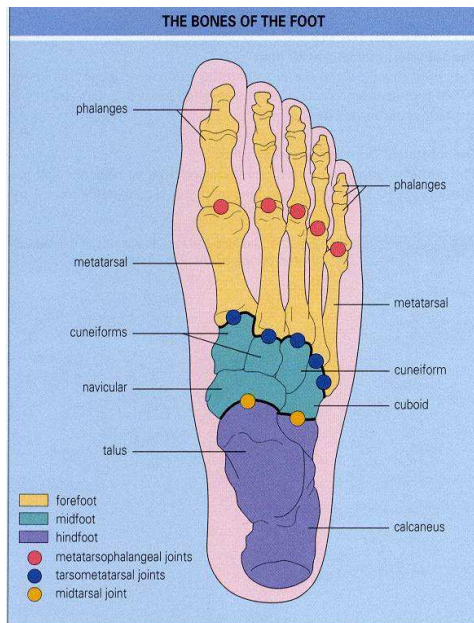


Foot and Ankle Pain

Pain in the ankle and foot may arise from the bones and joints, periarticular soft tissues, nerve roots and peripheral nerves, or vascular structures or referred from the lumbar spine or knee joint. Precise diagnosis of ankle and foot pain rests on a careful history, a thorough examination and a few rationally selected diagnostic tests.



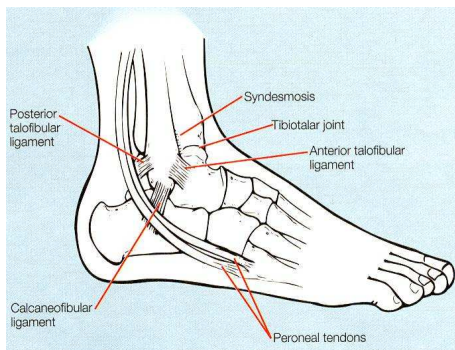
The foot can be divided into three sections: hindfoot, midfoot, and forefoot.

The **hindfoot** consists of the calcaneus and talus. The anterior two thirds of the calcaneus articulates with the talus, and the posterior third forms the heel. Medially the sustentaculum tali supports the talus and is joined to the navicular bone by the spring ligament. The talus articulates with the tibia and fibula above at the ankle joint, with the calcaneus below at the subtalar joint, and with the navicular in front at the talonavicular joint.

Five tarsal bones make up the **midfoot**: navicular medially, cuboid laterally and the three cuneiforms distally. The midfoot is separated from the hindfoot by the mid- or

transverse tarsal joint (talonavicular and calcaneocuboid articulations), and from the forefoot by the tarsometatarsal joints.

The **forefoot** comprises the metatarsals and phalanges. The great toe has two phalanges and two sesamoids embedded in the plantar ligament under the metatarsal head. Each of the other toes has three phalanges.

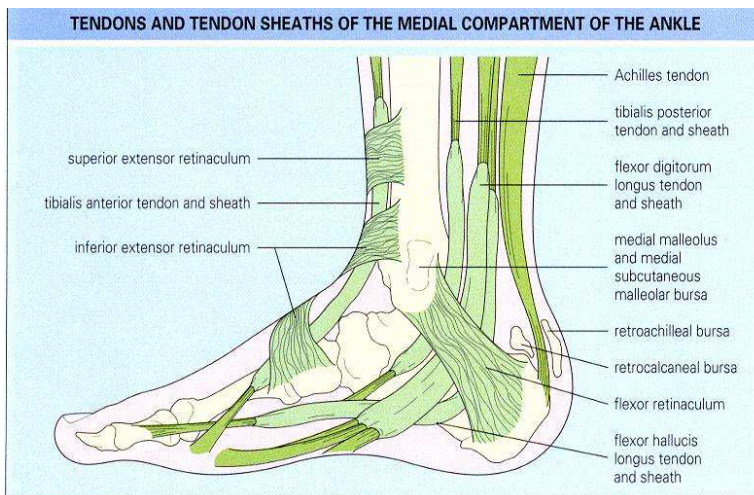


The **distal tibiofibular joint** is a fibrous joint or syndesmosis between the distal ends of the tibia and fibula. The joint only allows slight malleolar separation on full dorsiflexion of the ankle.

The ankle or **talocrural joint** is a hinge joint between the distal ends of the tibia and fibula and the trochlea of the talus. Most of the body weight is transmitted through the tibia to the talus. The tibial and fibular malleoli extend distally to form the ankle mortise that stabilizes the talus and prevents rotation.

