THE SAN DIEGO KNEE CLINIC

COMMON ANKLE INJURIES IN SPORTS

We will be offering counseling on diet and exercise. If interested, please contact my office and schedule a medically supervised *Health and Orthopedic Fitness* assessment appointment which will include a spine and joint health assessment evaluation. This assessment will not be covered by health insurance.

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Ankle injuries can be very disabling. With an understanding of the mechanisms of these injuries, and of the effects of therapy, physicians can help athletes return to full competition in a reasonably short period of time. An aggressive and studied approach to diagnosis and treatment is recommend.

Ankle injuries have been considered relatively minor in comparison with other types of injury that commonly occur in sport, and there seems to be a somewhat casual attitude toward the treatment of these injuries. Yet studies show that the average period of disability associated with an ankle sprain is from four to 26 weeks, and up to 40% of patients experience symptoms for up to four years. In view of the increasing importance of sports in the United States, these “minor” injuries deserve more careful attention.

The ankle is a hinge joint, allowing motion in only one plane: dorsiflexion and plantar flexion. Because the upper surface, or dome, of the talus is somewhat wider anteriorly, there is some limited motion of the ankle in other planes when the foot is plantar flexed. The full range of inversion, eversion,supination, and pronation possible by the foot does not occur in the ankle mortise, but in the subtalar joint.

The ankle mortise is formed by the distal tibia and its malleolus medially and by the distal fibula, which forms the lateral malleolus. This mortise receives the upper domed surface of the talus. The malleoli extend downward along the sides of the talus, providing a significant amount of bony stability to the ankle joint. The fibula provides both muscular and ligamentous attachments and appears to contribute to the weightbearing and dynamic stabilization of the ankle.

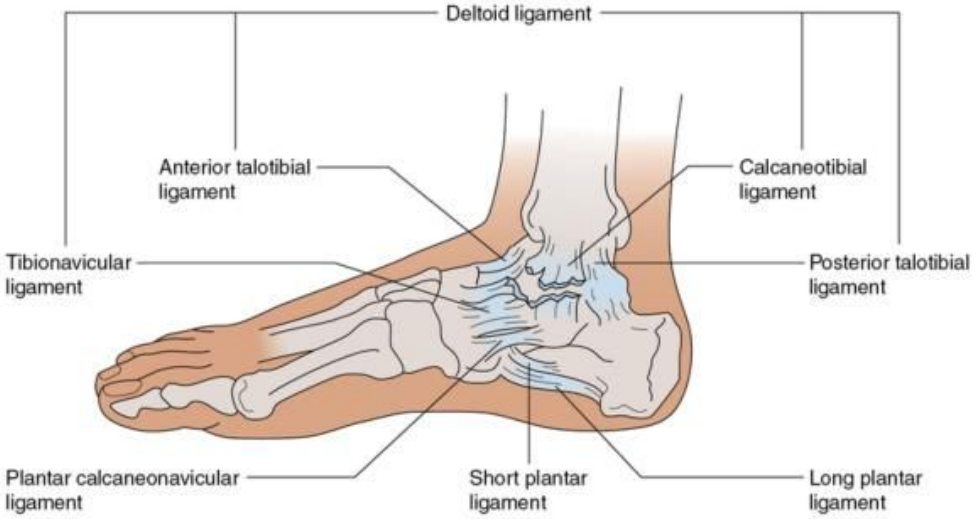


Figure 2. Injury to medial ligaments of the ankle. **Source:** HUMAN KINETICS

Ligaments provide soft-tissue support for ankle and hold the talus firmly in the mortise. Medially, the large ligament arising from the medial malleolus and fanning out to attach on the talus, calcaneus, and navicular bones is called the deltoid ligament. This ligament is actually composed of four functional structures that perform as a unit.

Although the ankle joint has a high degree of bony stability and appears to be fairly injury resistant, the ankle is really a joint of compromise between mobility and stability. The ligaments must be strong enough to hold the talus firmly in the ankle mortise, yet they must be supple enough to allow a full range of motion. Consequently, and because of the ankle's location and its functional relationship to the rest of the body, it is the most commonly injured joint in sports.

