneal heel pain. Currently plantar fasciitis has taken the place of what used to be referred to as heel pain syndrome. Plantar fasciitis can be divided into proximal plantar fasciitis and distal plantar fasciitis.[1] Proximal plantar fasciitis refers to pain only in the heel at the site of the plantar medial tubercle of the calcaneus.[1] Distal plantar fasciitis is characterized by pain and tenderness in the arch.

Plantar fasciitis has been described as having a self-limiting natural course.[2] Approximately 90-95 percent of patients improve with conservative management;[3] however, improvement may be slow,

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taking many months, and some patients do not improve after long courses of treatment.[4-7] This article will review the diagnosis and management of plantar fasciitis. A current update of treatment modalities will also be included as well as basic assessment of the most common differential diagnoses for plantar heel pain.

Mechanical Etiology of Plantar Fasciitis

In older people plantar fasciitis consists of degenerative micro-tears of the medial band of the plantar fascia. In younger people who are athletes and runners, plantar fasciitis is an overuse injury. The plantar fascia originates from the plantar medial calcaneal tuberosity and inserts into the bases of the proximal phalanges (Figure 1). During standing half the body weight is converted into tensile forces in the plantar fascia.[8] Ligament cutting experiments in cadavers have shown that the plantar fascia is the primary ligamentous restraint to arch collapse[9] and sectioning the plantar fascia causes arch sag in individuals operated on for intractable plantar fasciitis.[10]

Repetitive tensile traction loading within the insertion of the plantar fascia into the calcaneus over time strains the plantar fascia. After many years of walking, repetitive microtrauma tends to result in microtears at the origin of the plantar fascia. During sleep, the foot and ankle assume a relaxed 15° plantarflexed position because of the normal tone in the gastrocnemius and soleus muscles. This plantarflexed ankle position results in tightness of the posterior muscle group and shortening of the plantar fascia. Healing of the microtears in the plantar fascia occurs at night during sleep in this relaxed plantar flexed ankle position. In the morning the individual gets out of bed and steps down, dorsiflexing the ankle, and the delicately healed microtears in the plantar fascia rupture again. The attempted unsuccessful repairs of the microtears lead to chronic inflammation. This accounts for the pain of post static dyskinesia. One of the newer treatments for plantar fasciitis, the night splint, is thought to operate by keeping the foot in the dorsiflexed position all night in the splint and permits the plantar fascia to heal in this extended position, and then when the individual takes the first step in the morning the microtears in the plantar fascia will not rupture again. The chronic microtearing and reparative process may result in thickening of the plantar fascia when left untreated.[11] The thickening of all three bands of the plantar fascia in individuals with painful plantar fasciitis has been demonstrated with ultrasonography and magnetic resonance imaging (Figures 2A/B). Microruptures, hemorrhage, collagen degeneration at Sharpey's fibers (where the fascia inserts into the calcaneus), lead to fibrosis and ossification of the plantar fascia.(figure).[5,12]

The heel spur occurs dorsal to the plantar fascia and is located at the insertion of the flexor digitorum brevis tendon.

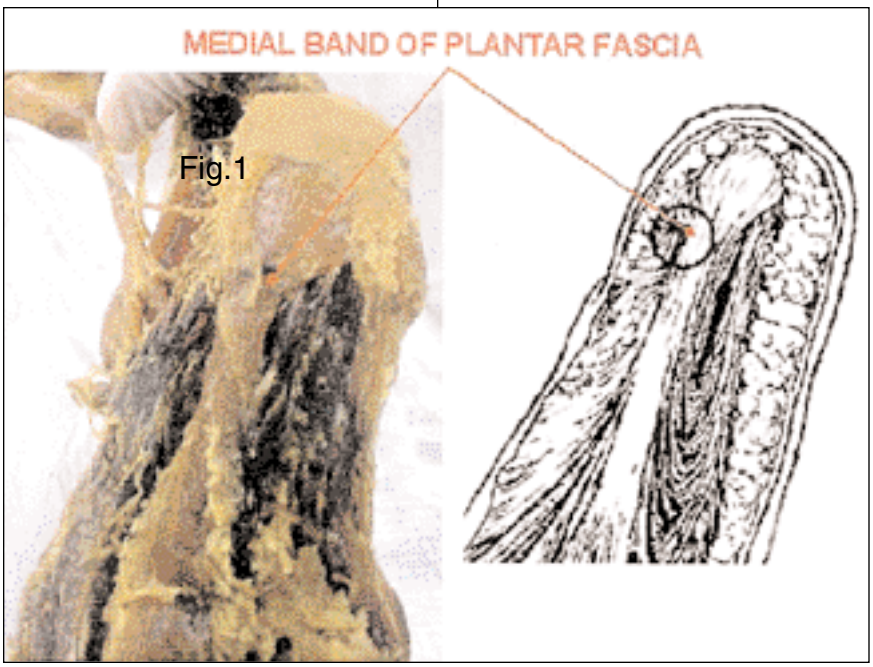

Figure 1. The medial band of the plantar fascia at the main insertion on the medial plantar tubercle of the calcaneus.

Plantar fasciitis is more frequent in females, associated with middle age (most commonly between age 40 to 60,[13] and occupations involving long periods of standing and tight tendoachilles.[14-18] Although plantar fasciitis most frequently occurs unilaterally, there is a bilateral presentation up to 15 percent of the time.[19] Athletes involved in running and jumping sports are likely to develop plantar fasciitis.[20-22] Patients sometimes remember increased walking or sports activity prior to developing plantar fasciitis.

