The ligaments of the ankle consist of many components, all of which work in concert to support the talo-crural joint during everyday and sporting activities.

Audio: The ligaments of the ankle consist of many components, all of which work in concert to support the talo-crural joint during everyday and sporting activities.

Video: All ligs on model - rotating

Audio: The talocrural joint is formed by the tibia, fibula, and talus.

Video: Highlight Tibia, Fib, Talus
The distal ends of the tibia and fibula form the mortise in which the superior portion of the talus articulates. This complex of ligaments is located on the medial aspect of the ankle and provides a great deal of mechanical stability during movement. It acts against eversion, valgus, pronation, and rotatory forces as well as anterior and lateral talar excursion.

Highlight Ankle mortise and Talus

Audio: The distal ends of the tibia and fibula form the mortise in which the superior portion of the talus articulates.

Video: Highlight Ankle mortise and Talus

When studying the ankle ligaments, perhaps the most complicated to visualize is the medial collateral ligament complex also known as the Deltoid ligament due to its delta-shaped appearance.

Highlight deltoid ligament

The deltoid ligament is a stabilizer of the talocrural joint and spans from the tibia to the talus, calcaneus, navicular and spring ligament via its components.

Audio: When studying the ankle ligaments, perhaps the most complicated to visualize is the medial collateral ligament complex also known as the Deltoid ligament due to its delta-shaped appearance.

Video: Highlight deltoid ligament

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Audio: This complex of ligaments is located on the medial aspect of the ankle and provides a great deal of mechanical stability during movement. It acts against eversion, valgus, pronation, and rotatory forces as well as anterior and lateral talar excursion.

Video: Model shows resistance to eversion, valgus, pronation, and rotatory forces as well as anterior and lateral talar excursion

The deltoid ligament is a stabilizer of the talocrural joint and spans from the tibia to the talus, calcaneus, navicular and spring ligament via its components.

Audio: The deltoid ligament is a stabilizer of the talocrural joint and spans from the tibia to the talus, calcaneus, navicular and spring ligament via its components.

Video: Ghosted deltoid spanning talocrural joint. Each bone is highlighted and labeled.
The spring ligament (or plantar calcaneonavicular ligament) spans between the anterior aspect of the sustentaculum tali of the calcaneus to the plantar surface of the navicular bone.

Audio: The spring ligament (or plantar calcaneonavicular ligament) spans between the anterior aspect of the sustentaculum tali of the calcaneus to the plantar surface of the navicular bone.

Video: Highlight bones of attachment

Audio: It supports the head of the talus in the talocalcaneonavicular joint and plays a key role in maintaining the medial longitudinal arch of the foot.

Video: Spring ligament, calc and nav highlighted and shown from beneath

Audio: The deltoid ligament consists of multiple components, but because of its complexity, its components are often defined differently and given different abbreviations in related literature. The component definitions used in this animation are based on the most recent studies which define 5 components of the Deltoid ligament. The complex consists of two layers – a deep layer, and a superficial layer.

Video: Highlight layers from Ant and post – 3-split screen or inset w/ ¾ rotating view and synced highlighting
The deep layer consists of the anterior tibiotalar and posterior tibiotalar ligaments.

Unghost ATTL and PDTL – highlight each

The superficial layer consists of the tibionavicular, tibiospring, and tibio calcaneal ligaments.

Unghost TNL, TSL, TSL and highlight each

This layer lies within the synovial capsule

Highlight synovial capsule

This layer lies superficial to the synovial capsule

Highlight synovial capsule
A good deal of variation in both thickness and visibility exists in these ligaments. Additionally because the deltoid ligament complex plays such a central role in talocrural stabilization, it is very often the site of injury.

In recent years, due to its high resolution, high-field (3-Tesla) MR imaging has become an extremely useful tool in evaluating both normal anatomical variation as well as these pathologic conditions.
The Anterior Tibiotalar Ligament (ATTL) is the smallest and most buried component of the Deltoid Ligament Complex. It attaches to the medial malleolus at the anterior colliculus and the anterior portion of the intercollicular groove and courses distally, anteriorly, and medially to its attachment on the talus, just distal to the anterior portion of the medial talar articular surface.

Its thickness ranges from 1-4mm.