Figures 1-2: Medical Art Services, Inc

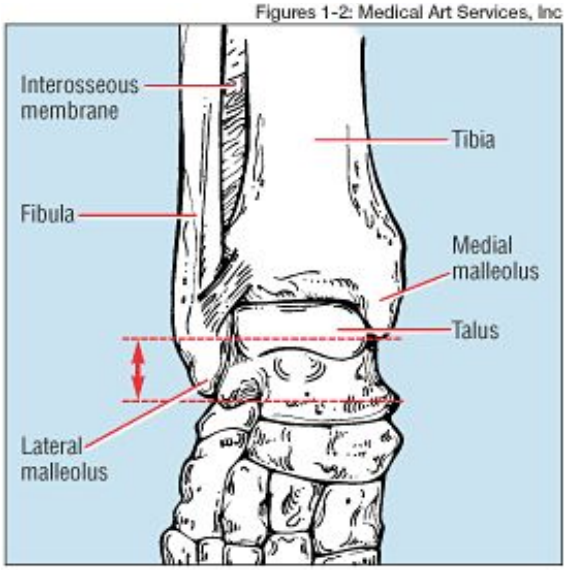


FIGURE 1. Anterior view of the ankle. Note the stabilizing boxlike mortise formed by the distal tibia and fibula over the talus. The lateral malleolus extends more distally than the medial malleolus (arrow). This creates a barrier to eversion, so most ankle sprains are caused by inversion.

Figure 2 source: *The Physician and Sportsmedicine*

Lateral inversion sprains involve the talofibular ligament or the calcaneofibular ligament or both. History, drawer tests, x-rays, and physical examination are central to diagnosis and evaluation of extent of injury.

By far the most common ankle injury in sports is the lateral inversion sprain. One reason for this is that many sports are performed on irregular playing surfaces, which greatly increases the risk of sprain. Other reasons for the likelihood of such sprains occurring are physical and anatomical. One complicating factor is that many athletes have both tight heel cords and a deficient proprioceptive sense at the ankle. Tight heel cords predispose the ankle to this injury because they force inversion of the foot at the heel strike. The proprioceptive deficiency develops because people - including athletes - normally spend the majority of their time on smooth, flat surfaces. The ankle often fails to develop the proprioception required of those who perform on varied terrain. The lateral ankle area is also more commonly injured because the lateral ligaments are smaller and weaker than the medial ligaments.

It is cumbersome to apply the standard sprain classification system to lateral ankle sprains since their severity usually depends on how many ligaments are torn. Instead, it is somewhat easier to categorize lateral ankle sprains as either one- or two- ligament sprains. If mild-to-moderate stress is applied to the inverted (or supinated) foot, usually only the anterior talofibular ligament is torn. As more force is applied, such as the weight of the falling body, the foot begins to dorsiflex while inverting even further. The calcaneofibular ligament then comes under strain and tears, becoming a two-ligament sprain.

It is important to examine the injured ankle as soon after injury as possible, before swelling and spasm can obscure any symptoms. A thorough history is imperative, particularly information concerning history of sprains or chronic instability of the injured ankle. The injured athlete will probably say that the ankle turned inward and that there was a pop or a snap accompanied by a searing pain at the lateral ankle. This initial episode may be followed by a period of up to 30 minutes in which the injury is relatively pain free.

