

Anatomy and evaluation of the ankle

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Ankle

- Anatomical Structures
 - Tibia
 - Fibular
 - Talus

Tibia

- This is the strongest largest bone of the lower leg. It bears weight and the bone creates the medial malleoli (the bump on the inside of your ankle) which is the medial aspect of the mortise or the (hole) that the talus lies within.



The Tibia is the medial bone and largest bone of the lower leg.

Fibula

- This is a smaller lateral bone of the lower leg. It is not vital for weight bearing yet it comprises the lateral (outside) aspect of the malleoli and makes up the lateral aspect of the mortise.

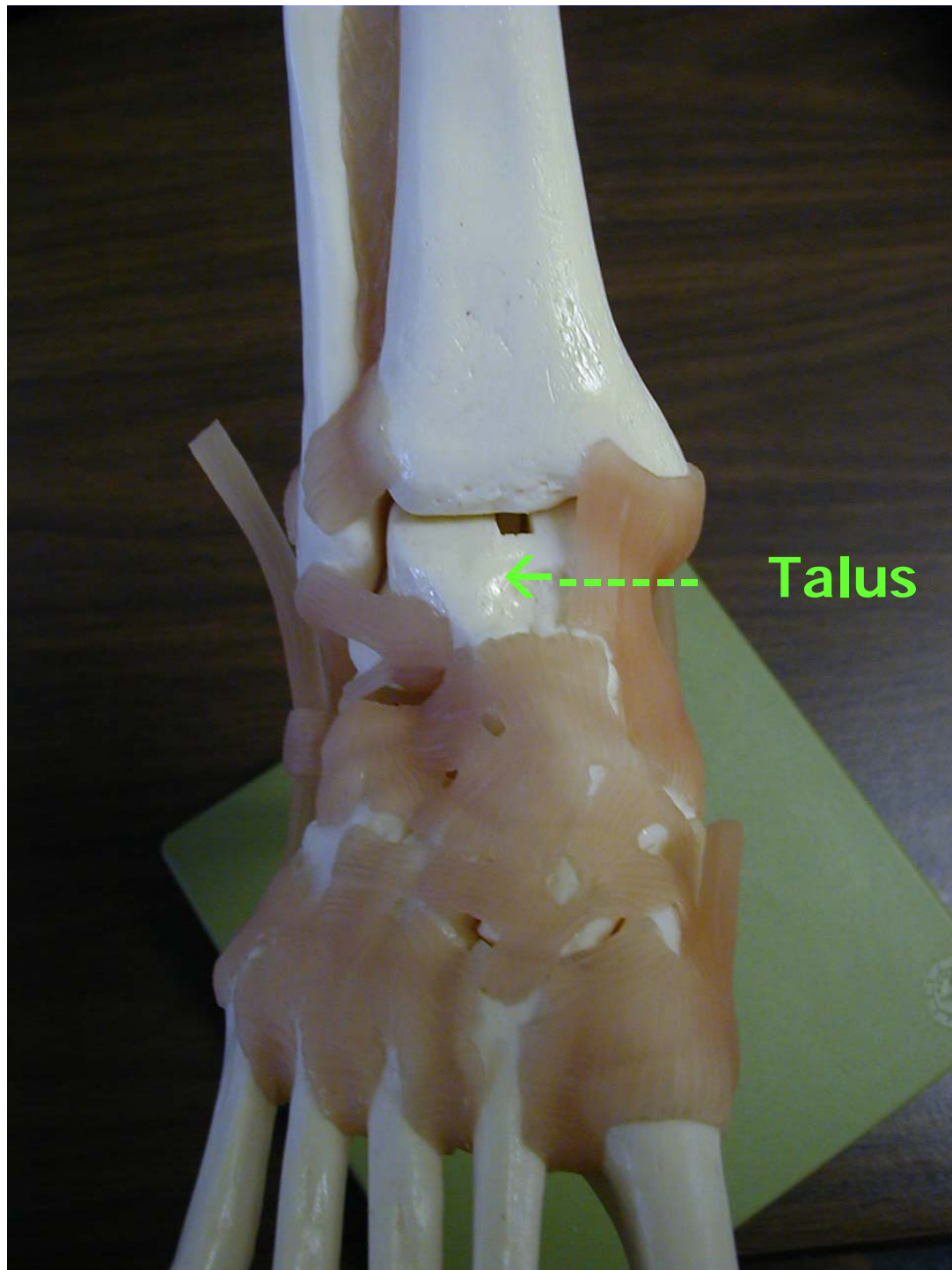
Fibula--->



The fibula is longer and non weight bearing. It makes up the lateral aspect of the mortise. The lateral malleoli lies inferior (below) the medial malleoli

