

Ankle Sprains in Theatrical Dancers

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Abstract

Theatrical dance is an art form that includes the various disciplines of classical ballet, modern dance, ethnic dance, and mixed forms such as Broadway and jazz. The accomplished theatrical dancer combines the physical attributes of the elite athlete¹⁻³ with the grace and esthetic sense of the superior artist. The extraordinary athletic demands of this art form may make the dancer vulnerable to injury.³⁻⁶

Major sites of injury in dance are the foot and ankle.⁷⁻⁹ When injuries to dancers participating in The American Dance Festival were reviewed, 38% involved the foot and ankle. Of these, the most common acute injury was the lateral ankle sprain.⁸

Despite their frequency, ankle sprains unfortunately are often inadequately treated. This paper discusses the anatomy, pathomechanics, diagnosis, treatment, and rehabilitation of this very common injury in dancers.

Anatomy of the Ankle Ligaments

The lateral ligamentous complex of the ankle comprises three ligaments—the anterior talofibular, the calcaneal fibular, and the posterior talofibular ligament (Fig. 1). The anterior talofibular ligament extends almost horizontally from the anterior margin of the distal fibula or lateral malleolus to the lateral aspect of the talus. The ligament is lax with the ankle in the neutral position, but becomes taut when the foot is plantar-flexed. The calcaneofibular ligament passes vertically from the tip of the lateral malleolus to attach to the lateral side of the calcaneus. This ligament is crossed by the peroneal tendons and is intimately associated with their tendon sheath. The ligament makes considerable contribution to the lateral stability of the ankle

as it spans both the ankle and subtalar joints. The posterior talofibular ligament is directed posteriorly from the lateral malleolus and attaches to the talus.

The lateral ligaments act as static stabilizers to the ankle, providing resistance to inversion stress placed on the hind- and mid-foot. The peroneal muscles, consisting of the peroneus longus and brevis, give dynamic reinforcement to these static structures.

On the medial side of the ankle, the medial collateral or deltoid ligament fans out from the tip of the medial malleolus to insert into the navicular, talus, and calcaneus. This ligamentous complex provides static stability to eversion stress to the medial or inner side of the ankle. Eversion sprains are relatively rare in dance. The vast majority of ankle sprains in dancers involve the lateral ligamentous complex and will be emphasized here.

Mechanism of Injury

The ankle has been referred to as a modified hinge joint, comprising of the talus, medial and lateral malleoli, and the articular surface of the distal tibia. The motions of the ankle joint are in the sagittal plane and are termed plantar-flexion (flexion) and dorsi-flexion (extension). The inherent bony and ligamentous structure will always be more stable in dorsiflexion. In some individuals, the talus is slightly wider anteriorly than posteriorly, thus making the ankle much less stable and more dependent on the lateral ligaments for stability when the foot is in plantar flexion.¹⁰

The most common mechanism of lateral ankle sprains is plantar flexion with inversion of the foot. The dancer is particularly vulnerable when landing from a jump with the foot in a plantar-flexed position. In this position, the talus is less stable within the ankle mortise and with inversion stress the primary static restraint to forced inversion is the anterior talofibular ligament. If the entire weight of the

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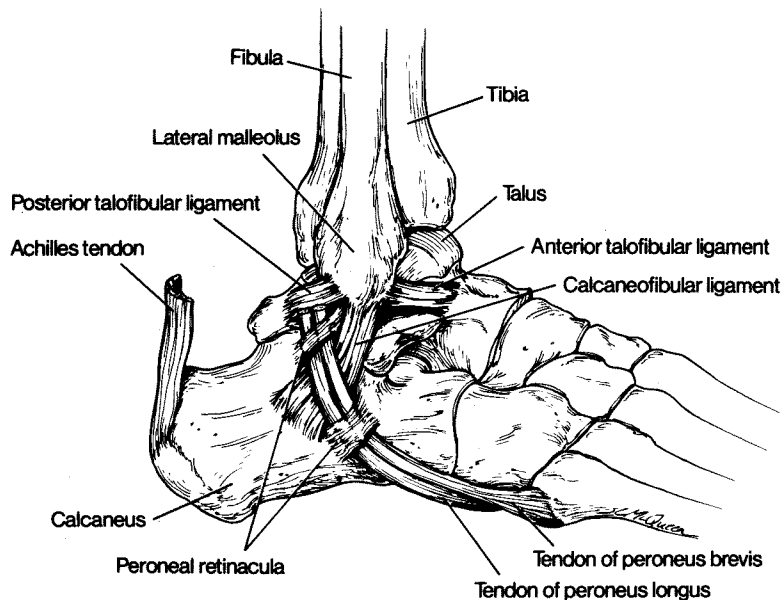