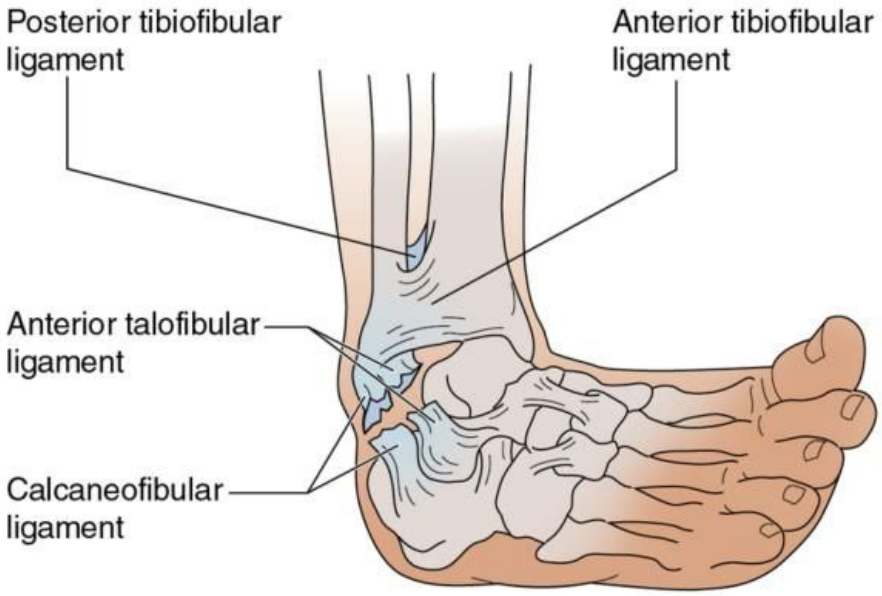


Figure 3. Injury to the lateral ligaments of the ankle**. Source:** HUMAN KINETICS

On the lateral side of the ankle are the anterior talofibular, the calcaneal-fibular, and the posterior talofibular ligaments. Additional support is provided by the synovial capsule, which encapsulates the entire joint and which, in some patients, is somewhat thicker anteriorly.

Immediately palpate the tibia, the fibula, both matteoli, and the base of the fifth metatarsal for signs of fracture. Next, palpate the involved ligaments to localize the site and extent of the sprain. An anterior drawer test of both ankles should also be performed to check for a tear of the anterior talofibular ligament and the calcaneofibular ligament. Place the patient supine on the examination table with the

foot and ankle in neutral. Place one hand on the tibia to stabilize the heel and pull up. On a positive test, the physician will see displacement forward of the ankle, feel an instability, and hear a clicking noise. A positive test indicates tears of both the anterior talofibular and the calcaneofibular ligaments. In acute injuries, there is usually too much guarding to elicit a positive drawer test. In cases of chronic instability, it is more readily demonstrated.

Always compare both ankles and always be sure to ask patients whether the instability is chronic or acute. Gross instability of the ankle is indicative of complete tears of both ligaments. As a further test, you may also ask patients to stand on their toes: If they are able to stand on their toes, then it is likely that the calcaneofibular ligament is not completely torn. If they are unable to stand on their toes, then it is likely that they have torn both ligaments. Bear in mind also that a proprioceptive defect in the ankle, which usually accompanies this injury, may cause some of the instability encountered.

X-ray evaluation is mandatory in all ankle injuries. Avulsions or fractures of both malleoli as well as osteochondral fractures of the talar dome are common in ankle sprains. Stress x-rays are also frequently performed, but timing is important, since swelling and spasm may limit their value. Local injection of 1% lidocaine will reduce spasm and pain, and in most cases will allow performance of the stress maneuver. An MRI is very helpful in establishing a diagnosis is mandatory for more severe ankle injuries.

Treatment of lateral inversion sprains depends on the severity of the injury.Chronic ankle instability may warrant surgical reconstruction of the lateral ligaments.

In the acute phase of an ankle sprain the treatment is always the same: ice, compression, and elevation. Crutches for the first few days are advisable for all sprains. The injury is iced for 30 minutes every two hours for the first two to four days following injury. A compressive wrap is also worn during the periods when the ice is not in place. In order to more evenly distribute the compression into the hollows around the ankle, a felt horseshoe is placed around both malleoli and held in place by the compressive wrap. Subsequent treatment depends on the severity of the sprain.

In a single - ligament sprain involving just the anterior talofibular ligament, pain is usually moderate and the athlete is able to move the foot up and down without much additional pain. Tenderness and swelling are located over the ligament at the anterolateral aspect of the ankle. Continue to ice the ankle two to three times a day for the first week and support the ankle with either tape of a semi rigid ankle support. Begin

range-of-motion exercises as soon as the patient can tolerate them, usually within three or four days. After two or three days, the athlete should be able to walk with only minimal discomfort and can return to competition if the ankle is properly supported in ten to 21 days.

There is some controversy as to the treatment of a two-ligament sprain. Some physicians cast the injured ankle for a period of four weeks following injury. Then begin range-of-motion exercise with the ankle supported with tape or other support. The cast is applied only after swelling has subsided, and exercise must be started as soon as possible.

