

FOOT PAIN

The foot is by definition a composite of all structures distal to the ankle joint. These structures include bones, muscles, tendons, ligaments, blood vessels, lymphatics, nerves, fat, dermal layers, and toenails. The bones and their interconnecting ligaments provide the basic structure of the foot. They include the tarsal, metatarsal, and phalangeal bones. There are seven tarsal bones: the calcaneus (heel), talus (providing a platform for the tibia), navicular, cuboid, medial cuneiform, intermediate cuneiform, and lateral cuneiform. Closely packed together, they articulate with one another and the five metatarsals, forming the longitudinal arch of the foot. When normal, this arch is designed to evenly distribute the standing body weight between each calcaneum and the proximal heads of the five metatarsals. There also exists a series of transverse arches that, together with the longitudinal arch, form the *half dome* shape seen in the normal foot (when the feet are in close opposition, their arches should together form a full dome). The distal heads of the five metatarsals articulate with the phalanges at their metatarsal-phalangeal joints. There are 14 phalangeal bones that articulate with one another to form the toes (two for the big toe and three for each of the other digits).

The muscles in the foot itself include the extensor digitorum brevis, lumbricals, flexor hallucis brevis, flexor digitorum brevis, dorsal interossei, abductor hallucis, abductor digiti quinti, plantar interossei, and the adductor hallucis. While these muscles help move the toes, the real power for foot movement comes from muscles proximal to the ankle joint whose tendons cross the ankle joint and insert on various foot structures. Those that insert on the posterior, lateral, or plantar aspect of the foot include the plantaris, gastrocnemius, soleus, tibialis anterior, tibialis posterior, peroneus longus, peroneus brevis, flexor digitorum longus, flexor hallucis longus muscles. The peroneus tertius, extensor digitorum longus, and extensor hallucis longus muscles insert on the dorsal aspect of the foot.

The foot is designed to serve as a support for the weight of the body when standing and to act as a lever for raising and propelling the body forward when walking or running. The muscles in the leg supply the power for lifting the body, and the heads of the metatarsals provide the fulcrum on which the body weight is lifted. The foot contains two main arches formed by the bones and supported by ligaments, with indirect support provided by the associated tendons and muscles. A certain degree of motion and elasticity is required from the arches if the foot is to function properly.

Foot pain may result from flat feet (fallen transverse arch), fractures of the metatarsal bones, hallux valgus (bunion), corns or callous formations, plantar warts, diseases that cause inflammation or swelling of the joints, aseptic soft tissue inflammation or soft tissue swelling, strain of associated ligaments or tendons, extracapsular muscle spasm, and muscle strain. Pain may also be produced by abnormal bony or joint formations (including claw foot), osteochondritis of the navicular bone or metatarsal head, anterior metatarsalgia, plantar neuroma, hallux varus (medial angulation of the big toe), hallus rigidus, hammer toe, overlapping or dorsal displacement of the toes, subungual exostosis, accessory bone formation (including heel spurs), displacement of peroneal tendons, inflammatory disorders of the Achilles tendon and its attachments, proximal nerve impingement, and intermittent claudication.

Referred pain from trigger point formations, in and proximal to the foot, is the most common source of acute and chronic foot pain.

Another very common source of *chronic foot pain* is inflammation of the extensor digitorum longus tendons or tendon sheaths (tenosynovitis) as they cross the tarsals, secondary to a lateral or medial strain or sprain of the ankle. The pain experienced is generally described as a deep aching pain or (more rarely) a "knifing" or sharp pain across the top of the most proximal tarsals. Walking without external support may be difficult. Recovery without proper care may be extremely slow (some patients have complaints that go back several years).

A DSR survey should be made to establish the presence of inflammation.

Treatment

Direct the treatment of *foot pain* at relieving the treatable causes determined to be responsible.

Application:

- If the condition is **acute**, icepack the inflamed zone. If **chronic**, electrically stimulate the inflamed zone. Place a negative electrode over the inflamed zone and a positive electrode over a more proximal site. Preset an electrical stimulation unit to deliver a visible contraction, at 7 Hz. Stimulate for 10 minutes. Then, set the unit to deliver a medium frequency current, with a duty cycle of 10-seconds on and 10-seconds off, sufficient to produce a near tetanic contraction of the involved muscles. Stimulate for 10 minutes.
- In either case (acute or chronic), manipulate the tissues in and around the inflamed zone to eliminate any adhesions that may be present.
- Then, preset the ultrasound unit to deliver a 1 MHz pulsed waveform, at 1.5 W/cm². Ultrasound the inflamed zone, utilizing an effective non-steroidal anti-inflammatory as a coupling agent, for six minutes.
- If the condition is **acute**, electrical stimulate the inflamed zone again. Place a negative electrode placed over the inflamed zone and a positive electrode over an associated muscle. Set the electrical stimulation unit to deliver a visible contraction at 7 Hz. Stimulate for 20 minutes. If trigger points are involved, and are the primary source of the pain syndrome, this technique should be considered optional, since it may irritate or re-trigger the trigger points. The effect, in most cases is only temporary, but in others it may slow recovery or shake the patient's confidence in your treatment choices.

Trigger Points

The following trigger point formations may, singly or in combination, refer pain into the area of the foot: Gluteus minimus, Adductor longus, Gastrocnemius, Anterior tibialis, Long toe extensors, Soleus, Short toe extensors, and Abductor hallucis.