Both the flat foot and the cavus foot are associated with plantar fasciitis. In the over pronated foot, which fails to supinate during propulsion, the plantar fascia abnormally stretches to stabilize the foot during toe-off.[13] Similarly the tight tendoachilles results in a pronated foot type, again resulting in excessive stretching of the plantar fascia. In contrast the cavus foot is often unable to pronate and dissipate ground reaction forces at heel strike, increasing the stress in both the plantar fascia and the fat pad.

Symptoms and Physical Examination of the Patient with Plantar Fasciitis

The diagnosis of plantar fasciitis is based upon clinical presentation

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rather than radiographs.[2,23] Patients complain of pain upon the first step in the morning (post static dyskinesia). The pain may be severe enough that the patient limps or is actually unable to bear weight on the affected heel. The pain lessens after taking a few steps, but tends to return again after walking and standing all day. Pain tends to reoccur during the day after periods of sitting when the patient gets up out of a chair.

Examination of the foot generally reveals a normal appearing foot with no gross deformity. The heel is usually not swollen or erythematous.

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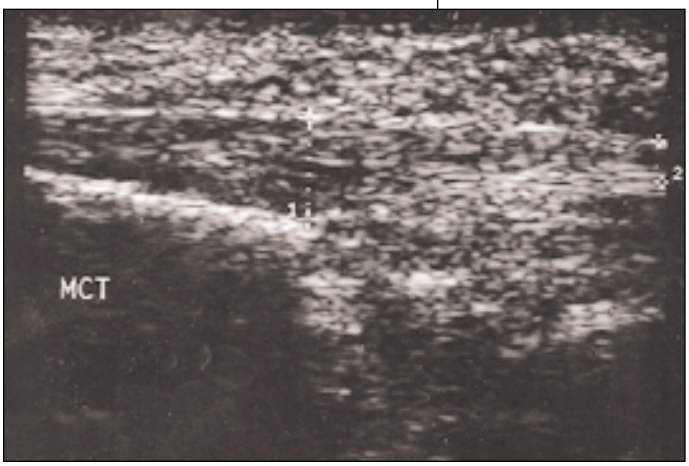

Figure 2A. Ultrasound imaging of normal medial band of the plantar fascia. The vertical line labeled "1" shows the relatively narrow width of the normal plantar fascia.

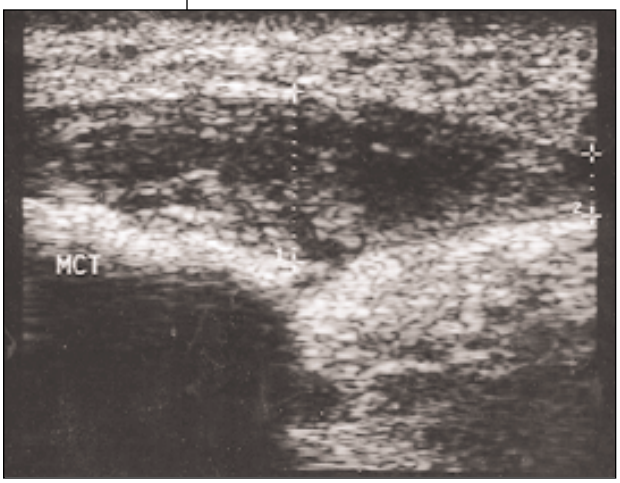

Figure 2B. Ultrasound imaging from patient with plantar fasciitis with enlarged medial band. The vertical line labeled "1" shows the relatively thickened width of the inflamed plantar fascia. The vertical line labeled "2" shows the normal width where the inflammation had disappeared. Although this ultrasonography study only shows the medial band, thickness of the central band and the lateral band has also been demonstrated.

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There is a point of maximal tenderness at the plantar medial tuberosity of the calcaneus (Figure 1). Tenderness on palpation of the plantar medial calcaneal tubercle is sometimes intensified by dorsiflexion of the ankle and toes. The middlevel plantar fascia is often painful to palpation as well.[24] The plantar fascia should also be palpated for nodules, indicating plantar fibroma or multiple nodules (fibromatosis) (Figure 3).

Figure 3. Plantar fibromatosis. Notice the medial bulges in the plantar fascia prominent on the medial side of the foot.

Imaging

X-rays are not particularly helpful unless they show evidence of another diagnosis, such as calcaneal stress fracture or bone tumor. The body's response to repeated microtears, inflammation and traction of the plantar fascia is the deposition of calcium, which results in the characteristic heel spur (Figure 4). Although the lateral heel spur is not the cause of heel pain in plantar fasciitis, it is associated with the disorder.[25-27] Plain lateral radiographs reveal a heel spur in approximately 50 percent[19,28] to 75 percent[29] of patients with painful plantar fasciitis; however, studies have observed that a heel spur may be found in 13 percent[30] to 63 percent[29] of asymptomatic heels. The heel spur occurs dorsal to the plantar fascia and is located at the insertion of the flexor digitorum brevis tendon.[31] Although the typical horizontal heel spur is not the cause of pain, some suggest that down-pointing bony spurs may actually produce heel pain.[32] Radiographs do not have to be performed on the first visit if there is no suspicion of fracture or more serious etiology of heel pain, but should be performed prior to injection.[33] Bone scans, although rarely necessary for plantar fasciitis, may show a positive delayed technetium 99 bone scan in chronic conditions.[31]

Figure 4. Characteristic heel spur associated with plantar fasciitis is pointy, well demarcated and parallel to the ground.