Another approach to treating the two-ligament sprain is more aggressive and deserves recommendation. Initially, the athlete is placed on crutches, and the injured ankles immobilized with tape, or with a semi rigid orthosis, or with a plaster posterior splint. The ankle is iced regularly and the patient is allowed to bear weight as tolerated. (Weight bearing is important in helping to regain the proprioceptive sense). Range-of-motion and isometric exercises are begun as soon as the patient can tolerate them in conjunction with cryotherapy. As therapy continues, more resistance can be tolerated as the pain recedes. The therapy program progresses until eventually the patient is capable of running in a straight line and working on the wobble board to develop the proprioceptive sense. The exercises are always done with the ankle taped or otherwise supported.

The period of rehabilitation for each patient will vary depending on the severity of the injury, that is, on whether the calcaneofibular ligament is partially or completely torn. In a severe two-ligament sprain, rehabilitation may consist of a period of up to three months under a therapist's care followed by an additional three months on a home rehabilitation program. It is vital that patients be provided with a suitable support to protect the ankle during this period. If this nonoperative approach fails to result in a stable ankle, than a surgical reconstruction of the lateral ligaments may be considered at a much later time.

Repeated lateral ankle sprains and/or improper treatment of these sprains may result in a chronic instability of the ankle. Of the ankle is unstable only under conditions of heavy stress, a conservative approach to treatment is successful in about 60% of the cases. This treatment consists of an exercise program to strengthen the peroneal muscles, proprioceptive exercises, and external support for the ankle in the form of tape or other semi rigid orthosis.

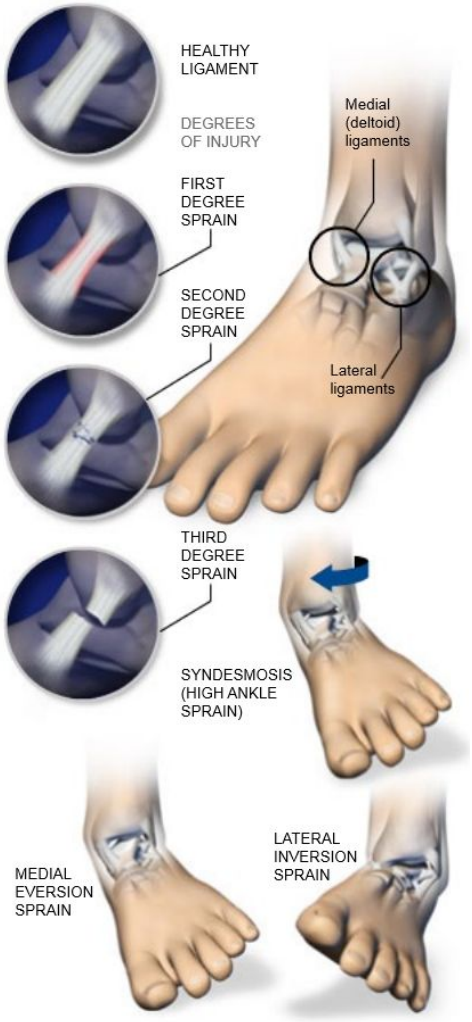
Many patients will alter their expectations and life styles to compensate for this instability. If the athlete continues to have functional problems and the ankle remains sore and continues to give way, then a surgical reconstruction of the lateral ligaments must be considered. Most of the reconstructive procedures performed for this problem use a portion of the peroneus brevis tendon to substitute for the anterior talofibular and calcaneofibular ligaments. More recently I have used a Bromstom technique which ia a tightening procedure of the lateral ankle ligament and soft tissues. These reconstructive procedures do not always result in a symptom-free ankle, but they can be among the most successful of all reconstructive procedures performed.

Anterior capsule sprains and medial eversion sprains occur less frequently than do lateral inversion sprains, but they may be more serious and take longer to heal.

Anterior capsule sprains occur when a forceful stress is applied to the plantar-flexed foot, as when a baseball player's foot turns under while he is sliding into base. Under such stress, the anterior capsule of the ankle can be torn. The athlete will complain of pain on resisted dorsiflexion and on passive plantar flexion.

A tear of the anterior capsule may be confirmed by performing a drawer test on the ankle. In this test the injured ankle is carefully compared with the uninjured ankle. If it is possible to elicit slightly more drawer on the injured ankle, then the capsule is probably torn. If a significant amount of drawer is elicited, then the lateral ligaments are also involved.

Treatment is essentially the same as that for a single-ligament sprain. The difference in this injury is that the anterior capsule sprain generally takes much longer to heal and to regain normal function.



