

Clinical Analysis of Foot Problems

by Karen S. Seale, M.D.

Introduction

Orthotists are vital members of the foot care team. Their expertise and special interests in materials and biomechanics add a unique dimension to the management of foot problems.

It is hoped that the principles of clinical assessment of foot problems set forth in this article will foster even greater interest in and understanding of the pathophysiology of foot problems. The purposes of this article are threefold:

- To familiarize the orthotist with the general concepts of clinical analysis of the foot.
- To assist the orthotist in designing the most appropriate orthosis based on clinical assessment of the problem.
- To give examples of clinical analysis of the following common foot problems for which an orthotic treatment may be prescribed:
 1. Heel pain
 2. Pes planus
 3. Metatarsalgia
 4. Ankle instability

Discussion

Clinical analysis of the foot consists of obtaining a pertinent history and performing a physical examination of the lower extremity. The medical history is an opportunity to gather as much information as possible by asking the patient to describe the pain, problem, or deformity. Specific information is sought by asking about the type of pain, its duration,

onset (whether insidious or abrupt), location of the pain, and activities that help or aggravate the pain (such as rest, walking, or wearing or removing certain shoes).

Physical examination involves inspection, palpation, and manipulation. Observe the patient, first with and then without his typical footwear, both standing and walking, with arms hanging freely at the sides. The patient should be observed from the front and from the back. With the patient seated at a height comfortable for the examiner and the shoes removed, palpation and manipulation can be performed. Palpation is not intended to inflict pain, but rather to identify areas of discomfort. For example, applying direct pressure in the center of the heel pad may cause discomfort in a patient with "heel spur" syndrome.

In addition to palpation, manipulation is used to assess range of motion of the various joints and to determine the biomechanical relationships of the component parts of the lower extremity. Although a description of a comprehensive foot examination is beyond the scope of this paper, clinical analysis of four common foot problems is included in the next section.

Heel Pain

A very common clinical problem for which shoe modifications may be prescribed is heel pain. Although many causes of heel pain exist, common etiologies include, (1) fat pad atrophy, (2) plantar fasciitis or "heel spur" syndrome, and (3) neuritis of the medial calcaneal or lateral plantar nerves.

Atrophy of the fat pad is particularly common among older individuals who will

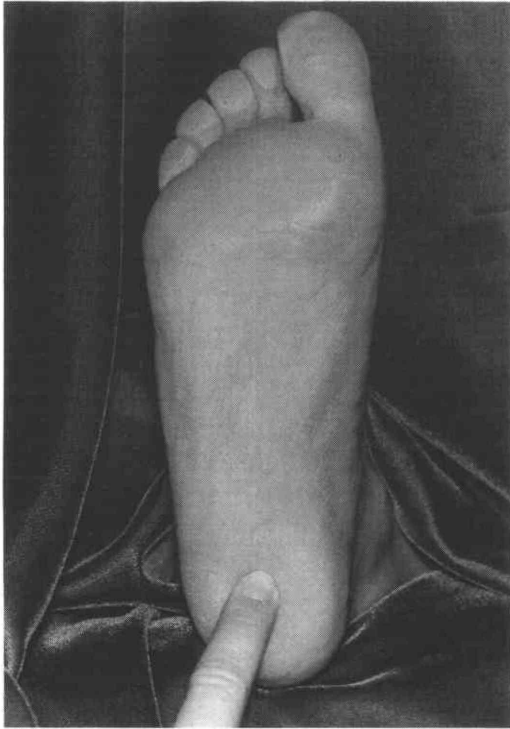


Figure 1A. Point of tenderness in patient with plantar fasciitis.

complain of localized pain about the heel brought on by walking, especially in hard soled shoes. Varying degrees of fat atrophy of the metatarsal area as well as the heel pad are observed on physical examination and the underlying tubercle of the calcaneus can be readily palpated. The key to successful shoe modification in treating this condition is to increase the padding beneath the heel.

The onset of chronic heel pain due to plantar fasciitis or "heel spur" syndrome may be either acute or insidious. It is often most severe upon arising in the morning, but improves after a period of "warming up." However, it may worsen if the patient remains on his feet during the day or with intermittent periods of rest and activity. The patient is usually tender to palpation at the origin of the plantar fascia on the plantar tubercle of the calcaneus and about one centimeter distally (Figure 1A). The principles of shoe modification management are soft soles, relief in the center of the heel, and a soft arch support to better distribute the weight and relieve the painful heel area.