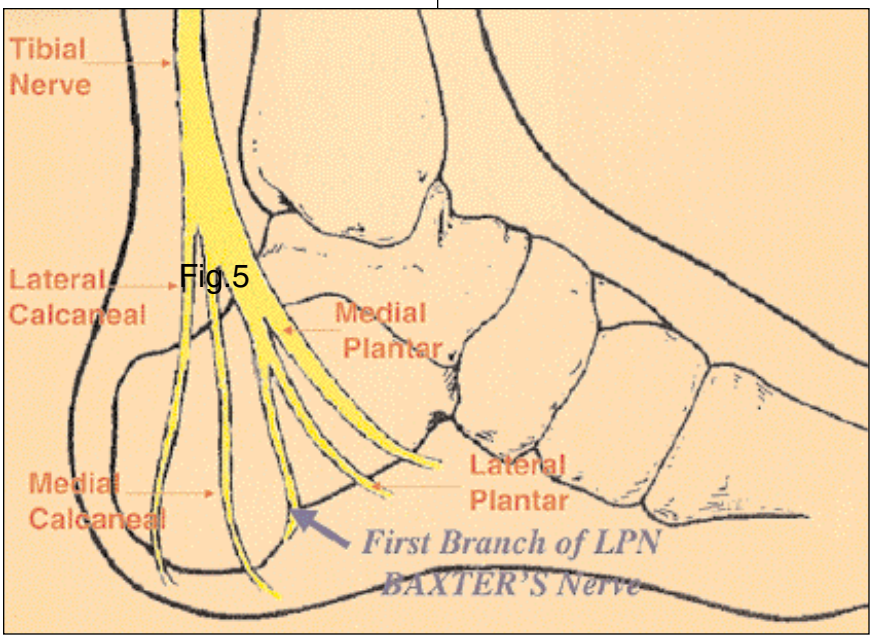

Figure 5. Anatomy of the tibial nerve. Notice that the tibial nerve divides into 3 major branches, the medial calcaneal nerve, the medial plantar nerve, and the lateral plantar nerve. The first branch of the lateral plantar nerve is Baxter's nerve, thought to be a major etiology of plantar heel pain.

Differential Diagnosis of Plantar Heel Pain

Almost any musculoskeletal condition can result in heel pain. The most common are described below.

Nerve Entrapment: Entrapment of the medial calcaneal nerve is a cause of heel pain. The tibial nerve divides at the level of the medial malleolus into superficial and deep branches (Figure 5). The superficial branch runs subcutaneously above the laciniate ligament and is named the medial calcaneal nerve. The medial calcaneal nerve innervates the plantar heel pad and is responsible for sensation to the plantar heel. Numbness in the plantar aspect of the heel after surgery for plantar fasciitis is a result of the medial calcaneal nerve inadvertently being cut.

An important cause of plantar

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fasciitis is entrapment of the first branch of the lateral plantar nerve (Baxter's nerve), also known as the nerve to abductor digiti quinti muscle, thought to account for the cause of plantar heel pain in 20 percent of patients (Figure 5).[31] The first branch of the lateral plantar nerve passes right next to the plantar medial tubercle of the calcaneus, where it may become entrapped and compressed between the abductor hallucis muscle and the medial belly of the quadratus plantae muscle.

The symptoms of entrapment of the first branch of the lateral plantar nerve include paresthesias along the course of the nerve, but no sensory deficit. Theoretically, motor weakness in the abductor digiti quinti muscle may occur and the patient is unable to abduct the fifth toe. Electromyography and nerve conduction studies are not helpful. Treatment of nerve compression is similar to treatment for plantar fasciitis.

Radiculopathy in the L-5 to S-1 distribution should be considered in the patient with low back pain especially when the heel pain is bilateral.[31]

Fat pad atrophy is demonstrated by pain directly under the bony prominence in the central aspect of the heel.

Heel Fat Pad Atropy: The heel pad cushion is composed of globules of fat encapsulated in a fibroelastic reticulated structure,[34] which effectively absorbs 20-25 percent of the contact force at heel strike.[35] The stresses to the tissues beneath the heel pad are inversely proportional to the thickness of the heel fat pad.[36] After the age of forty there is loss of collagen, elastic tissue, water and the overall thickness of the heel pad diminishes.[33] Fat pad atrophy is demonstrated by pain directly under the bony prominence in the central aspect of the heel.[24,37] The heel pad no longer feels thick and rubbery (Figure 6A). The bony calcaneal tuberostiy can be palpated. Loss of height of the fat pad may be observed (Figure 6B). In addition to normal aging, heel pad atrophy can be induced by injection of corticosteroids into the plantar heel fat pad.

Trauma/Calcaneal Fracture/Stress Fracture: Calcaneal fracture is an important cause of heel pain. The calcaneus is the most frequently fractured bone in the foot.[38] Most calcaneal fractures heal without major problems; however, some patients may be left with persistent severe heel pain. The patient presents with painful, tender prominences under the plantar surface of the calcaneus or from lateral peroneal impingement by the dis-

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Figure 6A. Patient with bilateral fat pad atrophy. Notice the shiny callused plantar aspect of the feet.

Figure 6B. Loss of height of the heel pad in patient with bilateral fat pad atropy from Figure 6A.

Figure 7A. Posterior tuberosity fracture of the calcaneus in a neuropathic patient. This patient demonstrated weakness of plantarflexion and calcaneal gait, characteristic of this type of trauma.