Source: Central Coast Orthopedic Medical Group

Medial eversion sprains occur when a sudden, strong force is applied to the abducted and externally rotated foot. Though these sprians are far less common than lateral inversion sprains, their consequences can be much worse.
As stress is applied, the deltoid ligament(inside ligament or medial ligament) can be torn or avulsed from the medial malleolus(tibia). If the force is strong enough, displacement of the talus may also result in a tear of the distal tibiofibular ligaments and the tibiofibular interosseous ligament.

Treatment of this sprain is the same as that for a severe two-ligament sprain. However, x-ray must be repeated in two days to be sure where is no diastasis(separation) of the tibia and fibula.

Stretching the achilles tendon before and after activity is basic to preventing Achilles tendinitis.

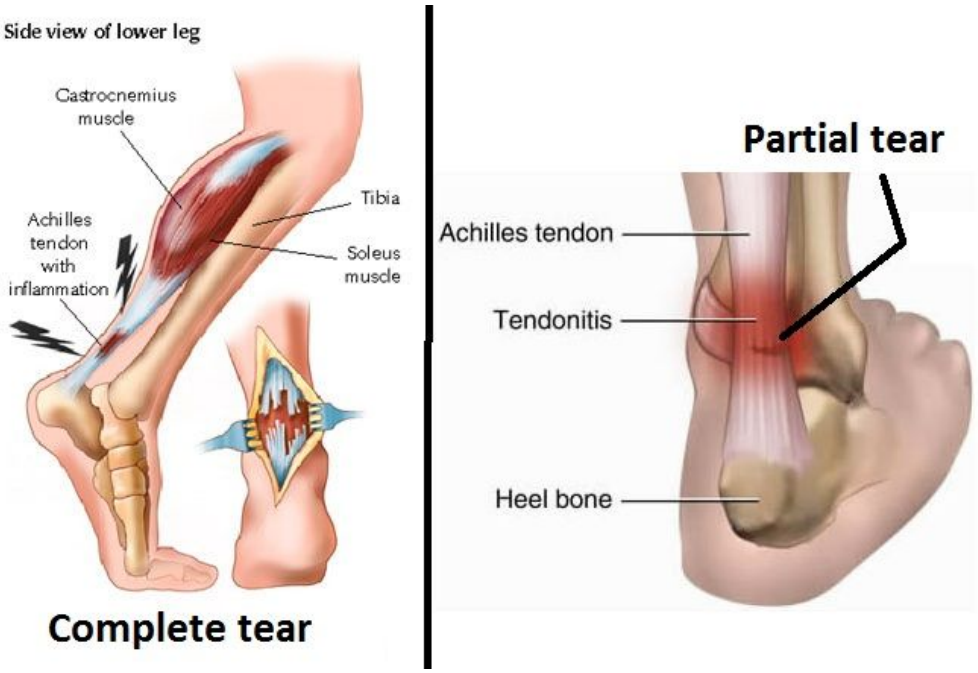


Figure 5. Complete and partial tear of the Achilles tendon.**"**The thickest and the strongest tendon in our body is the tendon of the calf muscles of the leg also known as the "Achilles tendon".
Source: Orchard Health Clinic. Osteopathy Singapore.
Web: https://singaporeosteopathy.com/category/pain/

The Achilles tendon is the largest/thickest tendon in the body, connecting the powerful gastrocsoleus complex to the calcaneus(heel bone). The most common cause of Achilles tendinitis is repetitive trauma to the tendon, particularly from running on hard surfaces. Another cause of Achilles tendinitis is repetitive, forceful stretching of a tight Achilles tendon. Achilles tendinitis is very painful and is the result of inflammation of the tendon and/or its sheath. This inflammation is caused by microtears in the tendon substance. Inflammation of the sheath is rare, very painful, and may be accompanied by calcium deposition in the sheath. The pain of Achilles tendinitis is characteristically more intense on arising and lessens as the day progresses.

Achilles tendinitis is an injury that can be prevented. Heel cord stretching before and after activity is essential, and the athlete should wear shoes appropriate to the type of activity to be performed. Some qualities to look for in a shoe are firm heel counter, which prevents excessive motion of the calcaneus and Achilles complex; a flared, shock absorbing rear sole, which will also help control rear foot motion; and a suitable sole or tread pattern for the sport. If the patient is a runner, encourage running on a surface that offers some shock absorption such as grass, packed sand, or a composition track. Asphalt or concrete should be avoided, but above all, patients should be advised to be rational about their training and not to do too much too soon. Let pain be the guide and do not push it.