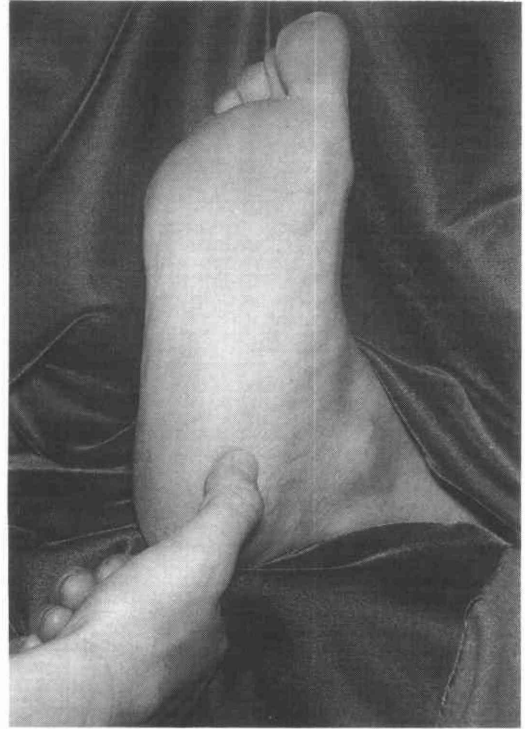


Figure 1B. Point of tenderness in patient with neuritis of medial calcaneal and/or lateral plantar nerve.

Neurologic causes of heel pain include neuritis and/or compression of the medial calcaneal nerve, the lateral plantar nerve, or the nerve to the abductor digiti quinti, which is a branch of the lateral plantar nerve.² The pain is usually not well localized as with plantar fasciitis, but tends to be diffuse. On physical examination tenderness may be found on the medial aspect of the heel over the origin of the abductor hallucis (Figure 1B). Occasionally, the examiner can elicit pain or tingling along the medial aspect of the heel with light tapping or pressure in this area. For these patients, an orthosis which limits excessive pronation, and thereby decreases the pull of the abductor hallucis across the nerves, is useful.

Pes Planus

Pes planus, or flat foot, is a descriptive term indicating the loss of height of the medial arch, but is a more complex entity than the name im-



Figure 2A. Note loss of longitudinal arch, with the excessive forefoot abduction and external rotation.

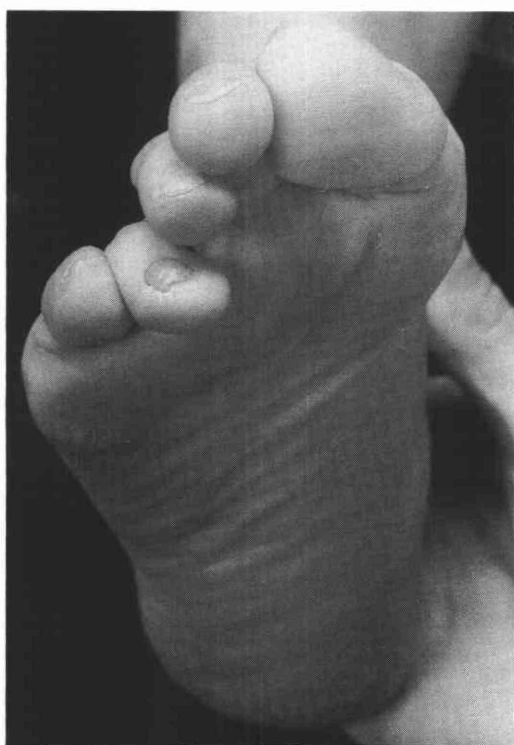


Figure 2B. Forefoot varus—plantar aspect of foot facing medially.

plies. There are many causes of symptomatic flat feet, including posterior tibial tendon rupture, Charcot joint degeneration secondary to neuropathy, rheumatoid arthritis, and generalized ligamentous laxity.⁴ The specific com-

plaints vary depending on the etiology, but in general, pes planus leads to diffuse aching of the foot and early fatigue. Patients with inflammation or early rupture of the posterior tibial tendon will note pain on the medial aspect of the foot and ankle early on, but as significant deformity develops, pain occurs on the lateral aspect of the hindfoot due to impingement of the fibula against the valgus-tilted calcaneus.³ The rheumatoid patient may have a great deal of diffuse pain, whereas the patient with Charcot joint degeneration secondary to neuropathy may have little or no pain in the presence of very severe deformity.