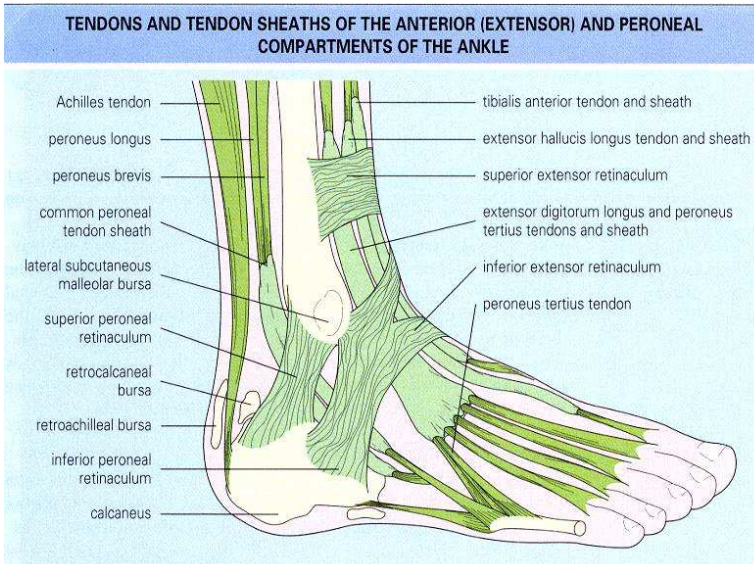


The joint capsule is lax in front and behind but is strengthened medially by the powerful deltoid ligament and laterally by three distinct bands: the posterior talofibular, calcaneofibular and anterior talofibular ligaments.



The synovial cavity does not communicate with other joints, adjacent tendon sheaths or bursae. Tendons crossing the ankle are invested for part of their course in tenosynovial sheaths.

The dorsalis pedis artery runs between the extensor hallucis longus and extensor digitorum longus tendons.



The peroneus longus and brevis tendons are enclosed in a single synovial sheath that runs behind and below the lateral malleolus.

The posterior tibial artery and nerve lie between the tendons of the flexor digitorum longus and flexor hallucis longus.

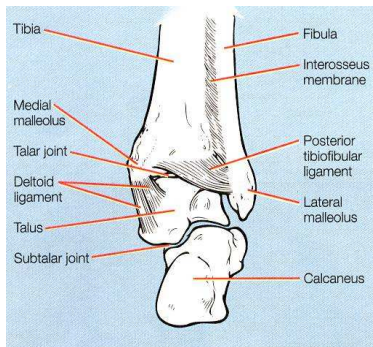
The flexor retinaculum bridges the gap between the medial malleolus and the calcaneus.



The common tendon of the gastrocnemius and soleus (Achilles tendon or tendocalcaneus) is inserted into the posterior surface of the calcaneus. The tendon does not have a synovial sheath, but is surrounded by a loose connective tissue pseudosheath or peritenon.

There are a number of bursa around the ankle. The retrocalcaneal bursa is located between the Achilles tendon insertion and the posterior surface of the calcaneus. The retroachillial bursa lies between the skin and the Achilles tendon and protects the tendon from external pressure. The medial and lateral subcutaneous malleolar or "last bursae", are located near the medial and lateral malleoli.

Movements of the ankle include dorsiflexion and plantarflexion. The axis of movement passes approximately through the malleoli. The gastrocnemius and soleus are the prime plantar flexors of the ankle. The tibialis anterior and extensor digitorum longus are the prime dorsiflexors.

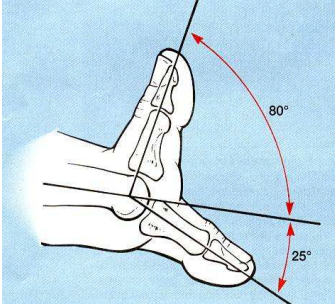


The **subtalar (talocalcaneal) joint** lies between the talus and calcaneus and permits inversion of the foot (sole of the foot turned inward), and eversion (sole of the foot turned outward).



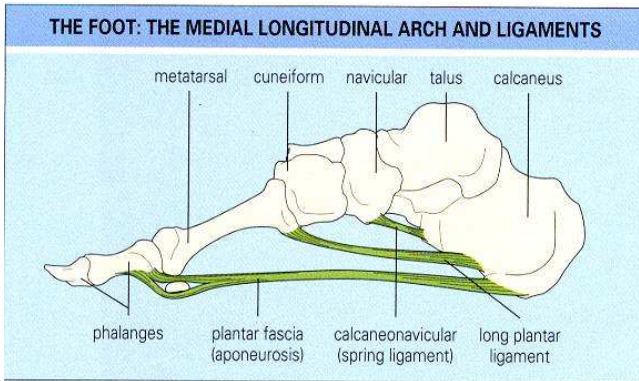
The **midtarsal (transverse tarsal) joint** is the combined talonavicular and calcaneocuboid joints. The cuboid and navicular are usually joined by fibrous tissue, but a synovial cavity may exist between them. The midtarsal joint contributes to inversion and eversion movements of the subtalar joint. The axis of rotation of the subtalar joint and midtarsal joints is such that inversion is accompanied by adduction of the forefoot (supination), and eversion with abduction (pronation).