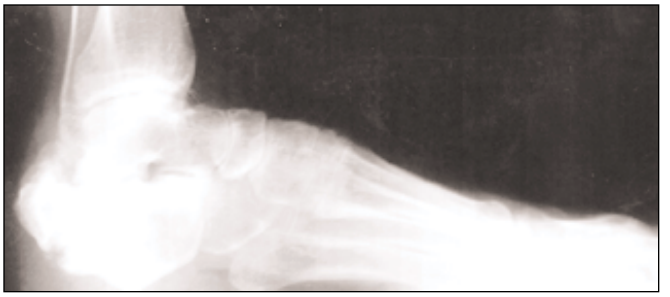

Figure 7B. Healing of posterior tuberosity fracture in an upwardly displaced attitude resulted in chronic pain throughout the heel.

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placed tuberosity fragment. Although 75 percent of calcaneal fractures involve the subtalar joint, the major long-term complications arise not from problems in the joint but from distortion of the calcaneal anatomy, with the heel shortening and widening, causing significant soft-tissue impingement. The patient with a calcaneal fracture generally has a history of falling from a height. The high fall drives the talus down against the medial side of the calcaneus. Calcaneal fractures which involve the subtalar joint result in a reduction in Bohler's angle (normally 20-40º).

Figure 8. This calcaneal fracture would have been missed with a lateral view. A calcaneal axial x-ray as shown here was necessary to see the fracture.

Posterior calcaneal tuberosity (avulsion) fractures are caused by a violent contraction of the Achilles tendon, with the foot in a fixed position[39,40] or a fall that causes the patient's heel to strike a hard surface with the triceps surae tensed.[41] Examination reveals weakness of the posterior muscle group with reduced active plantarflexion and calcaneal gait (Figure 7A/B).[42]

Calcaneal stress fractures do not involve falling from a height, but may reveal a history of milder trauma such as long periods of walking, a sports injury or ankle sprain. With calcaneal stress fracture, physical examination may show tenderness of the entire calcaneus rather than a point of maximal tenderness at the plantar medial tubercle as in plantar fasciitis. Edema and erythema of the heel are present, but the heel is not usually ecchymotic.[33] Pain is present at rest as well as weight bearing. A calcaneal axial radiograph shows the foot in the sagittal plane and may show some calcaneal fractures that a lateral x-ray will miss (Figure 8). Bone scan shows increased third-phase uptake. Six to eight months is necessary for full recovery.[43]

Infection: Infection secondary to a puncture wound or foreign body must be considered. Elevated white blood cell counts and body fever are diagnostic.

Arthritis: Patients with heel pain, especially older patients, should be questioned as to a history of rheumatoid arthritis, gout, or seronegative arthritis, all of which can be an etiology of heel pain. Proliferative periostitis around the calcaneus is diagnostic of seronegative spondyloarthropathy or rheumatoid arthritis (Figures 9A/B). Seronegative arthropathy may occur in a young male with heel pain and associated lower back pain, or other nonarthritic complaints such as penile discharge, dermatologic or eye symptoms. It should be noted that the heel pain is likely to be unilateral since seronegative spondyloarthritis is a pauciarticular asymmetric arthritis.[44] In contrast bilateral heel pain can be a presenting symptom of sarcoidosis and can accompany or precede sarcoid arthritis.[45]

A good foot orthosis to relieve the symptoms of plantar fasciitis should result in a decrease in strain in the plantar fascia.

Treatment for Plantar Fasciitis

Conservative treatment should resolve symptoms of plantar fasciitis within two to twelve weeks.[46] People having heel pain for more than twelve months are least likely to have positive outcomes after conservative treatment.[6] Therefore,

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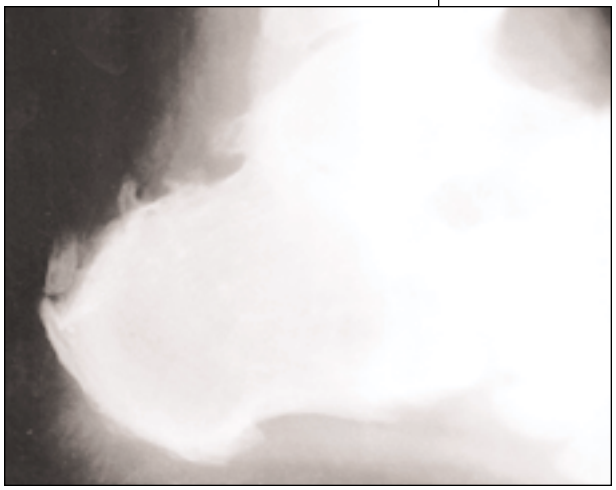

Figure 9A. Notice the exuberant fluffy periostitis surrounding the calcaneus. This patient had ankylosing spondylitis.

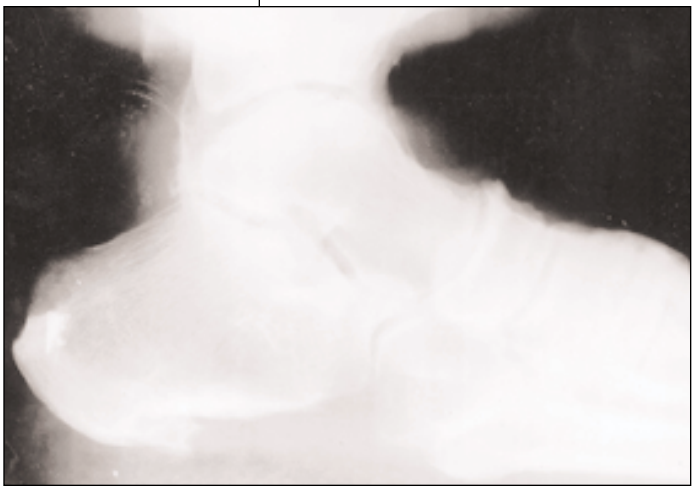

Figure 9B. Large atypical heel spur, does not look pointy like heel spur in Figure 4. This patient had psoriatic arthritis.

the earlier the treatment is initiated, the better the chances of complete relief. Treatment for plantar fasciitis usually involves several modalities at once. For example in a recent study involving a four-point approach to the management of plantar fasciitis, all patients received a heel cup or foot orthosis, exercise regimen, night splint, and nonsteroidal anti-inflammatory (NSAID) medication.[11] However, the NSAID therapy was given to those with more acute symptoms.