The first step in treating Achilles tendinitis is to immediately stop the activity that caused or aggravated the condition. Swimming is the best alternative activity. Apply ice to the inflamed tendon for 20 minutes, two for four times a day. Give aspirin or an oral anti inflammatory drug to control pain and inflammation. (Indomethacin is very good for calcific tendinitis but is rarely used). Avoid local steroid injection; it retards healing and may promote tendon rupture. After three to six weeks, begin a program of gentle feel-cord stretching exercises and add one-fourth-inch heel lifts in the shoes. The lifts should be worn for about a month after return to activity. The athlete can return to competition upon relief of upon but must work slowly toward peak performance.

If this condition is chronic, many physicians elect to place the athlete in a short-leg walking cast for periods of from two to six weeks to rest the injured tendon. Following immobilization, the patient performs range-of-motion exercises, graduating to a program of heel cord stretching and strengthening of the calf muscles. In rare cases, the physician may elect to strip the tendon sheath from the tendon and to remove any diseased or granulated tissue. It is best to try alteration of activity or resting the injured tendon before this surgical approach is taken.

Surgery is usually recommended for complete rupture of the Achilles tendon; partial rupture may be difficult to differentiate from tendinitis.

Though the Achilles tendon is extremely strong and able to withstand loads of up to 2,000 pounds during running, it is frequently torn. The usual mechanism if this tear is a sudden and forceful dorsiflexion(upward motion) of the foot when the calf muscles have already contracted. The tendon most commonly ruptures 2 cm to 6 cm above the insertion on the calcaneus, where the blood supply is the poorest.

The athlete with a complete rupture of the Achilles tendon is typically more than 30 years old and has had some degenerative changes in the tendon due to a compromised blood supply. (Through younger athletes usually only partially rupture this tendon, it is becoming more common to find complete ruptures in young athletes).

The athlete who has ruptured this tendon completely will usually relate having heard a pop followed by a tearing sensation and a searing pain. The rupture generally occurs when the athlete is pushing off against heavy resistance. Following the injury, the athlete should be able to walk, through with a limp. Examination will reveal a palpable gap at the posterior ankle, swelling, and increased passive dorsiflexion of the foot. The definitive diagnosis sign of a complete tear of the Achilles tendon is elicited by the squeeze test. With the athlete prone on the examination table and with feet hanging over the endm squeeze the middle third of the calf (just below its widest girth), and press toward the knee. If the foot fails to plantar flex, then the tendon is completely torn.

There are both closed and open approaches to the treatment of this injury. The major problem with the closed approach is that the retracted ends of the torn tendon must be adequately opposed. Also, the period of immobilization must be of sufficient duration to allow adequate healing. This period of immobilization can be very extensive. The majority of physicians choose a surgical approach to repair.

Though there are various ways to surgically repair a torn Achilles tendon, they all basically involve approximation of the torn ends and suturing. Following surgery, the foot is casted in a plantar flexion(downward) position .This cast is charged in two to three weeks and the foot then dorsiflexed within tolerance of the repair. This cast is usually worn for four to six weeks.On removal, the patient begins a progressive rehabilitation program and uses a heel lift or high-heeled shoes for a period of two to three months. Theoretically it takes up to one year to reach full healing.

A partial rupture of the Achilles tendon may occur either as the result of a single instance of high stress or as the result of repetitive microstress and microtearing of the tendon substance. The athlete usually complains of a sharp pain, particularly after exercise, that can be localized anywhere from just above the calcaneus to the lower third of the calf muscle. Onset of the pain may be either gradual or sudden. Though the athlete may walk with a limp, this ligament appears to function quite well with only 25% of its substance intact. A palpable defect may also be found in the tendon on examination.

An MRI is used to diagnose this injury and to differentiate it from Achilles tendinitis. Initial treatment of this injury begins with cryotherapy, the addition of heel lifts to reduce tension on the tendon, and possible posterior strapping of the leg to prevent excessive dorsiflexion of the foot. Most physicians also cast the injured leg for periods of four to six weeks in order to allow the defect to heal. As the pain begins to moderate, the patient is placed on a rehabilitative program of slow stretching and strengthening exercises. If this conservative approach fails to result in a healed defect, then surgical repair of the tendon to restore its full strength should be considered.