Pes planus is best observed seen while the patient is standing. One notes the decrease in the medial arch height, the increase in forefoot abduction and external rotation as well as the presence of heel valgus (Figure 2A). Observations, made from behind as the patient walks, are (1) the excessive external rotation of the foot relative to the line of progression, and (2) the lack of significant heel inversion motion from foot flat to heel lift.

Further biomechanical evaluation is performed by sitting in front of the seated patient to observe the relationships of the hindfoot to the leg and of the forefoot to the hindfoot. The subtalar joint motion is assessed by grasping the heel and tilting it laterally (into valgus or eversion) and then medially (into varus or inversion). Not infrequently, the patient with pes planus will demonstrate excessive eversion, greater than the normal excursion of 10°.

The foot is then placed in its "neutral position," which is the point at which the calcaneus is centered under the tibia and the talar head is adequately covered by the tarsal navicular. This is done by the examiner's holding the heel in alignment with the long axis of the tibia or in a few degrees of valgus and then adducting the forefoot approximately halfway between maximum forefoot abduction and maximum adduction. The position of the plantar aspect of the forefoot relative to the perpendicular axis of the tibia is noted. There is usually a component of forefoot varus which means the plantar aspect of the foot is facing medially (Figure 2B).

The principles of orthotic management of pes planus include correcting the valgus tilt of the calcaneus, providing a medial arch support, and posting of the first ray to control the hyperpronation.

Metatarsalgia

Metatarsalgia is pain in the forefoot area for which a wide variety of etiologies have been identified. For the purposes of this article, which is aimed at the practicing orthotist dealing with foot problems, the discussion will be limited to the following:

- Fat pad atrophy
- Sesamoiditis
- Disorders of the lesser metatarsophalangeal joints
- Interdigital neuroma
- Rheumatoid arthritis
- Pes cavus

Fat Pad Atrophy

As in heel pad atrophy, the soft tissue padding under the metatarsal heads may become atrophied with age, causing diffuse pain under the metatarsal heads due to the lack of sufficient padding for shock attenuation. The patient may complain of pain especially when walking on a hard floor without shoes. The atrophy is apparent on general inspection; palpation reveals the prominence of the metatarsal heads plantarly. The patient may be tender to palpation directly under the metatarsal heads. Soft soled shoes and soft inner soles with metatarsal pads proximal to the metatarsal heads are beneficial modalities.

Sesamoiditis

Patients with inflammation of the sesamoids of the first metatarsophalangeal joint will complain of well localized pain on the medial aspect of the foot just proximal to the first metatarsal head upon weight bearing. There may be a history of repeated jumping or running on the balls of the feet or of a crush injury due to a heavy object falling on the foot. The patient may walk by rolling his foot into supination and inversion, thus bearing the majority of the weight on the lateral border of the foot. Palpation directly over the involved sesamoid will cause localized tenderness beneath either the tibial or the fibular sesamoid (Figure 3A). Look for associated edema and swelling under and around the first metatarsal head. Passive extension of the first metatarsophalangeal joint will aggravate the pain. Placing the patient in low heeled shoes with padding devices which

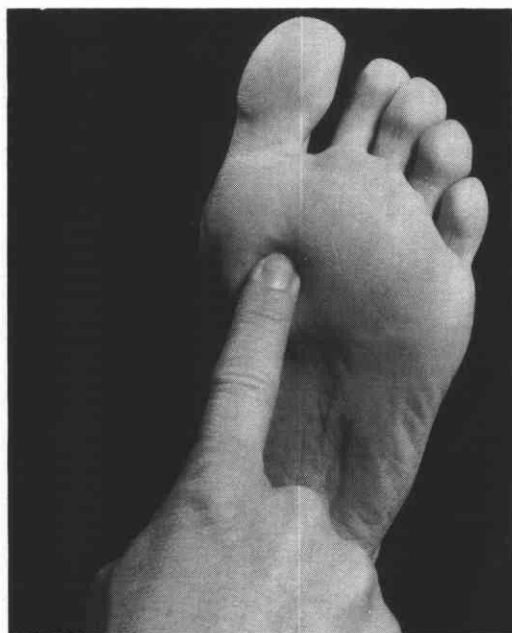


Figure 3A. Area of point tenderness of fibular sesamoiditis.

relieve weight bearing under the first metatarsal head are indicated.