The most common treatments for plantar fasciitis include: heel pads, foot orthoses, night splints, and injections. Historically, radiotherapy was used as a treatment and is currently being revived in Europe; however, this will not be discussed here.[47] Some of the empirical evidence for common treatments are reviewed below.

Heel Pads: The *SofSpot Viscoheel* (Bauerfeind USA, Inc, Kennesaw, GA) (Figure 10) is a silicone polymer heel cushion which has a built-in area of softer durometer specially designed to disperse weight around the plantar medial tubercle of the calcaneus, the site of inflammation in plantar fasciitis. Viscoelastic heel pads have been reported to reduce the impact of heel strike on the leg and low back by as much as fifty percent.[49-51] Studies have shown reduction or absence of heel pain occurred in 73 percent to 100 percent of individuals wearing the *Viscoheel Sof Spot* for several weeks.[53,54] *The Tuli heel cup* (Medi-Dyne, Colleyville, TX) is a soft rubber heel cushion (Figure 11A). The new sports variety is thicker and has more of their trademark waffling (Figure 11B/C). In patients with heel pain caused by fat pad atrophy, hard plastic heel cups (*M-F Athletic company*, Cranston, RI) theoretically position the heel pad underneath the calcaneus, restoring the natural cushioning and compressibility.[28,34]

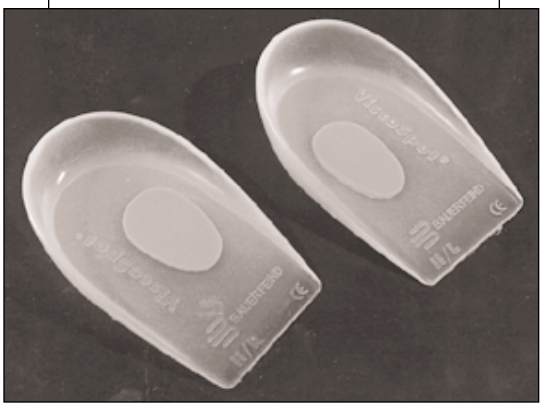

Figure 10. The *SofSpot Viscoheels* (Bauerfeind USA, Inc, Kennesaw, GA).

Custom/Prefabricated Foot Orthoses: The plantar fascia is in tension when the foot is loaded. Therefore a good foot orthosis to relieve the symptoms of plantar fasciitis should result in a decrease in strain in the plantar fascia.[55] Kogler and associates found that the UCBL orthosis

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and two other foot orthoses significantly decreased the strain in the plantar aponeurosis compared to the barefoot control and were considered effective arch supports. In contrast the functional foot orthosis, prefabricated foot orthosis, and shoe alone did not effectively reduce plantar fascia strain.[55]

Custom foot orthoses of various varieties have been reported to offer relief of heel pain in: 81 percent after wearing the orthosis for 3 months,[56] and in 74 percent of symptomatic runners with plantar fasciitis.[57]

A number of comparative studies found that functional foot orthoses relieved heel pain better than: urethane heel pads;[58] viscoelastic heel cups or anti-inflammatory therapy;[59] however, there was no difference in relief in heel pain between functional foot orthoses and inverted foot orthoses;[60] or whether the functional foot orthosis was fabricated from rohadur or TL-61.[61]

The UCBL orthosis has been reported to be effective in reducing the symptoms of plantar fasciitis in patients with extreme pronation[17,62] and was found to reduce heel pain caused by plantar fasciitis in 83 percent of those wearing this orthosis.[63] The UCBL orthosis, however, is bulkier, more restrictive in foot motion, more difficult to properly fit than a functional foot orthosis or arch support, and consequently results in less patient compliance.[17]

Stress relaxation is the decrease in stress with time once a material under loading has deformed to a constant length.

Recently, the first prospective randomized clinical trial on the treatment of plantar fasciitis was conducted on 236 adult patients from fifteen orthopedic treatment centers.[64] There were five treatment groups. All groups engaged in a stretching program. One group was treated with stretching only. The other four groups stretched and used one of four different shoe inserts, including a silicone heel pad, a felt pad, a rubber heel cup or a custom-made polypropylene foot orthosis. After eight weeks of treatment 95 percent improved with the *Bauerfeind silicone heel pad* (Bauerfeind, Kennesaw, GA); 88 percent improved with the *Tuli rubber heel cup* (Medidyne, Colleyville, TX); 81 percent improved with the *Hapad 3/4 length felt insert* (Hapad, Bethel Park, PA); 72 percent improved with stretching only, and 68 percent improved with the 3/4 length polypropylene neutral custom foot orthoses *(Prolab,* San Francisco). The authors concluded that a prefabricated shoe insert in conjunction with a stretching program was more likely to cause improvement in symptomatic plantar fasciitis than a custom polypropylene foot orthosis. The authors also reasoned shock absorption might have been the key feature in the prefabricated foot orthoses. Shock absorption is most effective in the silicone insert, followed by the Tuli rubber insert, and the felt Hapad insert with the polypropylene foot orthosis being the poorest shock absorber.