The **intertarsal joints** between the navicular, cuneiforms and cuboid are plane gliding joints which intercommunicate with one another and with the intermetatarsal and tarsometatarsal joints.

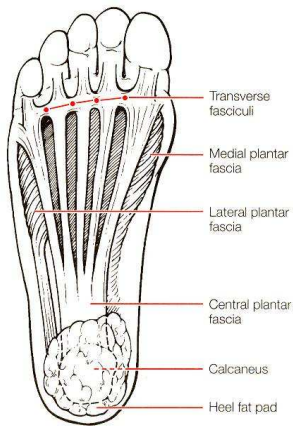


The **metatarsophalangeal joints** are ellipsoid joints lined with synovial cavities. They allow plantar flexion and dorsiflexion.

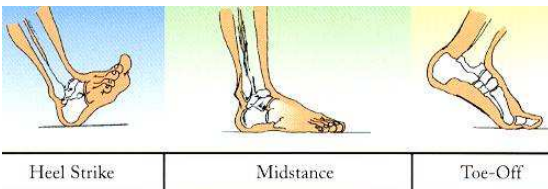
The **interphalangeal joints** (PIP and DIP) are hinge joints. A bursa (bunion) is commonly located over the medial aspect of the first MTP joint. Less frequently, a small bursa is present over the fifth metatarsal head (bunionette or tailor's bunion).



The **arches** of the foot are the result of the intrinsic mechanical arrangement of the bones supported by ligaments, intrinsic and extrinsic muscles, particularly the tibialis posterior and anterior muscles.



The longitudinal arches are held together by several layers of ligaments: the spring (calcaneonavicular) ligament; the long and short plantar ligaments joining the calcaneus to the metatarsal bases; and most superficially the plantar aponeurosis (fascia).



During toe off it helps the arch to reform and the foot to become more rigid.

History

Important as various characteristics of the pain can give an indication of its cause. Questions should address the quality of the pain, its distribution, mode of onset, periodicity, relation to weight bearing, and associated features such as swelling or color change. It is important to enquire about pain in other joints such as the hand and spine, including the sacroiliac joints, which might indicate that the foot pain is part of a polyarthritis. A history of diarrhea, psoriasis, urethritis or iritis may suggest that one of the spondyloarthropathies has to be excluded.

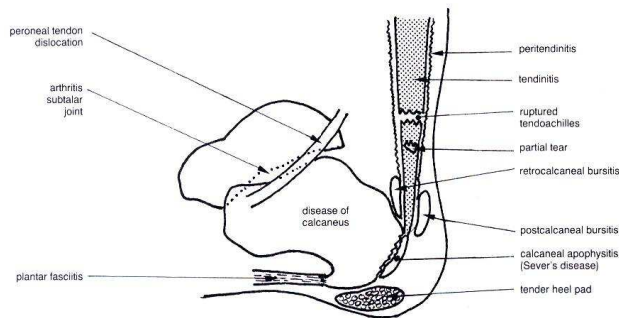
The following questions should be asked:

- Does the pain arise from a local condition or is it part of a generalized disease?
- Is there a history of psoriasis, chronic diarrhea or colitis, urethritis or iritis?
- Is pain present in other joints, thus indicating the foot/ankle pain is part of a polyarthritis, such as rheumatoid arthritis?
- Is the problem related to unsuitable footwear?
- Does the nature of the pain point to the cause?
 - Throbbing pain - inflammation
 - Burning pain - nerve entrapment, diabetic neuropathy, or reflex sympathetic dystrophy (RSD)
 - Severe episodic pain - gout
 - Pain worse at night - ischemia (small vessel disease), RSD, cramps or osteoid osteoma
 - Pain worse at night, relieved by aspirin - osteoid osteoma
 - Pain worse on standing after sitting or getting out of bed - plantar fasciitis

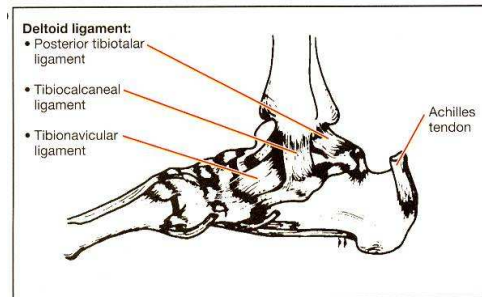
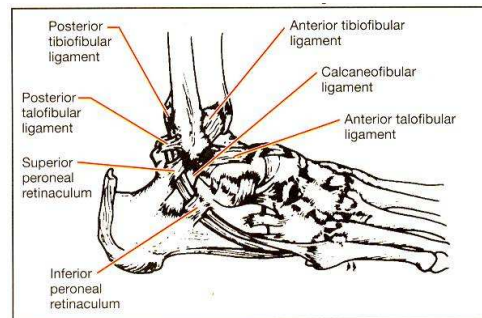
For ankle injuries it is important to ask about the nature of the injury:

- Did the foot twist in (invert) or twist out (evert)?
- Was the foot pointing down or up at the time of injury?
- Show me exactly where it hurts.
- What happened immediately after the injury?
- Were you able to walk after the injury?
- What happened when you cooled off?

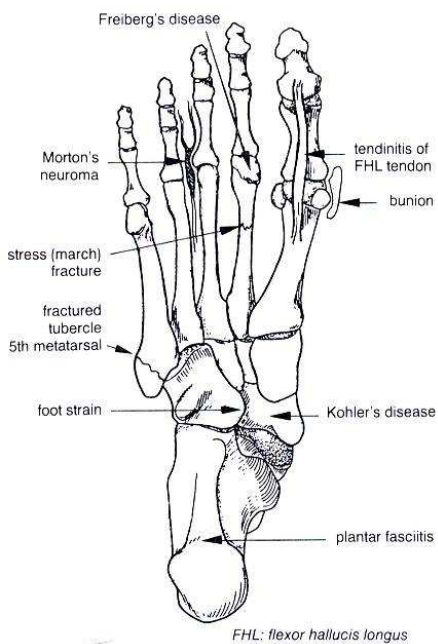
If there has been a fall onto the foot from a height, consider the possibility of a fracture of the calcaneus or talus or disruption of the syndesmosis between the tibia and fibula.



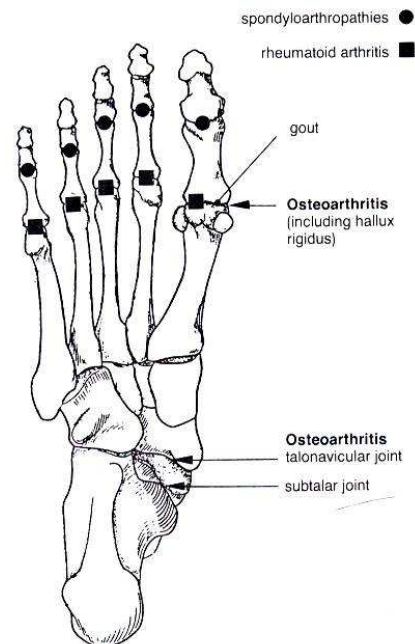
Common causes of heel pain.



Soft tissues commonly injured in ankle injury.



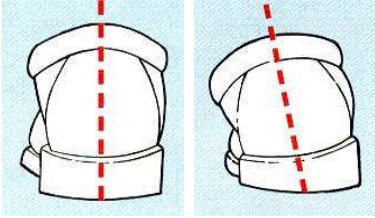
Typical sites of important causes of foot pain.



Typical sites of arthritic causes of foot pain.

Physical Examination

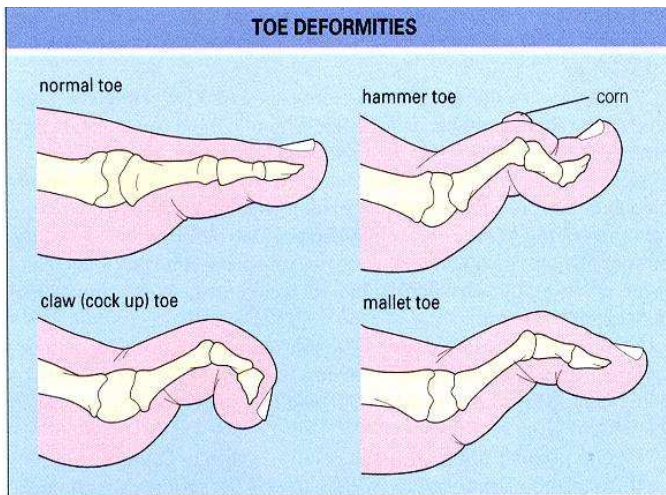
The ankle and foot are inspected in both the resting and standing positions for evidence of swelling, deformity, or skin abnormalities, such as edema, erythema, tophi, subcutaneous nodules or ulcers.



Inspect the footwear (normally a shoe wears first on the outer posterior margin of the heel). The illustration shows a normal shoe and changes due to medial ankle pronation.