Dislocation of the peroneal tendons causes tenderness and swelling behind the lateral malleolus, a clue to diagnosis.

The tendons of the peroneus brevis and peroneus longus muscles track in a groove behind the lateral malleolus(outside) of the ankle. The peroneus brevis attaches at the base of the fifth metatarsal and the peroneus longus attaches near the head of the first metatarsal. These tenon/muscle units act to plantar flex and to evert the foot. The tendon of the peroneus longus also plays an important part in maintaining the transverse arch of the foot. Perhaps of more importance to athletes, these tendons and muscles are responsible for stabilizing the leg upon the foot, particularly when weight is borne on only one foot.

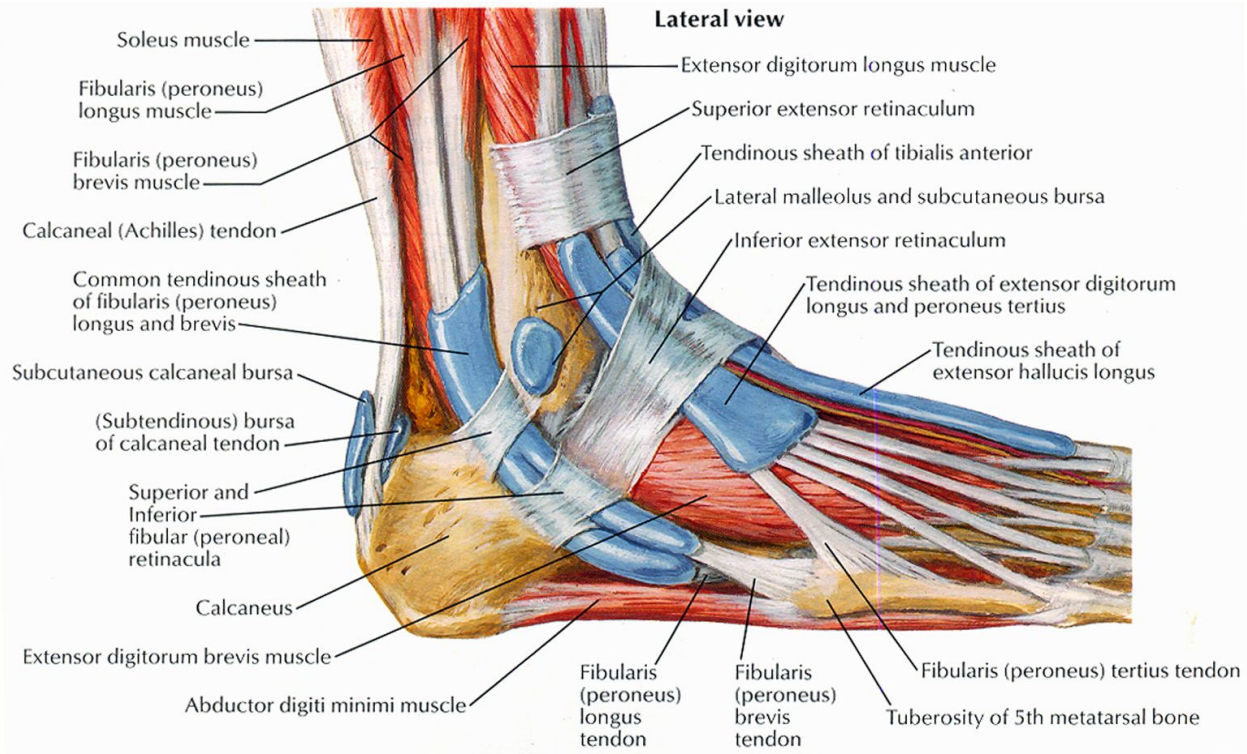


Figure 6. Lateral view of the ankle with peroneal tendons and related structures**. Source:** Core Walking for Pain Relief.
Web: https://corewalking.com/the-muscles-that-work-the-pulleys-that-lift-the-arches-of-the-feet/

Dislocation of the peroneal tendons occurs when the foot is forcefully dorsiflexes and inverts when the peroneal muscles have already contracted. The peroneal reticula, which hold the tendons in the groove behind the lateral malleolus, may rupture and allow the tendons to dislocate over the lateral malleolus. In most cases, only the superior of the two retinacula ruptures. This condition may also be the result of repetitive microtrauma, with tearing in the retinacula, particularly if the groove is shallow. This is a serious injury in that the ankle becomes unstable and can give way under normal stress.