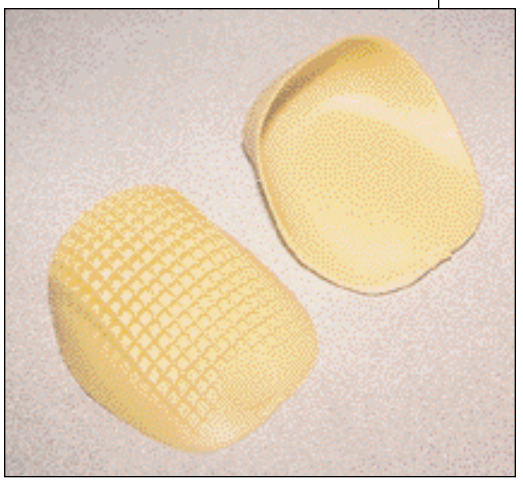

Figure 11A. Classic *Tuli heel cup* with characteristic waffling design (MediDyne, Colleyville, TX).

Figure 11B. The new *sports green Tuli heel cup* (MediDyne, Colleyville, TX) is thicker and has more of their trademark waffling.

Figure 11C. New *Tuli Heel cup* (MediDyne, Colleyville, TX) shown from bottom.

Injections: Heel injections are a commonly used office procedure for the patient with heel pain. In one study 24 of 26 heels injected with hydrocortisone remained asymptomatic at the time of the 3-month follow-up.[65] In contrast, another report found that heel injections provided relief for four to six weeks; however, at the time of the six month follow-up the pain had returned in all cases.[66] Similarly, in another study steroid injection was found to provide pain relief for greater than 3 days in only 35 percent of patients.[6]

Patients who present with a highly symptomatic foot with a point of maximal tenderness may get relief from being injected immediately. Some have concluded that

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heel injections are most effective for the acutely symptomatic heel and orthotics are best for chronic heel pain.[7,13] However, some prefer to postpone injections anywhere from ten weeks[46] to four months[11] after unsuccessful conservative treatment. Up to three injections can be administered in a year, spaced approximately two to four weeks apart. The patient can be prone, supine or seated. The ankle and great toe can be dorsiflexed to find the point of maximal tenderness, which is at the medial aspect of the plantar fascia origin. The safest, least painful approach to the origin of the plantar fascia is from the medial side of the foot near the origin of the plantar fascia (Figure 12). Plantar surface injections should be avoided because they might leak corticosteroid into the fat pad. Lateral injections should also be avoided. One to two milliliters of 1 percent or 2 percent lidocaine and one milliliter of .5 percent must be combined with 10 milligrams of triamcinolone hexacetonide for a total of 2.5 milliliters. A 1.5 inch length 25-27 gauge needle allows for a relatively smooth entry as well as infiltration technique and "redirecting the needle." The major risk of injecting the origin of the plantar fascia is rupture of the tissue.[67] Injections may also thin the calcaneal fat pad if inadvertently deposited into the calcaneal fat pad. Patients should avoid heavy impact loading activities for seven to fourteen days after the injection, such as running and jumping immediately after injection, but should continue to gently stretch the plantar fascia and continue to use heel pads and orthoses.

A short leg walking cast was the most effective of numerous other conservative therapies which included steroid injection, rest, ice, runner's shoe, crepe-soled shoe, and heel cup.

Posterior Splint: Recently the Posterior Night Splint has been used in the treatment of recalcitrant cases of plantar fasciitis (figure 13).[32,68-73] The night splint should maintain the plantar fascia in a stretched position during sleep by passively dorsiflexing the ankle five to ten degrees. As previously mentioned during sleep, the unbraced foot and ankle assumes a plantarflexed position due to the normal tone in the gastrocsoleus muscles. This nonfunctional plantarflexed position results in tightness of the posterior muscle group and the plantar fascia and is thought to account for the severe pain which patients with plantar fasciitis experience upon their first step out of bed in the morning as the plantar fascia resumes its functional weight-bearing length.[32] Stress relaxation is the decrease in stress with time once a material under loading has deformed to a constant length.[74] This is due to the viscoelastic nature of all biological tissues.

Similarly, when the plantar fascia is kept in a dorsiflexed, stretched position by the night splint, the biomechanical phenomenon of stress relaxation occurs and the plantar fascia relaxes in the new stretched position. The tension night splint maintains the foot in a dorsiflexed attitude while sleeping, thereby preventing tightness and contractures of the Achilles tendon and plantar fascia that occurs as a result of the plantarflexed posture of the foot during sleep. The night splint should be used for a trial of six to eight weeks.

The tension night splint is typically used in combination with other treatments for heel pain. A night splint in conjunction with stretching, viscoheels and nonsteroidal antiinflammatory medications was more effective in the treatment of plantar fasciitis than the same treatments without the night splint.

Eleven of 14 patients with one year or more of heel pain had complete resolution in less than four months with a polypropylene ankle foot orthosis set in 5-degree dorsiflexion, stretching, Tuli heel cups, and nonsteroidal antiinflammatory medication at the time of nine month follow-up.[73] Of the 3 patients who did not improve, overweight and noncompliance were considered to be the cause of the problem.

Mizel and associates[69] treated 57 patients who were

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symptomatic for at least 10 months with a combination of a molded ankle foot orthosis and a rocker bottom shoe. At average follow-up of 16 months, symptoms were completely resolved in 59 percent and improved in 18 percent.

Powell and colleagues[71] reported 88 percent improvement in 37 patients with recalcitrant plantar fasciitis treated with a dorsiflexion night splint at the time of six month follow-up.[71]

Although the literature on night splints tends to be fairly positive, patients are required to wear the night splint for as long as four months, making compliance difficult, especially in obese individuals. Some night splints may also be uncomfortable to wear and sleep in all night.