Talus

- This bone transmits the forces from the calcaneus up into the tibia and also allows the articulations of Plantar Flexion (pointing the foot downward) Dorsiflexion or pulling the foot upward and Inversion (rolling the foot inward) and Eversion (rolling the foot outward)



Talus

Talocrural Joint

- The formation of the mortise (a hole) by the medial malleoli (Tibia) and lateral malleoli (fibula) with the talus lying in between them makes up the talocrural joint. This is a hinge joint and allows most of the motion with plantarflexion and dorsiflexion.



Talocrural Jt.

Subtalar Joint

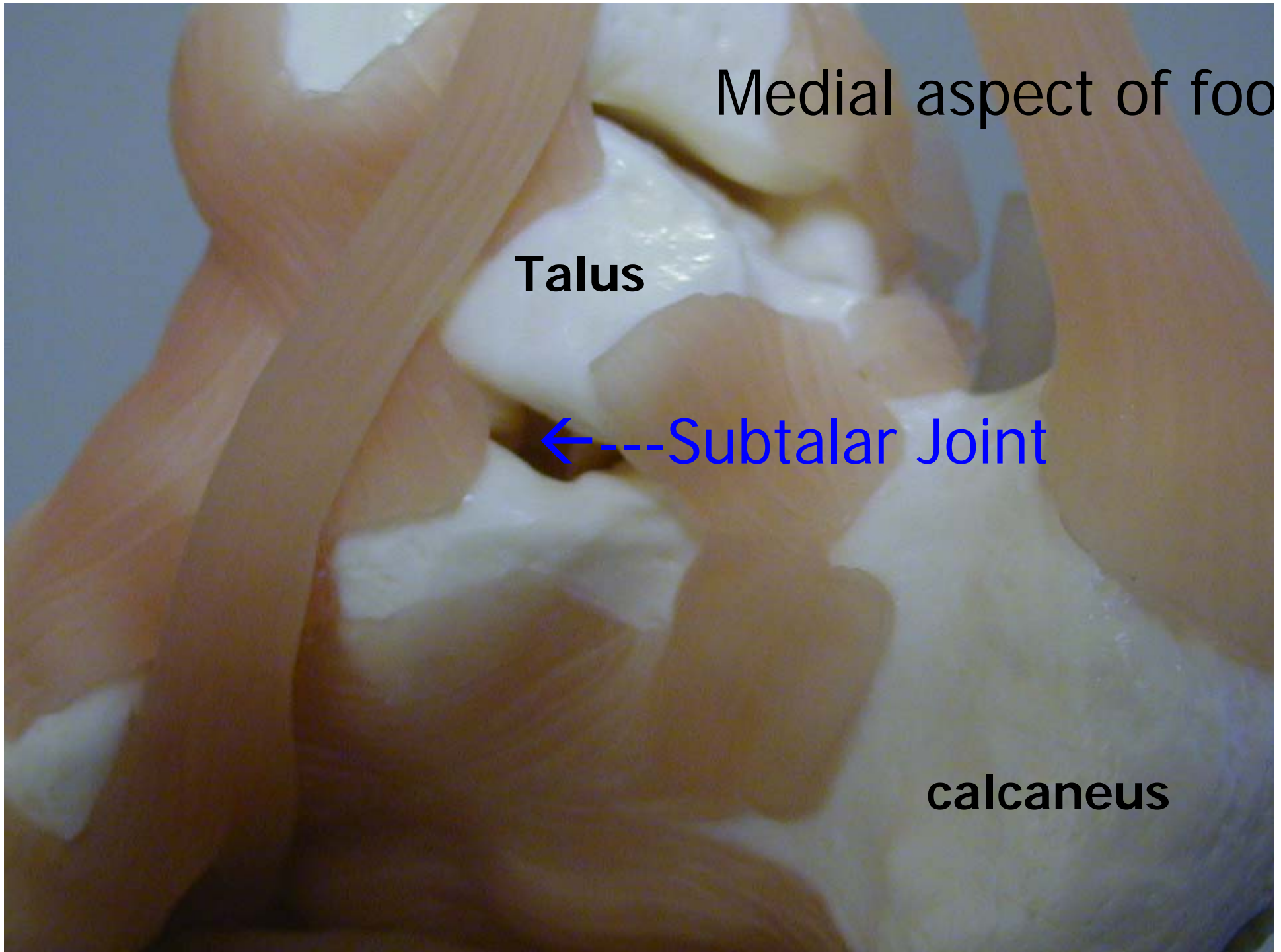
- The articulation between the talus and the calcaneus is referred to as the subtalar joint. Motion allowed by this joint is inversion (roll inward)/eversion (roll outward) as well as rear foot pronation (inward tilt of the calcaneus) and supination (outward tilt of the calcaneus) .

