

Use of Posterior Night Splints in the Treatment of Plantar Fasciitis

Plantar fasciitis is a frequent cause of heel pain in athletes, as well as in persons who are not involved in sports. Stretching, strengthening, correction of training errors and orthotics are essential components in any treatment program. For patients who do not respond to these interventions, posterior night splints can obviate the need for invasive therapies such as corticosteroid injections and surgery.

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Plantar fasciitis is a common cause of heel pain. The patho-physiology of this condition is often misunderstood, and predisposing conditions are frequently not recognized. A lack of understanding of the biomechanics of plantar fasciitis may result in an inadequate treatment plan and failure to relieve the patient's pain. Even with appropriate treatment, plantar fasciitis is often resistant to therapy. Heel pads, stretching and orthotics are the cornerstones of any rehabilitation program. Because of the high failure rate of these measures, injection of the heel with corticosteroids is frequently performed. While corticosteroids are often effective, they can also cause problems, especially with repeated use. Night splints provide relief for many patients and carry little, if any, risk.

Prevalence

Pain in the foot and ankle is a common problem among runners. In surveys of injured runners, the prevalence of foot and ankle pain was surpassed only by that of knee pain.(1) Plantar fasciitis and Achilles tendonitis are the most common causes of foot and ankle pain in this population.(2) The most common cause of localized heel pain is plantar fasciitis.(3) Persons who are overweight and who spend long periods of time standing are also at increased risk of developing plantar fasciitis.

Anatomy

The plantar fascia originates at the medial tubercle on the plantar surface of the calcaneus. From its narrow origin on the calcaneal tubercle the plantar fascia fans out, becoming thinner, and attaches to each of the metatarsal heads. The plantar fascia functions much like a bowstring and supports the longitudinal arch of the foot (4) The medial calcaneal nerve, a branch of the posterior tibial nerve, innervates the origin of the fascia.(5) Overlying the origin of the plantar fascia is a fat pad that functions as a shock absorber during the heel-strike phase in running.(6)

Etiology

Plantar fasciitis is an overuse injury resulting in micro-tears of the fascia at its origin.(7). These micro-tears frequently occur after a change in a runner's training routine. Some investigators believe that overuse may cause entrapment of the posterior tibial nerves that innervate the plantar surface of the heel.(8)

History

In the patient with heel pain, it is important to obtain a detailed history before performing the physical examination. Rapid increases in the number of miles run per week, an increased frequency or intensity of workouts, a change in terrain or running surface, and a decrease in the recovery time between workouts have all been cited as precipitating factors in plantar fasciitis among athletes.(9) In the non-athlete, the history will often reveal a recent increase in the amount of walking, standing or stair climbing at the patient's job site.

The classic complaint of patients who present with plantar fasciitis is a sharp, piercing pain through the heel and foot when attempting to stand on awakening.(10) The pain gradually abates with ambulation but recurs on standing after the patient has been seated for a prolonged period. Pain also increases at the beginning of a workout, decreases during exercise and may recur toward the end of an intense workout.(11) Pain is usually lessened during sleep and is not likely to wake the patient.(12)

Examination

Palpation of the heel elicits pain at the medial tubercle and along the medial longitudinal arch.(13) Occasionally, swelling of the fascia or a nodule may be noted during examination of the plantar surface of the foot.(14) Passive dorsiflexion of the foot or extension of the great toe may intensify the pain.(15)

Examination of the arch of the foot is essential to the evaluation for plantar fasciitis. Cavus deformity (high arch) and pes planus (flatfoot) are associated with an increased risk of injury to the plantar fascia.(14) Pes planus with excessive pronation is, however, much more likely than a cavus deformity to be found during the evaluation of the patient with heel pain.

Excessive pronation results in decreased stability of the hindfoot. This lack of stability places an increased strain on the origin of the plantar fascia during the stance and push-off phases of running.(16) Entrapment of the nerve branch to the abductor digiti quinti(17) and the medial calcaneal branches of the posterior tibial nerve(18) is also thought to be an important source of heel pain. Pes planus and excessive pronation increase the severity of nerve entrapment and contribute to heel pain in overweight, middle-aged patients who stand for long periods on hard surfaces.(13)

It is also important to examine the patient's footwear. Loose heel counters, inadequate arch support, a tight toe-box construction, or a worn-out pair of shoes have all been linked to an increased incidence of heel pain.(15) If the patient is a runner, his or her athletic shoes should be evaluated for any of these shortcomings. If possible, an older, well-worn pair of shoes should also be examined. Abnormal wear patterns on an older pair of shoes often indicate an underlying foot mal-alignment or instability of the hindfoot. Excessive wear to the medial portion of the heel of the shoe would indicate excessive pronation.