Disorders of the Lesser Metatarsal Joints

Disorders such as subluxation or dislocation, isolated synovitis, or Freiberg's disease can cause pain limited to a single metatarsophalangeal joint.⁵ The onset of pain may be insidious and there may or may not be a history of trauma associated with the onset of pain. The patient is usually able to point to the involved area. Pain can be elicited upon palpation of the involved joint and with passive manipulation. Synovial thickening may be appreciated when comparing the thickness of the involved joint to the normal joint of the opposite foot.

Interdigital Neuroma

The well localized pain associated with an interdigital, or Morton's, neuroma is caused by a thickening of the soft tissues surrounding the common digital nerves on the plantar aspect of the foot and occurs most frequently between the third and fourth metatarsal heads. This entity occurs frequently in women and probably



Figure 3B. Technique for eliciting tenderness of interdigital neuroma between third and fourth metatarsal heads.

results from the repeated trauma to the metatarsal region caused by the wearing of high heeled shoes. The patient is usually able to point out the area of maximum pain on the plantar aspect of the foot, pain which occasionally radiates to the toes, and which is worse with weight bearing when wearing snug, thin soled shoes. Removing the shoes and massaging the foot usually affords some temporary relief.

The physical examination will be normal to inspection, but upon palpation pain can be elicited by squeezing the soft tissues between the involved metatarsal heads. This is done by using the thumb and forefinger of one hand to simultaneously press from dorsal and plantar while compressing all the metatarsal heads medially and laterally with the opposite hand (Figure 3B). Occasionally, the enlarged nerve tissue can actually be felt to roll between the finger and the thumb.

Keeping the pressure off the involved area with a metatarsal support proximal to the metatarsal heads and eliminating snug, high heeled shoes can be helpful in decreasing the pain.

Rheumatoid Arthritis

The typical advanced deformities of rheumatoid arthritis causing metatarsalgia are hallux

valgus with lateral deviation and dorsal dislocation of the lesser metatarsophalangeal joints. This results in the distal displacement of the plantar fat pad, thus leaving the metatarsal heads displaced plantarly with insufficient fat pad coverage (Figures 3C and 3D). Broad, soft soled shoes with an adequate height of the toe box to accommodate the deformities are necessary. Providing a soft, total contact insert with metatarsal padding proximal to the prominent metatarsal heads is helpful in decreasing the weight born by the metatarsal heads and more evenly distributing the weight across the sole of the foot.

Pes Cavus

A common complaint of the person with pes cavus, or a high arch, foot deformity is metatarsalgia. The elevated arch results in greater weight being borne on the metatarsal heads. The cavus foot is more rigid and, thus, has less shock attenuation capability than the normal, more supple foot. Metatarsalgia can be worsened in the presence of clawing of the toes, which involves hyperextension of the metatarsophalangeal joints, thus making the metatarsal heads even more prominent plantarly.

The deformity can best be appreciated on



Figure 3C. Typical forefoot deformities of rheumatoid arthritis—hallux valgus and dorsal dislocation of metatarsalphalangeal joints (plantar view).



Figure 3D. Typical forefoot deformities of rheumatoid arthritis—hallux valgus and dorsal dislocation of metatarsalphalangeal joints (lateral view).

physical exam by watching the patient in a standing position. In addition to the elevated longitudinal arch, heel varus may be noted. Plantar flexion of the first ray may be present and can be seen by viewing the foot anteriorly with the patient seated. Stabilize the calcaneus in alignment with the tibia and note the level of the plantar aspect of the first metatarsal head relative to the others. The patient with metatarsalgia secondary to pes cavus may benefit from a soft arch support to increase the weight bearing surface of the foot and to improve shock attenuation.