FIGURE 1 Ligaments of the lateral aspect of the ankle.

dancer's body continues forward, enormous stress will be placed on this ligament and injury frequently occurs. If the force continues an injury to the calcaneal fibular ligament will occur as well. Injury to the posterior talofibular ligament is unusual except in complete ankle dislocations.

With injury, the dancer notes immediate pain anterior to or beneath the lateral malleolus. Swelling and subcutaneous hemorrhage are also commonly noted in these areas. On occasion the dancer may note a "snapping or popping" sensation at the time of injury, strongly suggesting complete ligament rupture.

Other factors may contribute to injuries in dancers.^{1,4} Fatigue from an arduous class or rehearsal schedule may play an indirect role in ankle injuries. Fatigued peroneal muscles may be less capable of providing dynamic stability to the ankle joint. Static stabilizers, such as the ligaments, may become the primary restraint to inversion stress increasing their vulnerability to injury. The dance surface may also be a factor in ankle sprains. Raked stages as well as abnormally hard, resilient, slippery or uneven floors may create insecure footing for the dancer, increasing the likelihood of a misstep and resulting injury.¹¹

Choreography that emphasizes rapid, repeated jumps, and/or elaborate angular footwork may also contribute to ankle injury. Indeed, certain steps, such as *entrechat six* and *double saute de basque* in classical ballet, may particularly expose the dancer to increased risk of injury.⁷ Chronic ankle instability secondary to prior injury may increase the possibility of future and perhaps more severe sprains.

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Diagnosis

An accurate, precise diagnosis is fundamental to proper treatment of ankle sprains. The goals of the examining physician include determination of which ligament(s) have been injured, assessment of severity of injury, and objective exclusion of injury to other bony, tendinous, or cartilaginous structures about the ankle.

On examination, the precise anatomic location of the tenderness and swelling may provide evidence of whether the anterior talofibular ligament has been injured alone (single ligament sprain) or in conjunction with the calcaneofibular (two-ligament sprain). Tenderness isolated to the anterior talofibular ligament suggests the more common injury to only that ligament. Tenderness and swelling over both the anterior talofibular and calcaneofibular ligament indicate the more severe two-ligament sprain.

Significant tenderness isolated to the distal fibula or the base of the fifth metatarsal is more suggestive of fracture of these structures rather than ligamentous sprain. Tenderness over the Achilles tendon without lateral pain and swelling advances consideration of Achilles tendon injury. If tenderness is present posterior to the lateral malleolus, in the region of the peroneal tendons, the diagnosis of peroneal tendon subluxation must be entertained.⁹

Radiographic examination is an important aspect of the evaluation of ankle injuries. Routine x-ray examination is necessary to rule out the possibility of fracture. If significant ankle ligament rupture is suspected, stress x-rays may provide information relevant to the severity of that sprain.

Stress films, performed usually under local anesthetic block, allow the examiner to determine if a complete tear of the anterior talofibular ligament or combined anterior talofibular and calcaneofibular ligaments has occurred. The anterior drawer and talar tilt tests are the most common stress examinations. The integrity of the anterior talofibular ligament is demonstrated by the anterior drawer test.¹² The