The symptoms of peroneal tendon dislocation mimic those of a lateral inversion sprain. The main difference is that the examiner can localize tenderness and swelling behind the lateral malleolus rather than on the lateral border. It may also be possible to reproduce the dislocation of the tendons on examination by dorsiflexing the athlete's ankle. An MRI is also quite helpful initially.

Though there are both open and closed approaches to the treatment of this injury, many physicians agree that it is more sensible to attempt a surgical repair of the retinacula as soon after injury as possible, before the retracted ends can atrophy. The closed approach follows closely the treatment for a severely sprained ankle. If the torn

ends of the retinacula are not successfully opposed and immobilized and allowed to heal, the result may be an unstable ankle and reconstruction will be necessary.

If the condition is chronic, then it is likely that the peroneal retinaculum has atrophied to the point where repair would be impossible. Surgical reconstruction may not be necessary for many patients who are able to function well in spite of the dislocated tendons. In the case of an athlete, however, a reconstruction is indicated to restore function to the tendons and stability to the ankle.External support of the ankle does not compensate well for the instability in this case.

Osteochondritis dissecans of the ankle cannot be diagnosed by physical examination alone; x-rays and MRI are necessary.

Because of its position and function, the dome of the talus is subjected to a variety of loading conditions during normal athletic activity. Repetitive, varied loading may result in the gradual separation of a small fragment of subchondral bone and its overlying articular cartilage from the talar dome and is called osteochondritis dissecans. The location of the lesion can be anywhere on the talar dome. It is likely that both compressive and shear-type loads, concentrated in a small area on the dome, are responsible for the separation of the fragment.

Most patients with this injury describe a gradual onset of pain, intensifying over a period of weeks or even months. The pain is usually most intense just after exercise, and because of swelling or impingement of the fragment, the ankle may become stiff or lock. The only means of accurately identifying this injury is with an x-ray. Several different views may be required to adequately localize the lesion. If plain x-rays are not adequate to visualize the defect, then computerized axial tomography or radioisotope studies may be used.

The initial steps in treating osteochondritis dissecans consist of casting the injured limb in a short-leg, non-weight-bearing cast. Keep the ankle immobilized until evidence of healing is noted between the fragment and the underlying bone. Immobilization may be necessary for as long as 18 weeks. If the symptoms persist in spite of this conservative approach, surgical interventions should be considered.

The surgical approach consist of excising the bone fragment and either curetting or drilling the crater that is left by the fragment. The curetting or drilling into the subchondral bone permits a reestablishment of the blood supply to the lesion and

permits the invasion of a fibrous cartilage. Though it is not true articular cartilage, this new fibrous cartilage appears to function quite adequately.

What can be done to prevent ankle injuries? Does taping help?

It would be difficult to determine how many miles of adhesive tape are used each year in sports. In the last several years there has been a great deal of controversy about the value of prophylactic taping of the ankle. Recent studies have shown that athletes lose a considerable amount of support from the tape before they even get out of the training room. But other studies have shown that tape compares favorably with semirigid orthotics for support offered.

Should healthy ankles always be taped? A poor taping job is certainly worse than no tape at all, and it is a fact that performance is influenced by tapping the ankles. Some athletes become psychologically dependent on tape and will not participate without it. However, it is recommended that all athletes in contact or high-risk sports tape their ankles. Taping is optional for those in sports where the risk of ankle injury is lower.

The physiological and environmental factors that influence ankle injuries should be considered. Start athletes on a daily program of heel cord stretching that will lessen the tendency of the foot to invert at heel-strike and provide appropriate footwear for the type of activity. High-top shoes, regardless of the sport, will provide significant external stabilization of the ankle. The shoes should have excellent shock absorption characteristics and should offer good heel control while allowing forefoot flexibility. Playing fields should be well groomed and free of hazard. Each athlete should also begin a program designed to improve strength and flexibility in the lower limb and one that stresses the development of the proprioceptive sense in the ankle. Finally, the athlete must be encouraged to report any seemingly minor ankle injury.

This article was originally published by me in the Journal of Sports Medicine and has been edited to provide a more up to date version.

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