Imaging Studies

In some patients, the body's response to repeated micro-tears of the plantar fascia is the deposition of calcium. Calcification of the plantar fascia often results in the formation of a heel spur. The spur most often appears on radiographs as an anterior and horizontal projection off the calcaneus at the site of the origin of the plantar fascia.

The significance of a spur is controversial. In a study(19) of heel roentgenograms in 461 symptomatic patients, heel spurs were found in 125 patients (27 percent). Heel pain developed in only 10 percent of the patients with spurs. Up to 50 percent of patients with plantar fasciitis have heel spurs detectable on radiographs,(20) but the presence of a spur does not correlate with a more severe or prolonged clinical course.(13) Because of their low diagnostic and prognostic value, radiographs are not recommended in the routine evaluation of the patient with plantar fasciitis.

Differential Diagnosis

CALCANEAL APOPHYSITIS -Plantar fasciitis usually does not develop in adolescents. Calcaneal apophysitis, or Sever's disease, is a more likely cause of heel pain in this population.(21) Calcaneal apophysitis is an overuse injury to the open epiphysis of the

posterior calcaneus. Treatment of calcaneal apophysitis consists of rest, stretching and a gradual return to activity.

TARSAL TUNNEL SYNDROME-The symptoms of tarsal tunnel syndrome may also be confused with plantar fasciitis. Tarsal tunnel syndrome is caused by entrapment of the posterior tibial nerve in the tarsal tunnel, as the nerve passes below the medial malleolus.(22) Unlike the pain of plantar fasciitis, the pain of tarsal tunnel syndrome is often worse at bedtime and is better on rising. Percussion over the tunnel may produce pain in the foot (Tinel's sign), and the diagnosis is confirmed with electro-diagnostic studies. Treatment consists of rest, non-steroidal anti-inflammatory drugs (NSAIDs) or corticosteroid injections and, in recalcitrant cases, surgical release.(23)

CALCANEAL FRACTURE-A history of acute trauma can be associated with a bony injury and should prompt the clinician to rule out a calcaneal fracture.

SYSTEMIC ILLNESSES-Other causes of heel pain, especially bilateral pain, are systemic illnesses such as systemic lupus erythematosus, gout, ankylosing spondylitis and Reiter's syndrome.

Rehabilitation

Initial treatment of plantar fasciitis consists of the traditional course of rest and ice used for most forms of tendonitis. NSAIDs may help control pain during the acute phase, but they are probably not useful in the presence of longstanding symptoms. Heel pads or heel cups may be helpful to relieve acute symptoms.(13) Taping of the foot to prevent excessive pronation and reduce stress on the origin of the plantar fascia can also provide rapid pain relief (24).

Correction of forefoot abnormalities and hindfoot instability is essential in the treatment of plantar fasciitis. Orthotic shoe inserts are effective for pain relief in patients with either pes planus and hyper-pronation, or a cavus foot. A survey(25) of 46 runners using orthotics for plantar fasciitis found that 74 percent reported great improvement of symptoms with the use of orthotics and 90 percent continued to use orthotics even after resolution of symptoms. Rigid, semi-rigid and flexible shoe inserts have all been used, and the choice of the proper device is dependent on the experience of the clinician. It may also be possible to obtain adequate arch support simply by changing the type of shoe.

Athletes should look for shoes with a close-fitting heel counter and adequate medial arch support. Various types of heel cups and heel pads have been used with variable success.(13). These pads may be of greatest benefit to older patients because the heel fat pad becomes thinner with age. Heel pads may also benefit patients who stand on hard surfaces for extended periods.

After relief of acute symptoms, stretching of the Achilles tendon and plantar fascia is the cornerstone of the rehabilitation program. Stretches are intended to decrease the strain on the origin of the plantar fascia during exercise.(13)(15) The importance of an aggressive stretching program should be emphasized to patients who are involved in athletics.