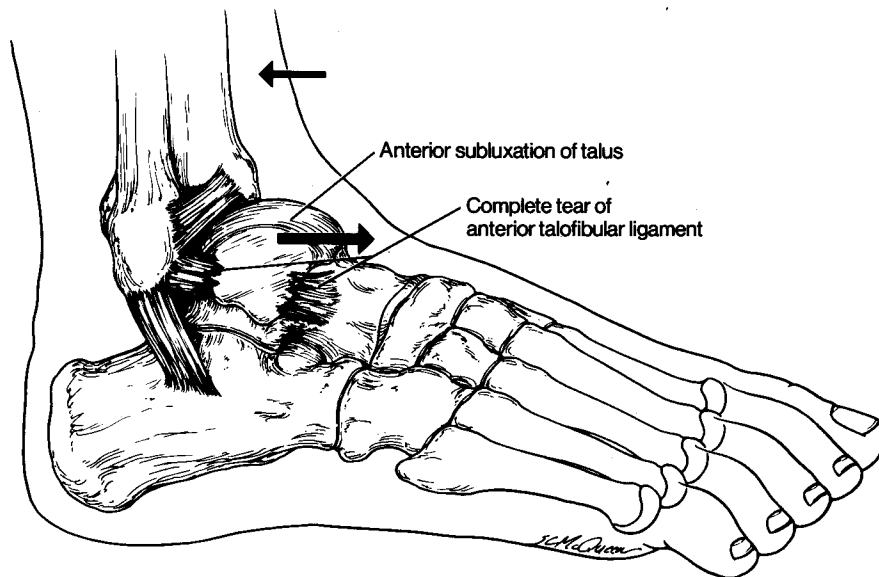


FIGURE 2 Rupture of the anterior talofibular ligament can be demonstrated by the positive anterior drawer sign in which the talus can be subluxed anteriorly beneath the tibia.

test is positive if the talus can be subluxed anteriorly from beneath the ankle joint with the foot in slight plantar flexion (Fig. 2). The talar-tilt test involves attempted inversion of the talus within the ankle joint.¹³ Significant tilt when compared with the contralateral or uninjured ankle suggests rupture of the calcaneofibular ligament (Fig. 3).

Treatment

Regardless of severity, successful treatment of ankle sprains requires aggressive management. Simple elastic wrapping and activity restriction are inadequate not only in the treatment of the acute injury but also in prevention of future sprains. Aggressive treatment provides the opportunity for optimal recovery, prompt return to dance, and sustained performance without undue risk of repeated sprains.

Initial management of all ankle sprains, regardless of severity, is directed toward pain control and reduction of swelling. It consists of protection, rest, elevation, ice massage, and application of a compressive dressing.¹⁴

Mild Sprains

Mild sprains are the most common and represent a stretch or partial tear of the lateral ligament(s). Negative anterior drawer and talar tilt tests indicate no instability. Compression can be provided by serial taping or the air cast. If tape is employed, it should be removed daily, the ankle re-examined, and the ankle retaped until swelling and pain have subsided. The foot is maintained in a neutral or dorsiflexed position. Alternatively, the patient is placed in an inflatable semi-rigid orthosis in which compression is obtained by means of inflatable air cells shaped like a stirrup and placed along the medial and lateral malleoli. Both taping and the air cast provide medial and lateral support, thus restricting inversion and eversion of the ankle joint, yet allowing limited plantar and dorsiflexion.¹⁵

When weight bearing is painful, the dancer is fitted with crutches and instructed to ice the ankle 15–20 minutes four

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times daily. Weight bearing is allowed as tolerated, but only when a normal heel-toe gait is possible. Icing and elevation are directed toward reduction of swelling and should be continued until pain and swelling are no longer limiting factors. Progressive weight bearing using a three-point crutch gait is permitted and crutches are discontinued when the patient can walk with a normal gait.

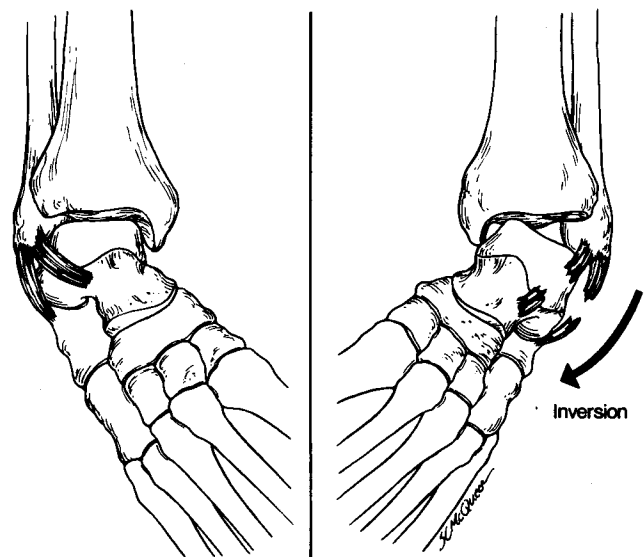


FIGURE 3 A positive talar tilt sign, when compared to the contralateral (uninjured) side, is associated with combined tears of the anterior talofibular and calcaneofibular ligaments.