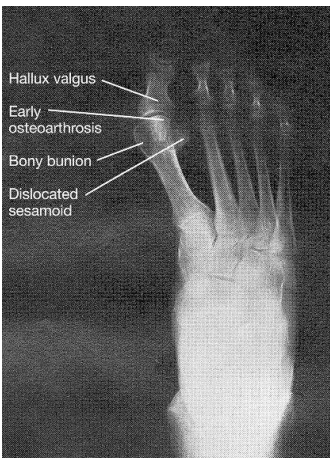


Note any gait abnormalities including limping and abnormal toe in or toe out.



Note any deformities, e.g., hammer toes, bunions - medial (hallux valgus) and lateral (tailor's bunion) - and claw toes.

Hallux rigidus



Hallux rigidus

Also note any swellings including callosities, muscle wasting, skin changes and signs of ischemia.

Pitted keratolysis or "stinky feet" is also known as "sneakers feet" and is related to sweaty feet. The organism responsible is the corynebacterium.

Jogger's toe

Anterior
Drawer Test

Positive test

Thompson test for Achilles rupture

Talar Tilt Test

Positive test

External Rotation Stress Test
For syndesmotic injury

Squeeze Stress Test
for syndesmotic injury

Inversion Stress Test

Compression of intermetatarsal contents

Suction Test for syndesmotic injury

Medial Ankle Pronation

The arch of a patient's foot typically determines the type of last he or she requires in an athletic shoe: a curved last (a) for a high arch, semicurved (b) for a medium arch, and a straight (c) for a low arch.

Fractures

Head of 5th metatarsal and attachments to head

Lateral malleolus fracture with normal mortise

Any patient with proximal fibular tenderness after a twisting ankle injury should have x-rays taken of both the ankle and tibia and fibula.

Metatarsal fracture

Midfoot fracture

Midfoot fracture CT

Navicular stress fracture location

Trigger Points Causing Ankle and Foot Pain

Anterior ankle pain can be caused by trigger points in the tibialis anterior, peroneus tertius, and extensor digitorum longus muscles.

Lateral ankle pain can occur from trigger points in the peroneus brevis muscle.

Medial ankle pain can be caused by the abductor hallucis.

Posterior ankle pain can be caused by trigger points in the soleus and tibialis posterior muscles.

Heel pain can be due to the soleus, quadratus plantae, and the abductor hallucis muscles.

Plantar midfoot pain can be caused by trigger points in the gastrocnemius, flexor digitorum longus, and adductor hallucis muscles.

Dorsal forefoot pain can be due to the extensor digitorum brevis and extensor hallucis brevis, extensor digitorum longus, extensor hallucis longus, flexor hallucis brevis, or the interossei of the foot.

Metatarsal head pain can be caused by the flexor hallucis brevis, adductor hallucis, flexor digitorum brevis, flexor hallucis longus, interossei, and abductor digiti minimi.

Plantar great toe pain can be due to a trigger point in the flexor hallucis longus, while dorsal great toe pain can be caused by a trigger point in the tibialis anterior.

Achilles Tendon Disorders

The injuries are most common in two groups: those aged 35 to 50 years who are active in recreational or low-level competitive sports, and younger, highly active people at all competitive levels.

Participants in racket sports and long-distance running are particularly susceptible to injury.

At the extreme of Achilles tendon disorders, the tendon rupture, 74% are sustained by male athletes between the ages of 30 and 40. Acute ruptures typically present with a history of acute, sharp pain and a loud snapping or popping noise. A commonly reported sensation is that of being struck in the back of the leg. After rupture, patients are either partially or completely incapacitated and are not able to forcibly plantar flex the foot. However, patients usually are capable of bearing some weight on the extremity.

The Thompson squeeze test can be used to help confirm an acute rupture. The examiner squeezes the calf muscle of the affected leg; plantar flexion of the foot indicates at least some continuity of the Achilles tendon complex.

Retrocalcaneal bursitis presents with heel pain that can be localized by squeezing the soft tissues medially and laterally just anterior to the Achilles tendon.

In Acute Achilles tendonitis the tendon may be surrounded by warm, boggy. Inflamed tissue, which can be felt by squeezing the tendon between the thumb and forefinger and gliding over the tendon proximally to distally. A gritty feeling beneath the skin during this maneuver often suggests tendonitis.

Chronic tendonitis is identified by widening or thickening of the tendon, which is particularly evident when the tendon is compared with the contralateral side. Patients who have chronic tendonitis present with plantar flexion weakness and posterior heel pain that worsens with activity. On palpation, the Achilles tendon is noted to be swollen and tender just proximal to the calcaneal tuberosity.

Peroneal Tendon Dislocation

This injury consists of anterior dislocation of the peroneus longus and brevis tendons at the lateral malleolus.