Medial aspect of foot

Talus

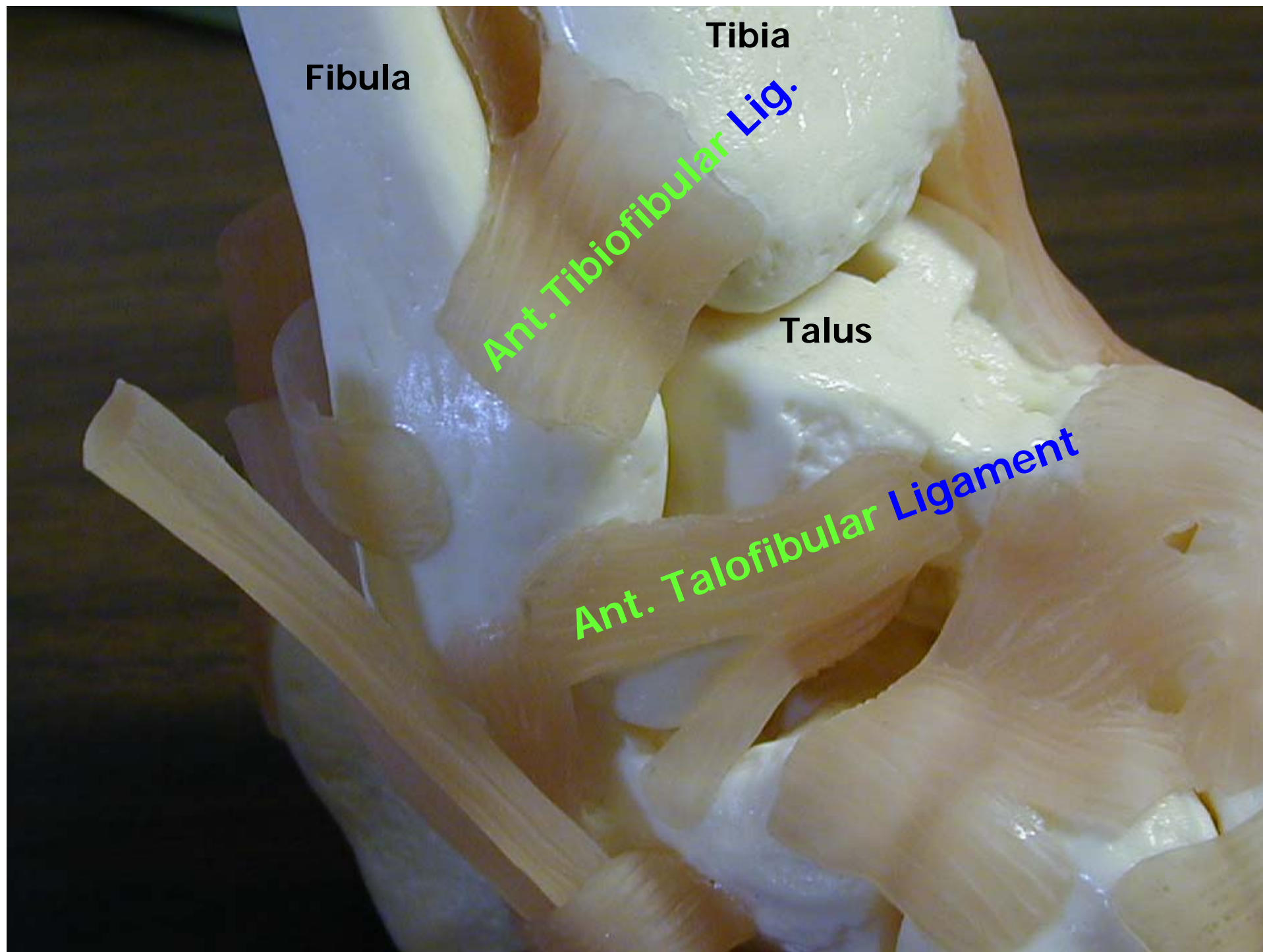
←---Subtalar Joint

calcaneus



Ankle Ligaments

- There are three lateral ligaments predominantly responsible for the support and maintenance of bone apposition (best possible