Strengthening of the posterior calf muscles should begin as soon as it can be tolerated by the patient. Weakness and loss of flexibility of the calf muscles alter the normal heel position during the push-off phase of running and increase the strain on the plantar fascia.(24) Isometric training should begin almost immediately in the rehabilitation process, and the athlete can progress to isotonic exercises as soon as symptoms allow.

Heel raises, using weights, are the easiest way to strengthen the calf musculature, but rubber tubing can also be used. Commercial products are available for this purpose, but bicycle inner tubes are an inexpensive alternative. Patients are instructed to start their program by putting the foot through a limited arc of motion and then gradually advance to a

full arc of motion as tolerated. It is also helpful to strengthen the intrinsic muscles of the foot by placing one end of a towel under the foot and gathering the towel up under the foot by plantar flexing of the toes.(15)

Strength training to improve proprioception may also be helpful(24) and may decrease the likelihood of future injury. Balance boards may be used for this training, but patients can construct a simple wobble board by attaching a small piece of a two-by-four to a piece of 3/4-in plywood. The patient then stands on the board and shifts his or her weight from side to side to improve proprioception and balance.

Return to running should be attempted as soon as symptoms allow. Distance should be increased in small increments and, initially, hills should be avoided. Ice packs on the heel may be of benefit following a workout. With proper treatment and rehabilitation, most patients are usually able to achieve pre-injury levels of exercise.(13)

Other Treatments

Although most persons return to full activities after completing the rehabilitation program, some patients, despite their best efforts, continue to experience significant pain. Traditionally, corticosteroid injections and surgery have been the modalities used to relieve chronic heel pain. Surgery, although successful and well tolerated, should always be considered a last resort and is not necessary in the majority of patients.(13) Corticosteroid injections are used much more frequently than surgery for persistent pain but are not without problems. Multiple corticosteroid injections have been associated with fascia weakening and rupture,(14) as well as atrophy of the fat pad beneath the calcaneus.(13). If the decision is made to administer injections to the heel, a medial approach is advisable because it is much better tolerated by the patient.

Posterior Splinting

Before resorting to corticosteroid injections or surgery, the clinician should consider the use of a posterior splint. A 4-in wide roll of fiberglass casting tape or a roll of fiberglass splint material is used to form the splint. The patient's foot is held in maximum dorsiflexion. The splint material is applied to the posterior of the foot and leg, extending from the metatarsal heads to the belly of the gastrocnemius. The splint material should not be moistened before application.

A 4-in wide elastic bandage is then wetted in a bucket of water and wrapped around the foot and leg, encompassing the splint material. The moisture of the elastic bandage allows the fiberglass to harden and makes application of the splint clean and easy. Dorsiflexion is maintained by the clinician or assistant until the splint has hardened. To maintain maximal dorsiflexion, an individually fitted splint may be superior to a preformed posterior splint that holds the foot in a neutral position.

The patient is instructed to wear the splint on retiring each evening. The splint is held in place by the elastic wrap while the patient sleeps, and is removed in the morning. Splinting maintains the length of the plantar fascia as the patient sleeps. This prevents the stiffening and contraction of the fascia that normally occur during sleep. Patients should maintain their usual rehabilitation program of stretching and strengthening and continue to use orthotics if indicated.

PERSONAL EXPERIENCE

I have successfully treated approximately 30 patients with posterior splints. Patients presenting with plantar fasciitis who use posterior splints are initially instructed on proper stretching and strengthening exercises, are fitted with orthotics and/or heel pads if necessary, and are given NSAIDs if the pain is of recent onset. Follow-up in two to three weeks is suggested. If significant pain relief is not experienced after these initial interventions, a night splint is made. The patient is instructed to return in another two to

three weeks. If the patient still has not improved, an injection of corticosteroid is given in the heel. In the patient population at my institution, it has not been necessary to administer an injection of corticosteroids for heel pain in the five years since this regimen was initiated.

The literature mentions little research regarding the use of night splints in patients with plantar fasciitis. In one study,(26) 14 patients who had heel pain for longer than one year were treated with night splints. Treatment before the use of splints consisted of orthotics, stretching, strengthening and corticosteroid injections. In less than four months, 11 of the 14 patients had relief of symptoms. In view of the low potential for complications and the low cost, splinting seems to be a reasonable alternative to invasive therapies such as injections or surgery.

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