Sudden supination of the foot while the knee is flexed and the ankle dorsiflexed is one

mechanism of injury; plantar flexion and inversion, as in downhill skiing injuries, is another. Skiers, football players, and gymnasts are commonly affected.

Physical exam reveals swelling, sensitivity, and tenderness over the posterolateral malleolus. The dislocated tendons, which sit laterally over the lateral malleolus, are easily palpated. Treatment is a short leg cast or surgery.

Tarsal Coalition

This is an abnormal fusion in bones of the hindfoot and mid foot. It may be bony (synostosis), cartilaginous (synchondrosis), or fibrous. The most common type is the calcaneonavicular coalition followed by the talocalcaneal bar.

Physical examination reveals a limitation of subtalar motion, pain located directly over the coalition, rigid flatfoot, peroneal spasticity, and occasional heel pain radiating into the calf.

The Sinus Tarsi Syndrome

Correct diagnosis of this condition is important because it can be mistaken for a chronic ankle sprain and given improper treatment. One critical clue is a sensation of hindfoot instability when walking on uneven surfaces. The sinus tarsi, also known as the talocalcaneal sulcus, is an anatomic space between the inferior neck of the talus and the superior aspect of the distal calcaneus. The most common cause of sinus tarsi syndrome is a severe inversion ankle injury. In a simple ankle sprain, damage occurs to the stabilizing ligaments of the lateral ankle, while in sinus tarsi syndrome the force is enough to tear the

tarsal canal ligaments (anterior talofibular, calcaneofibular, cervical, lateral talocalcaneal, and interosseous talocalcaneal).

Both the chronic ankle sprain and sinus tarsi syndrome share the same mechanism of injury and involve sprains to the lateral ligaments of the ankle. Subtalar ligament injuries, however, lead to chronic inflammation in the sinus tarsi canal and minor hindfoot instability.

The physical exam will reveal exquisite tenderness over the sinus tarsi. The proximity of the anterior talofibular ligament to the sinus tarsi requires very specific palpation to identify the source of pain. One simple technique to detect tenderness is to use the eraser on a pencil to press on these structures one at a time. It is very important to evaluate for ankle instability, as

demonstrated ankle instability will rule out sinus tarsi syndrome. Ankle instability is diagnosed by excessive talar motion on inversion or on anterior drawer stress test when compared with the opposite side. Unilateral instability is always pathologic.

Fat Pad Syndrome

A direct blow to the bottom of the heel that results in a bruise, such as a forceful heel-first landing on a rock by a swimmer, can also injure the fat pad, causing symptoms similar to plantar fasciitis. Examination of the heel usually reveals tenderness directly under the weight-bearing portion of the calcaneus rather than on the anterior distal tuberosity.

A well-fitted heel cup cushions the heel and prevents the fat pad from splaying, thereby improving the cushioning of the calcaneus. Also helpful are shoes with softer midsoles, which provide more cushioning for the fat pad.

When the foot is not bearing weight the fat pad is thick. With shoeless weight bearing the fat pad spreads out laterally. Well-fitted shoes with a good heel counter or a heel cup can maintain the thickness of the fat pad under the calcaneus.

Tendinitis

Involvement of the posterior tibial tendon on the medial side and the peroneus longus tendon on the lateral side can occur in the recreational athlete unaccustomed to hours of stress.

With inflammation of these tendons, pain and tenderness are usually present along the tendon inferior and distal to the malleoli. This tendinitis does not usually cause pain until weight is placed on the foot. Stressing the suspect tendon by applying resistance with the hand on the actively contracting muscle of the patient's inverted or everted foot can help identify the tendon as the source of pain. If this test is negative, pain could be originating from injury to the ligaments, tissue, bone, or ankle joint. Weight-bearing stress with a standing toe raise is used to assess tendon integrity. A newly collapsed arch suggests the rarely occurring posterior tibial tendon rupture. An orthotic can be helpful in this condition.

Tarsal Tunnel Syndrome

Occurs when the posterior tibial nerve or one of its branches becomes constricted beneath the fibrous roof of the flexor retinaculum. Clinically, the patient will complain of paresthesia on the medial plantar aspect of the foot. If there is entrapment of the lateral plantar nerve, the patient may present with heel pain.

One of the most reliable diagnostic findings in tarsal tunnel syndrome is a positive Tinel's sign (tingling elicited by tapping along the course of the nerve). Orthoses can be helpful, particularly in patients with overpronation.