Short Leg Walking Cast: Thirty-two patients with heel pain for more than one year were treated with a short leg walking cast for an average of six weeks (range, 1-12 weeks).[75] At the time of 15-month average follow-up, 25 percent had complete resolution of heel pain and 61 percent reported improvement. The authors concluded that casting should be tried prior to surgical intervention. In another study of the outcome of nonsurgical treatment for plantar fasciitis, a short leg walking cast was the most effective of numerous other conservative therapies which included steroid injection, rest, ice, runner's shoe, crepe-soled shoe, and Tuli's heel cup.[76]

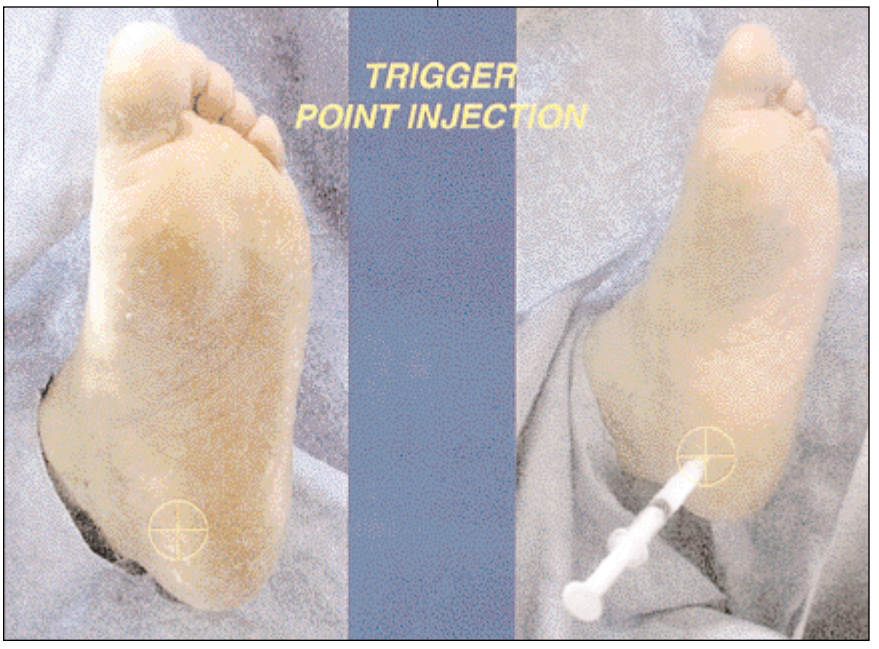

Figure 12. Trigger point injection into posterior medial aspect of heel at the point of maximal tenderness.

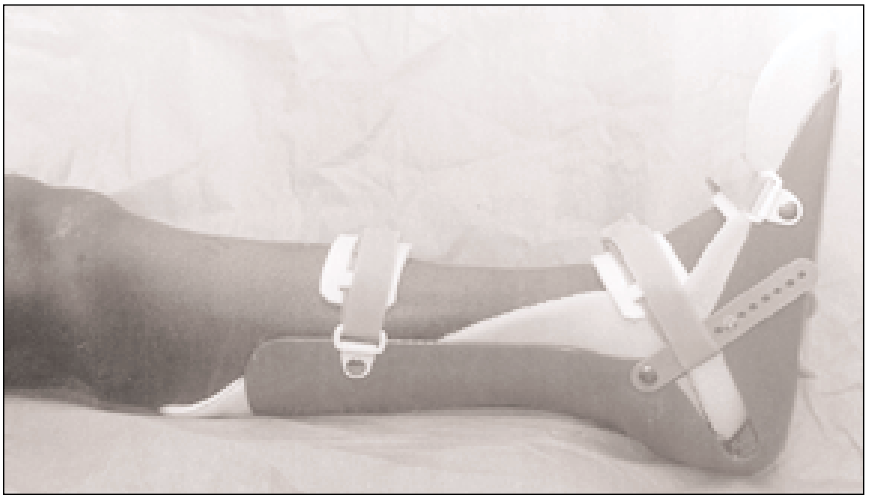

Figure 13. Posterior night splint.

Recommendations for Treatment of Plantar Fasciitis

The authors' preference in the management of plantar fasciitis revolves around how long patients have had heel pain.

Initial treatment in a patient with heel pain up to three months: Patients with symptomatic heel pain for up to three months should be advised to reduce activity and to stay off their feet, start a stretching program and wear a heel cushion or insole inside the shoe. If they are overweight, weight reduction is discussed and the patient is advised to lose weight. The patient's shoes are observed. Many patients find it helpful to wear an elevated heel, which transfers pressure to the forefoot. Running shoes with thick shock absorbing soles and walking shoes with wide rubber soles are good for reducing plantar weight bearing pressure. If the heel is very acutely symptomatic, an injection is administered at the first visit after x-raying. Patients should be allowed at least four weeks of initial treatment.

Heel pain three to 12 months: Patients having heel pain for approximately three to twelve months may continue with the same treatments as above. However, one or more of the following will be added: custom foot orthoses, night splints, injections, physical therapy and nonsteroidal anti-inflammatory medications.

Heel pain for more than one year: Patients having heel pain for more than a year may continue with all of the treatments above, but should also consider surgery as an option. In extreme cases the patient may be forced to permanently change activities of daily living, including job modification. ■

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EXAMINATION

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See answer sheet on page 115.