The ATTL is a part of the deep layer of the deltoid ligament and lies within the synovial capsule deep to the tibionaviculcar, tibiospring, and tibiocalcaneal ligaments.
The Posterior Tibiotalar Ligament (PTTL) is the thickest and most robust component of the Deltoid Ligament Complex. It attaches to the posterior portion of the anterior colliculus, the intercollicular groove and the anterior portion of the posterior colliculus.

Its thickness ranges from 6-11mm it contains adipose tissue interspersed between its fiber bundles.

It courses distally, posteriorly and medially to its broad attachment on the talus, from the medial surface under the tail of the articular facet to the posteromedial talar tubercle.

The PTTL is also a component of the deep layer of the deltoid ligament within the synovial capsule and lies partially underneath the tibiocalcaneal ligament of the superficial layer.
The Tibionavicular ligament (TNL) is the most difficult component of the Deltoid Ligament Complex to visualize both in vivo and on imaging due to its orientation and inconsistent presence in patients. It attaches to the anterior border of the anterior colliculus and... Its thickness ranges from 1-2mm.

If present, the TNL is the most anterior component of the superficial layer of the Deltoid Ligament complex and is superficial to the synovial capsule.
The Tibiospring ligament (TSL) is usually the thickest component of the Deltoid Ligament Complex's superficial layer. It attaches to the anterior aspect of the anterior colliculus of the medial malleolus.

- **Audio:** The TSL's thickness ranges from 1-4mm.
- **Video:** Show thickness

The TSL courses distally and broadens to its attachment on the superomedial plantar calcaneonavicular (spring) ligament.

- **Audio:** The TSL courses distally and broadens to its attachment on the superomedial plantar calcaneonavicular (spring) ligament.
- **Video:** TSL appears

- **Audio:** It is the middle component of the superficial layer of the deltoid ligament and is superficial to the synovial capsule.
- **Video:** Show TSL w/ rest of Deltoid ghosted
The Tibiocalcaneal ligament (TCL) is a cord like ligament and forms the posterior border of the superficial layer of the deltoid ligament. It attaches to the medial aspect of the anterior colliculus and its thickness ranges from 1-3mm. As part of the superficial layer of the deltoid ligament, it lies superficial to the synovial capsule over the anterior portion of the PTTL.
The coronal, axial, and transverse oblique views are most helpful in imaging the components of deltoid ligament. The foot is normally placed in neutral position (or slight plantar flexion to reduce the magic angle effect). Other techniques recommend dorsiflexion or plantar flexion depending on the target ligament component. Intermediate and T2-weighted imaging with and without fat-saturation are used.

MR imaging can play a key role in diagnosis of pathologic conditions. With High-field (3-Tesla) MR imaging radiologists can more accurately localize and characterize pathologic conditions and recognize associated injury patterns. Also, deep deltoid injury can often go unnoticed by other imaging and clinical diagnostic methods. Untreated deltoid ligament insufficiency can lead to osteoarthritis of the ankle joint.

Anatomical surroundings and attachment sites – The first step in evaluating the components of the deltoid ligament is to identify the bony anatomical landmarks of that slice location. This narrows the possibilities of what the structures in that region might be.  
- Signal intensity – Once the radiologist is oriented to the region, signal intensity is used as an
On MR imaging, the ATTL is best visualized in the coronal plane and while some studies claim that it is present in only 50% of patients, others claim that it is present in all patients.

The ATTL usually appears to have uniform thickness and well delineated borders.

In T2 weighted images, the signal is less consistent and can be of low or intermediate intensity with a homogeneous or inhomogeneous, and sometimes striated pattern. In intermediate weighted images, the ATTL appears as a homogeneous, thin, low intensity signal structure.

Audio: Case image description

Audio: Component highlighted on multiple case images and characteristics listed on side of screen
On MR imaging, the PTTL is best visualized in the coronal plane and is present in all patients.

The PTTL usually appears to thicken distally and have well-delineated borders.

In T2-weighted images, the signal intensity can be low or intermediate, but the signal intensity pattern is consistently striated. In intermediate-weighted images, the PTTL has a striated appearance, similar to T2. If fat-suppression is used, the striated intensity pattern may not be easily visible. The striated pattern tends to be less visible in patients over 45 years old, however, lack of this pattern in younger patients may indicate pathology.