fit). These ligaments prevent inversion of the foot.
- These ligaments are:
 - Anterior talofibular ligament
 - Calcaneofibular ligament
 - Posterior talofibular ligament



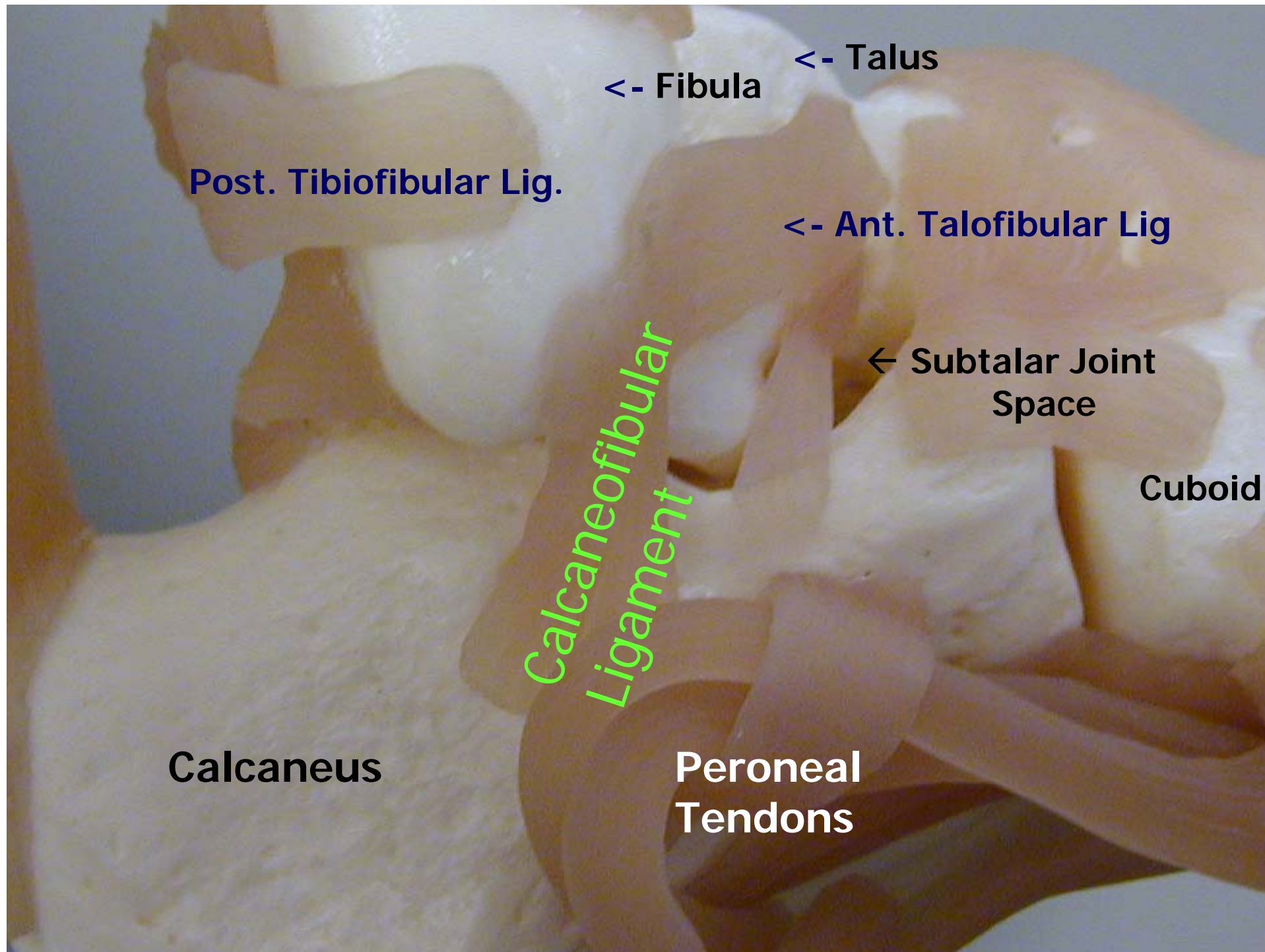
Fibula

Tibia

Ant. Tibiofibular Lig.