1) In most cases conservative treatment should resolve the symptoms of plantar fasciitis within:
   A) one week
   B) two to twelve weeks
   C) three months
   D) Impossible to determine

2) The tibial nerve divides at the level of the medial malleolus into superficial and deep branches. The superficial branch, which runs subcutaneously above the laciniate ligament, is named the:
   A) Lateral plantar nerve
   B) Medial plantar nerve
   C) Medial calcaneal nerve
   D) Lateral calcaneal nerve

3) Which one of the following nerves supplies sensory innervation to the medial and plantar heel pad?
   A) medial calcaneal nerve
   B) lateral calcaneal nerve
   C) Lateral plantar nerve
   D) Medial plantar nerve

4) Which of the following nerves would be most susceptible to compression beneath the heel?
   A) the first branch of the medial plantar nerve
   B) The first branch of the lateral dorsal cutaneous nerve
   C) The medial calcaneal nerve
   D) The first branch of the lateral plantar nerve

5) Baxter's nerve is found between what two muscles?
   A) Medial belly of quadratus plante and abductor digiti quinti
   B) Abductor hallucis and flexor digitorum brevis
   C) Abductor hallucis and medial belly of quadratus plantae
   D) Abductor hallucis and medial band of plantar fascia

6) In the first prospective randomized clinical trial on the treatment of plantar fasciitis conducted on 236 adult patients from fifteen orthopedic treatment centers, the most effective treatment for initial plantar fasciitis after 8 weeks of treatment was:
   A) Stretching alone
   B) Stretching and Tuli heel cups
   C) Stretching and Bauerfeind silicone heel pads
   D) Stretching and custom polypropylene foot orthosis

7) According to the research literature, which foot orthoses have been found to reduce heel pain from plantar fasciitis?
   A) Bauerfeind silicone heel pads
   B) Root Functional foot orthosis
   C) UCBL foot orthosis
   D) All of these

8) The initial treatment for plantar fasciitis consists of:
   A) Endoscopic plantar fasciotomy
   B) Custom foot orthoses
   C) Reduction in weight bearing activity and heel cushion or insole.
   D) Reduction in weight bearing activity, stretching program and heel cushion or insole.

9) The most important purpose of taking an x-ray in patients with plantar fasciitis is:
   A) To diagnosis a heel spur
   B) To diagnosis a calcaneal stress fracture or bone tumor
   C) To determine whether a patient requires surgery
   D) To rule out posterior heel involvement

10) The main causes of fat pad atrophy include:
   A) Steroid injections into the heel pad
   B) Normal aging
   C) Traction on the plantar fascia
   D) Both normal aging and steroid injections

11) How long a trial should night splints be used for?
   A) 2 weeks
   B) 6-8 weeks
   C) 6 months
   D) 1 year

12) The night splint stretches the plantar fascia by the biomechanical phenomena of:
   A) Creep deformation
   B) Viscoelasticity
   C) Stress relaxation
   D) Rate dependent properties

13) Which one of the following is NOT helpful in distinguishing calcaneal stress fracture from plantar fasciitis?
   A) Pain is present off weight as well on weight bearing with calcaneal stress fracture
   B) The entire heel may be swollen and tender with calcaneal stress fracture
   C) X-rays will show a calcaneal stress fracture
   D) The patient generally will describe a history of falling from a height with calcaneal stress fracture

14) Generally speaking, the earlier the treatment of plantar fasciitis, the better the outcome.
   A) True
   B) False

15) What is the relationship between plantar fasciitis and heel spur on radiograph?
   A) 1/2 to 3/4 of patients with plantar fasciitis have heel spur, but up to almost 2/3 of heel spurs are present in asymptomatic heels.
   B) The heel spur is the cause of the heel pain.
   C) There is no relationship be-

Continued on page 114

Continuing Medical Education

EXAMINATION

(cont'd)

tween plantar fasciitis and heel spur.
D) Approximately 50 percent of patients with plantar fasciitis have a heel spur, but patients with asymptomatic heels generally do not have heel spur.

16) The effectiveness of injection therapy for management of plantar fasciitis shows:
A) There is usually a partial reduction in heel pain after 1 or 2 injections.
B) There is usually short acting relief of heel pain, but after a while the heel pain usually returns.
C) Two injections are usually necessary, but if done properly, should alleviate heel pain in patients having pain for under one year.
D) Injections should be administered plantarly for the best effect

17) Generally the maximum amount of heel injections should not exceed:
A) 1 per year
B) 1 per month
C) 3 per year
D) Any amount as long as administered properly

18) The major problem with the night splint in the treatment of plantar fasciitis is:
A) compliance
B) Requires long periods of time to work
C) Especially poorly tolerated by obese individuals
D) All of these

19) Surgery for plantar fasciitis should be considered:
A) After a short trial of conservative therapy.
B) Even without conservative therapy in patients who have had heel pain for more than 3 years.
C) After conservative therapy fails in patients who have had plantar fasciitis for more than one year.
D) Surgery should never be considered because conservative treatment always works.

20) The prognosis for plantar fasciitis may be described as:
A) May resolve without any treatment
B) Usually resolves with conservative treatment
C) May require long periods of time to resolve even with conservative treatment
D) Any of the above

See answer sheet on page 115.

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Update on Plantar Fasciitis
(Sobel and Levitz)

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2.	A	B	C	D	12.	A	B	C	D
3.	A	B	C	D	13.	A	B	C	D
4.	A	B	C	D	14.	A	B	C	D
5.	A	B	C	D	15.	A	B	C	D
6.	A	B	C	D	16.	A	B	C	D
7.	A	B	C	D	17.	A	B	C	D
8.	A	B	C	D	18.	A	B	C	D
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