Moderate Sprains

Moderate sprains consist of significant injury to the anterior talofibular ligament but with maintenance of the integrity of the calcaneal fibular ligament. A positive anterior drawer may be present, indicating complete rupture of the anterior talofibular ligament, but the talar tilt test is negative, signifying functional preservation of that ligament.

Moderate sprains are associated with significant swelling, making early taping or application of the air cast often impractical. A soft compressive dressing with posterior splint may be required for several days until swelling has decreased. At that time serial taping or the air cast may then be applied. Protective motion may be required for 3–4 weeks.

Severe Sprains

These injuries consist of rupture of the anterior talofibular combined with significant injury to the calcaneal fibular ligament. Often there are complete tears of both ligaments, rendering the ankle grossly unstable in two planes within the ankle mortise. Although nonoperative management is indicated in dancers with mild or moderate sprains, consideration may be given to operative management in severe ankle sprains.^{7,8,16–19} Although the subject of some controversy, operative management provides the most reliable restoration of ligament integrity and decreases the possibility of long-term ankle instability secondary to stretched or scarred ligaments.

Nonoperative management of severe sprains consists of serial plaster casting until swelling and pain are no longer present. The ankle is further protected with serial taping or the air cast. Protected motion is usually required for 4–6 weeks in these severe injuries.

Rehabilitation

A structured rehabilitation program is fundamental to successful management of ankle sprains. Accurate diagnosis followed by prompt appropriate treatment are only the initial steps in the total care of these injuries. Proper rehabilitation ensures early optimal return to dance and also provides the best opportunity to prevent further ligamentous or other injury to the ankle.

The goals of rehabilitation include restoration of motion, strength, endurance, proprioception, and confidence in the ankle joint. Range-of-motion in plantar and dorsiflexion can be begun early in the treatment phase of mild and most moderate sprains. With reduction in swelling, gentle active plantar and dorsi-flexion exercises should be encouraged with ankle maintained in tape or the air cast. If pool facilities are available, swimming is an excellent technique not only for restoring range-of-motion to the injured ankle but also for maintaining aerobic fitness. Water walking (forcefully moving in chest deep water) is an excellent aerobic maintenance activity. Early in rehabilitation the dancer should be encouraged to perform barre exercises while in the swimming pool taking advantage of the bouyant effect of water (Fig. 4). Initially, the uninjured leg is used as the leg of

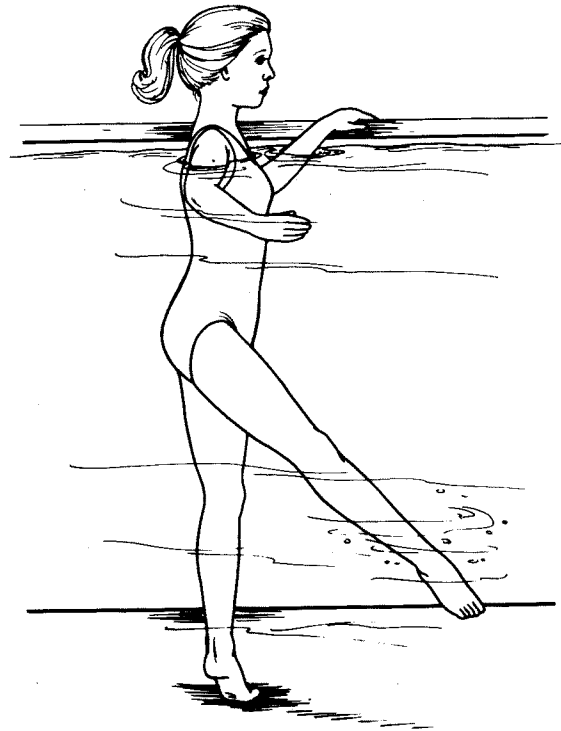


FIGURE 4 Barre exercises can be performed in a swimming pool early in the rehabilitation of ankle sprains.