Ankle Instability

Ankle instability may be the result of lateral ligamentous laxity, a varus heel, or a varus angulated tibia.⁴ A patient with lateral ligamentous laxity of the ankle may give a history of having initially sustained an ankle sprain secondary to significant ankle trauma followed by recurrent sprains with minimal or no trauma. The wearing of high heeled shoes worsens the tendency of recurrent ankle sprains as this further throws the foot into supination.

Ligamentous laxity causing ankle instability can usually be demonstrated by the "lateral talar tilt" test. The ankle is stress tested both in

dorsiflexion, to test the calcaneofibular ligament, and in plantarflexion, to test the anterior talofibular ligament. The tibia is held stationary as the examiner applies pressure on the lateral aspect of the hindfoot in a medial direction (Figure 4). The ankle, which lacks adequate ligamentous support, will tilt medially indicating instability.

The presence of heel varus can be appreciated by viewing the patient from behind as he stands with shoes removed. It will be noted that the calcaneus is medial to the longitudinal axis of the tibia. Upon manipulation of subtalar joint motion, there may be decreased eversion of the calcaneus relative to inversion.

A person who had a varus angulated tibia, either from a congenital deformity or secondary to a tibia fracture which has united in varus, may also experience ankle instability. With such malalignment, the biomechanical forces pass lateral to the center of the calcaneus. Observing the standing patient from the front, the examiner will note that an imaginary plumb line dropped from the center of the patella will fall lateral to the center of the ankle on the affected side.

A lateral heel and sole wedge tilts the hindfoot into slight valgus to help prevent recurrent ankle instability.

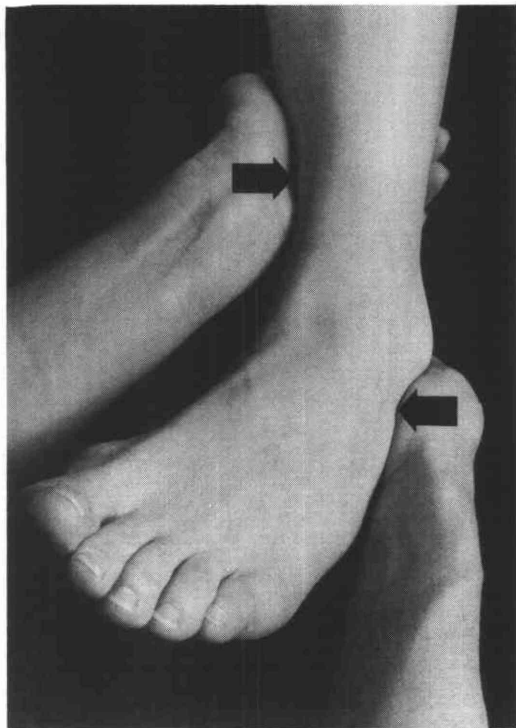


Figure 4. "Lateral talar tilt" test for ankle instability.

Summary

The principles of clinical assessment of four common clinical problems for which orthotic treatments are prescribed have been discussed. The information gained from the medical history and physical examination used in clinical assessment of foot problems can aid the orthotist in improving his or her effectiveness as a vital member of the foot care team.

References

- ¹ Baxter, Donald E., "The Evaluation and Treatment of Forefoot Problems in the Athlete" (Unpublished manuscript).
- ² Baxter, Donald E. and C. Mark Thigpen, "Heel Pain-Operative Results," *Foot & Ankle*, 5:1, 1984, pp. 16-25.
- ³ Johnson, Kenneth, "Tibialis Posterior Tendon Rupture," *Clinical Orthopaedics & Related Research*, 166, 1983, pp. 143-150.
- ⁴ Mann, Roger A., "Biomechanical Approach to the Treatment of Foot Problems," *Foot & Ankle*, 2:4, 1982, pp. 205-212.
- ⁵ Mann, Roger A., "Metatarsalgia," *Postgraduate Medicine*, 75:5, 1984, pp. 150-167.
- ⁶ Mann, Roger A. *Surgery of the Foot*, The C.V. Mosby Co., 1986.

Author

Karen S. Seale, M.D. is assistant professor in the Department of Orthopedics, University of Arkansas Medical School Center.