Talus

Ant. Talofibular Ligament



Posterior
tibiofibular
Ligament

Peroneal
tendons

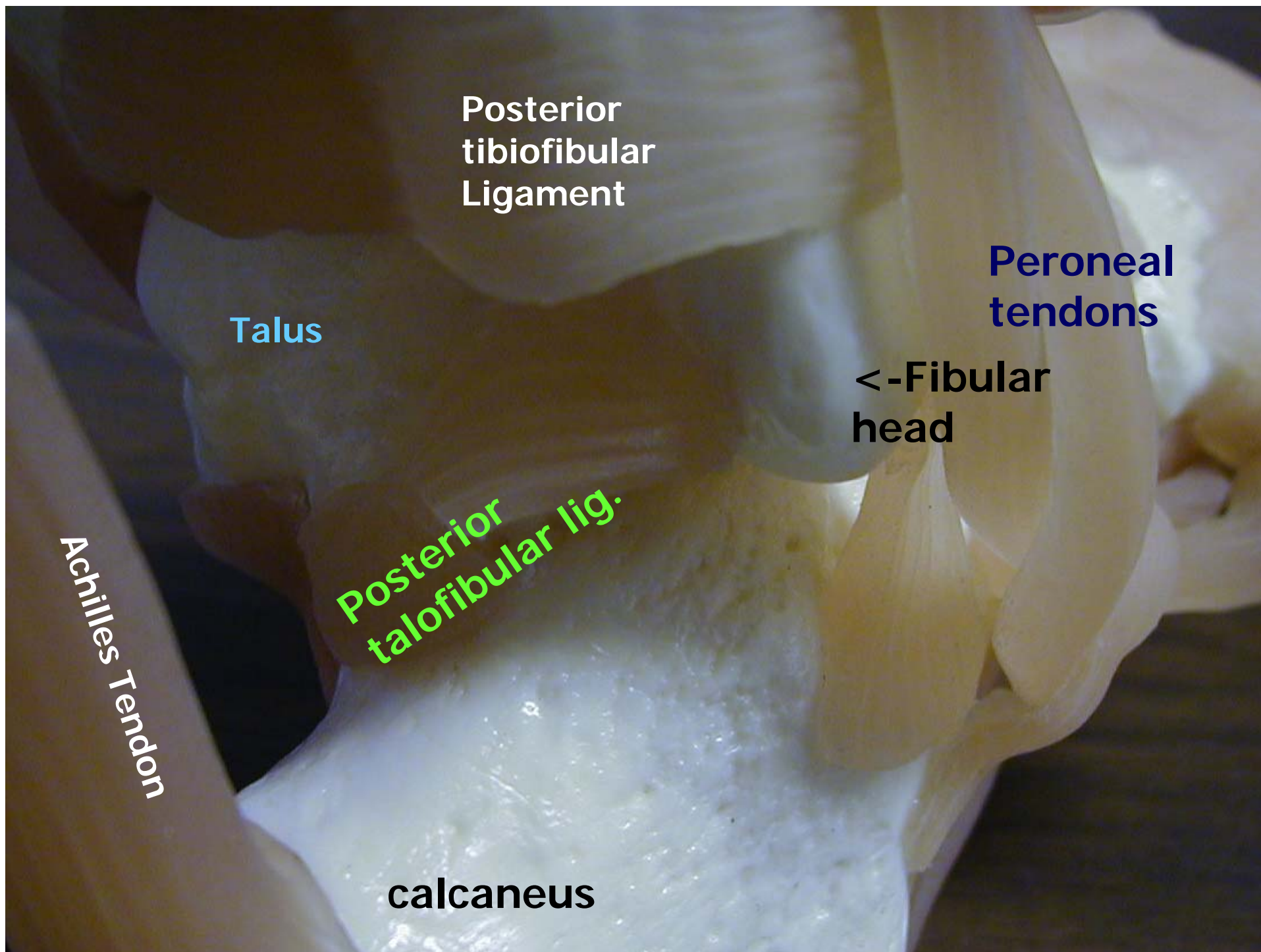
Talus

<-Fibular
head

Posterior
talofibular lig.