MRI materializes over section and moves to side of screen.

Case image description

Component highlighted on multiple case images and characteristics listed on side of screen.

Component highlighted on scrolling MR.
On MR imaging (graphic), the TNL is best visualized in either consecutive coronal slices with the foot in neutral position, the coronal plane with the foot in plantar flexion, the transverse oblique plane, or a reconstructed plane along the length of the TNL using isotropic reformatting.

The TNL usually appears to be of uniform thickness with either blurred or well delineated borders.

According to most studies, the TNL is present in about half of the patient population. In T2-weighted images, its appearance is variable and can appear as a low or intermediate signal with a homogeneous or inhomogeneous signal intensity pattern. On Intermediate weighted images, the TNL has a homogeneous, low-intensity signal.

Audio: According to most studies, the TNL is present in about half of the patient population. In T2-weighted images, its appearance is variable and can appear as a low or intermediate signal with a homogeneous or inhomogeneous signal intensity pattern. On Intermediate weighted images, the TNL has a homogeneous, low-intensity signal.

Video: Plane moves through foot and stops at plane of component

Audio: On MR imaging (graphic), the TNL is best visualized in either consecutive coronal slices with the foot in neutral position, the coronal plane with the foot in plantar flexion, the transverse oblique plane, or a reconstructed plane along the length of the TNL using isotropic reformatting.

Video: MRI materializes over section and moves to side of screen

Audio: The TNL usually appears to be of uniform thickness with either blurred or well delineated borders.

Video: Component highlighted on scrolling MR

Audio: Case image description

Video: Component highlighted on multiple case images and characteristics listed on side of screen
On MR imaging, the TSL is best visualized in the coronal plane and is always visible.

In T2-weighted images, the TSL usually appears as a low intensity signal with a homogeneous signal intensity pattern. On intermediate weighted images, the TSL appears the same as in T2, a low intensity signal with a homogeneous signal intensity pattern.

The TSL usually appears to thicken distally and have well delineated borders.

Component highlighted on scrolling MR

Case image description

Component highlighted on multiple case images and characteristics listed on side of screen
On MR imaging, the TCL is best visualized in the coronal plane and is visible in most patients.

Audio: On MR imaging, the TCL is best visualized in the coronal plane and is visible in most patients.

Video: Plane moves through foot and stops at plane of component

Audio: Plane moves through foot and stops at plane of component

Video: MRI materializes over section and moves to side of screen

Audio: In T2-weighted images, it is usually of low intensity with a homogeneous signal intensity pattern. On intermediate weighted images, the TCL ---

Video: MRI materializes over section and moves to side of screen

Audio: Case image description

Video: Component highlighted on multiple case images and characteristics listed on side of screen
Of all of the components of the Deltoid Ligament, those of the deep layer are most commonly injured. It is important that the superficial and deep layers be evaluated for injury and categorized separately. MR imaging is well suited for this distinction and familiarity with injury imaging patterns allows for accurate diagnoses of injury to the components of one or both of these layers.

It is believed that the deltoid ligament is injured more often than previously thought, but is rarely injured in isolation. Injury usually occurs concurrently with (text list) distal avulsion fractures, medial malleolar fractures, osteochondral injuries of the talus, lateral ligament and syndesmosis injuries, tibialis posterior tendon and spring ligament abnormalities, and antero/posteromedial impingement syndromes.

Two main systems are used to record the characteristics of deltoid ligament injuries in a standardized fashion.
To record the location of the injury, the injury is evaluated to be of type 1 (proximal), type 2 (intermediate), or type 3 (distal). In the general population, it has been found that approximately 70% of deltoid ligament injuries are type 1, only 10% are type 2, and 20% are type 3.

In order to rate the severity, a ligament injury grading system is used when evaluating MR imaging of the deltoid ligament. A grade 1 sprain (or mild sprain) is indicated by periligamentous edema and stretching. A grade 2 sprain (or partial tear) is indicated by intra-ligamentous fluid-like T2 signal, attenuation or thickening. A grade 3 (or complete disruption) is seen as a complete gap in the ligament signal.