Anterior Tarsal Tunnel Syndrome

Caused by compression of the deep peroneal nerve as it passes beneath the superficial fascia of the ankle. The most common cause of this syndrome is trauma to the dorsum of the foot. Wearing overly tight shoes or squatting and bending forward, as when planting flowers has also been implicated in this condition. This entrapment neuropathy presents primarily as pain, numbness, and paresthesias of the dorsum of foot that radiates into the first dorsal web space. Nighttime foot pain similar to the nocturnal pain of carpal tunnel syndrome is often present. The patient may report that holding the foot in the everted position decreases the pain and paresthesias. A positive Tinel's sign just medial to the dorsalis pedis pulse over the deep peroneal nerve as it passes beneath the fascia is usually present. Active plantar flexion will often reproduce the symptoms. Weakness of the extensor digitorum brevis may be present if the lateral branch of the deep peroneal nerve is affected.

Impingement Syndrome Due to Spurs of the Anterior Ankle

Pain occurs on dorsiflexion of the foot.

Turf Toe

Term used to describe injuries of the first metatarsophalangeal joint that occur during play on artificial turf. The mechanism of injury is hyperextension of the first MTP joint as a fixed, dorsiflexed foot is forced into the ground. The capsule and plantar plate are stretched and torn. Also, it can be the result of a hyperflexion mechanism in which the dorsal capsule is torn. There can be associated fractures of the phalanx or metatarsal head. The signs and symptoms include pain, swelling, or stiffness. Ecchymosis may be present.

Hallux Rigidus

Due to arthritis of the first MTP joint with stiffness, and osteophytes. The patient has pain and stiffness localized to the joint that is exacerbated by activity, especially extension of the joint.

Morton's Neuroma

Also known as intermetatarsal or interdigital neuroma and involves perineural fibrosis of a common digital nerve. Typically it occurs at either the second or third intermetatarsal space, but it may occur at other intermetatarsal spaces. The common point of impingement of the neuroma is immediately distal to the transverse intermetatarsal ligament. Compression of digital nerves by the metatarsal heads and the transverse intermetatarsal ligament

appears to be a major cause of Morton's neuroma.

Symptoms of intermetatarsal neuroma are localized to the forefoot and toes. The condition may initially present as a dull ache or cramping sensation, with associated numbness. Tingling or burning radiation to the toes along with intermittent symptoms of sharp, shooting pain are reported. Digital dorsiflexion may cause pain during propulsive phases of walking or during forefoot weight-bearing activity such as sprinting, jumping, squatting, or repeated hopping. Narrow-fitting footwear usually induces symptoms; relief is often reported with shoe removal or massage of the foot.

Dorsoplantar compression of the intermetatarsal space often reveals a palpable mass and usually reproduces pain that may radiate to the toes or proximally along the course of the affected nerve. Manual pressure to the medial and lateral aspects of the forefoot may compress the neuroma between the two metatarsals.

A metatarsal pad applied to the foot over the heads of the central three metatarsals may reduce symptoms by preserving intermetatarsal space.

Icing after sports activity may relieve the pain. This can be done by rolling a plastic bottle full of ice beneath the foot.

Plantar Fasciitis

The fascia arises from the medial calcaneal tuberosity and attaches to the base of the proximal phalanx of each toe. With weight bearing, it tenses like a bowstring on the plantar surface and helps maintain the medial longitudinal arch. If the fascia is tight or the calcaneal insertion is overstressed, plantar fasciitis may develop. The resulting pain is usually greatest at the fascial insertion on the medial calcaneal tuberosity. In some cases, the inflammatory response will cause calcification at the origin of the fascia and result in spur formation along the lines of traction.

Plantar fasciitis is characterized by heel pain that is usually more severe when the patient first arises. Initially, the pain, which the patient may describe as burning, may occur only at the medial tuberosity of the calcaneus and with exercise. With progression, pain may start interfering with activities of daily living and be experienced more distally along the medial aspect of the fascia.

Plantar fasciitis is a clinical diagnosis. Examination reveals exquisite local tenderness at the anteromedial calcaneus, which may spread along the fascia. Passive dorsiflexion of the toes or having the patient perform heel raises may exacerbate the pain.

The location of the medial plantar fascia origin may be approximated by dorsiflexing the foot and great toe and palpating the tender area where the stretched plantar fascia appears to attach to the calcaneal tuberosity.

The characteristic lesion in plantar fasciitis is an enthesopathy that results from tensile overload of the plantar fascia insertion on the medial calcaneal tuberosity.

Heel spur

Partial rupture of the plantar fascia is associated with an acute event and produces sudden onset of pain, swelling, and subsequent bruising. This injury may be associated with prior injection of steroids.

The coexistence of a system disorder should also be considered. Plantar fasciitis may be the first symptom of or a complication of rheumatoid arthritis, gout, or seronegative spondyloarthritis such as Reiter's syndrome and ankylosing spondylitis.

Sprained Ankle

Most ankle sprains involve the lateral ligaments (up to 90%) while the stronger, tauter medial (deltoid) ligament is less prone to injury. Most sprains occur when the ankle is plantar flexed and inverted, such as when landing awkwardly after jumping or stepping on uneven ground.