Swimming is an excellent technique not only for restoring range-of-motion to the injured ankle but also for maintaining aerobic fitness.

support and the injured leg is the working leg. In later stages of rehabilitation the roles can be reversed.

When the dancer can bear weight without limping, the second phase of rehabilitation may be started. During this phase, emphasis is placed on stretching as well as strengthening of the muscle tendon units that cross the ankle joint. Toe raises, performed on an inclined board, allow stretching, as well as concentric and eccentric contraction of this gastroc-soleus group. Cycling is also an excellent technique for providing both range-of-motion and resistance exercise.

Dorsiflexion and eversion resistance exercises are to be especially emphasized. Resistance can be provided by free weights strapped to the foot or by looped, surgical rubber tubing. The patient slips the forefoot through one loop and attaches the other loop to a fixed support. Resistance can be adjusted by varying the initial stretch in the tubing. The foot is slowly moved through the entire arc of dorsiflexion or eversion to provide both concentric/eccentric contraction via the anterior tibial or peroneal muscle groups respectively (Fig. 5).

Peroneal muscle strengthening is extremely important because these muscles are the dynamic backup for the recovering lateral ligaments. Because dance emphasizes the

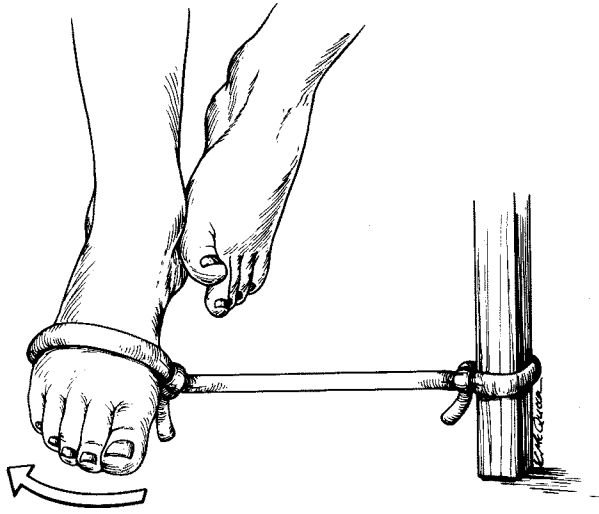


FIGURE 5 Strengthening of the peroneal musculature can be accomplished by eversion exercises using surgical tubing as resistance.

relevé position of plantar flexion, eversion strength training for the peroneals should be performed with the foot in the plantar-flexed position.

The third phase of rehabilitation combines both strength and proprioceptive training for the peroneals and other muscle groups that cross the ankle. The balance board helps to restore confidence, proprioception, and fine muscle coordination about the ankle. The single plane board is employed initially. The dancer is then advanced to the balance disk, which requires control of all functional patterns about the ankle. At this time the dancer can begin barre exercises in class, but should initially exclude the relevé positions of demi- or full pointe.

Functional exercise is the fourth and final phase of ankle ligament rehabilitation. Running for endurance, figure-eight running, and jumping are included in this phase. Progressive resistance exercises are continued, particularly for the peroneal muscle group. At the completion of rehabilitation the dancer is encouraged to maintain a regular program of dorsiflexion and eversion strength training.

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Editorial Comment

The review of ankle injuries presented here represents current thought concerning treatment of dancers. The authors emphasize certain principles: immediate rest, ice, compression, and elevation (RICE) followed by early mobilization. One should note, however, that tests for ankle instability in dancers may be misleading. Stress testing with or without local anesthesia may be done using two methods. The leg may be fixed and the heel drawn forward, or the heel may be fixed and the tibia displaced backward to test for sagittal laxity. The anterior drawer sign includes internal rotation of the talus with respect to the tibia. Stress testing for talar tilt may reveal subtalar joint laxity. This clinical finding is difficult to substantiate on standard stress x-rays. One must also consider the fact that dancers often have increased joint laxity. Thus, a "positive" stress test is not uncommon in an asymptomatic ankle.

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