Common features of sprained lateral ligaments:

- Ankle gives way
- Difficulty in weight bearing
- Discomfort varies from mild to severe
- Bruising (may take 12-24 hours) indicates more severe injury
- May have functional instability: ankle gives way on uneven ground

On physical examination:

- Note swelling and bruising
- Palpate over bony landmarks and three lateral ligaments
- Test general joint laxity and range of motion
- A common finding is a rounded swelling in front of the lateral malleolus
- Test stability in A-P plane (anterior drawer sign)

For a severe injury the possibility of a fracture - usually of the lateral malleolus or base of the fifth metatarsal - must be considered. If the patient is able to walk without much discomfort straight after the injury a fracture is unlikely. However, as a rule, ankle injuries should be x-rayed.

The biggest decisions we have to make with MyoFascial Disruption Treatment involve whether there's a major fracture or dislocation, or simply a soft-tissue injury. If there is no gross deformity of the ankle, it's unlikely that there are any major complications. Basically, you have to decide whether you are going to take care of the patient or refer the patient to an orthopedist.

Persistent Pain After Ankle Sprain

Pain that lasts 6 or more weeks after a sprain may come from inadequate rehabilitation (unrecognized myofascial disruptions), impingement, occult osteochondral or chondral lesions, peroneal tendon or syndesmosis injury, or lateral instability.

MyoFascial Disruption Treatment Approach to Sprained Ankles

An ankle sprain can occur with inversion of the foot leading to an enthesopathy. The ankle may be twisted as the person falls to that side causing myofascial bands that extend from the ankle to the calf. A further mechanism of ankle injury occurs when the foot is held in place while the ankle is twisted. This injury usually causes ankle joint dysfunction needing traction/thrust manipulation. With ankle joint dysfunction the patient will complain of pain deep in the joint, state that the ankle feels tight, will have generalized tenderness, and will gently wrap the fingers around the ankle, distal leg, or foot.

All sprained ankles contain an enthesopathy of the origin or insertion of the anterior tibiofibular ligament, which causes limited dorsiflexion. In all sprained ankles this problem should be treated first. Once all enthesopathies of this ligament are treated correctly, dorsiflexion is restored. Once all the enthesopathies of the ankle are corrected, the patient should be able to walk without a limp and have little pain. Enthesopathies can be treated with firm pressure or with electric point stimulation.

The anterior ankle enthesopathies are treated first, and then any myofascial bands are located and treated. The lateral lower leg band starting at sock level is present in almost all myofascial band sprained ankles. This band extends around the lateral malleolus, onto the dorsum of the foot to the end of the metatarsals (usually fourth and fifth).

Myofascial layer disruption type of sprained ankle is not as common as the other distortions, and occurs more in hockey and basketball. Medial and lateral ankle swelling is present, and lateral ankle swelling is always present. Once ankle dorsiflexion is restored by treating the enthesopathies, treatment can focus on correcting the joint dysfunctions. In traction disruption the patient will gently grasp the ankle, distal leg or foot. In the less common compression disruption the patient gently grasps the ankle and will also make a sideways pushing sweep with the fingers back and forth across the top of the ankle.

Superficial fascial disruptions rarely occur in ankle sprains, but do occur in foot sprains.

References

- Fam AG. The Ankle and Foot. In: Klippel JH, Dieppe PA. Rheumatology. 2nd edition. Vol 1. Mosby, Philadelphia; 1998: 12.1-12.4.
- Murtagh J. General Practice. McGraw-Hill Book Co, Sydney; 1994: 581-583.
- Corrigan B, Maitland GD. Practical Orthopaedic Medicine. Butterworth-Heinemann, Oxford; 1993: 184.
- Typaldos S. Orthopathic Medicine. The Unification of Orthopedics with Osteopathy through the Fascial Distortion Model. 3rd ed. Self Published, Bangor, Maine; 1999: 111-112, 114, 118, 120, 125, 143-144.
- Travell JG, Simons DG. Myofascial Pain and Dysfunction. The Trigger Point Manual. The Lower Extremities. Vol 2. Williams & Wilkins, Baltimore; 1992: 356, 372, 399, 429, 461, 490, 504.
- Myerson MS, Biddinger K. Achilles tendon disorders. Practical management strategies. Physician Sports Med 1995; 23: 47-54.
- Simons SM. Foot injuries of the recreational athlete. Physician Sports Med 1999; 27: 57-70.
- Waldman SD. Atlas of Common Pain Syndrome. W.B. Saunders Co, Philadelphia; 2002: 285-287.
- Batt ME, Tanji JL. Management options for plantar fasciitis. Physician Sports Med 1995; 23: 77-86.