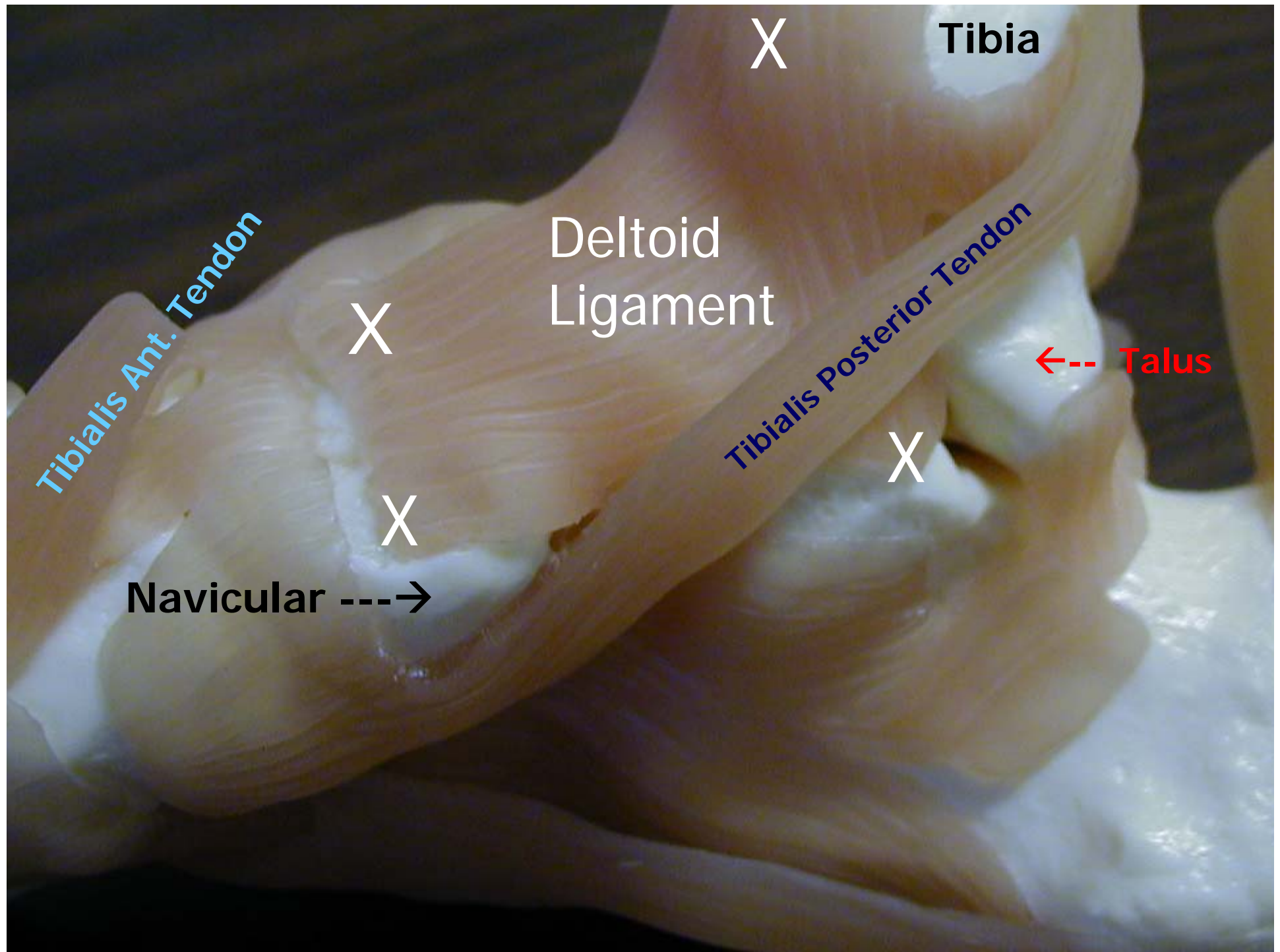
Achilles Tendon

calcaneus



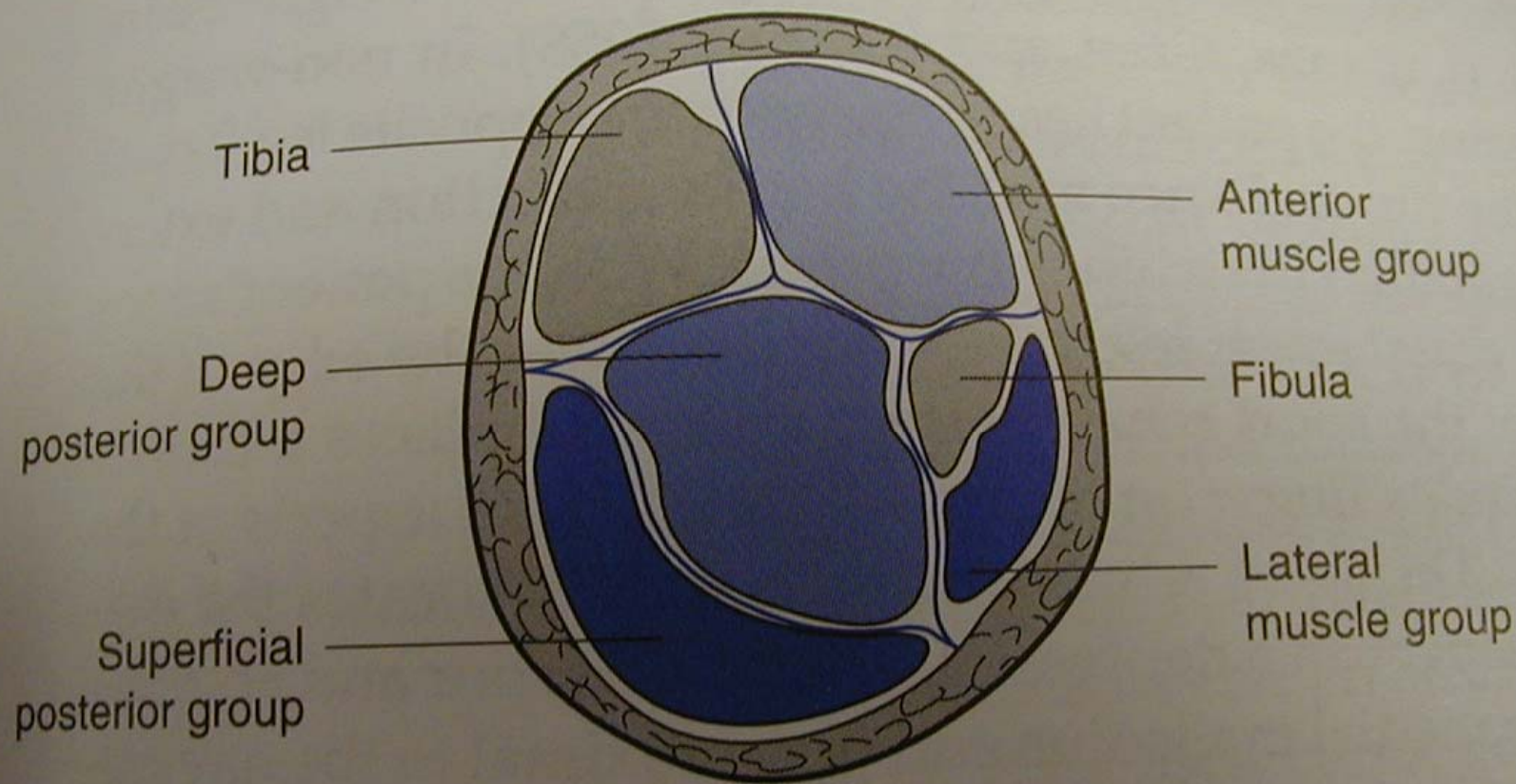
The deltoid ligament

- This is located on the medial aspect of the foot. It is the largest ligament but is actually comprised of several sections all fused together. This ligament prevents (eversion) of the ankle. The deltoid ligament is triangular in shape and has superficial and deep layers. It is the most difficult ligament in the foot to sprain.



Muscles of the lower leg/ankle

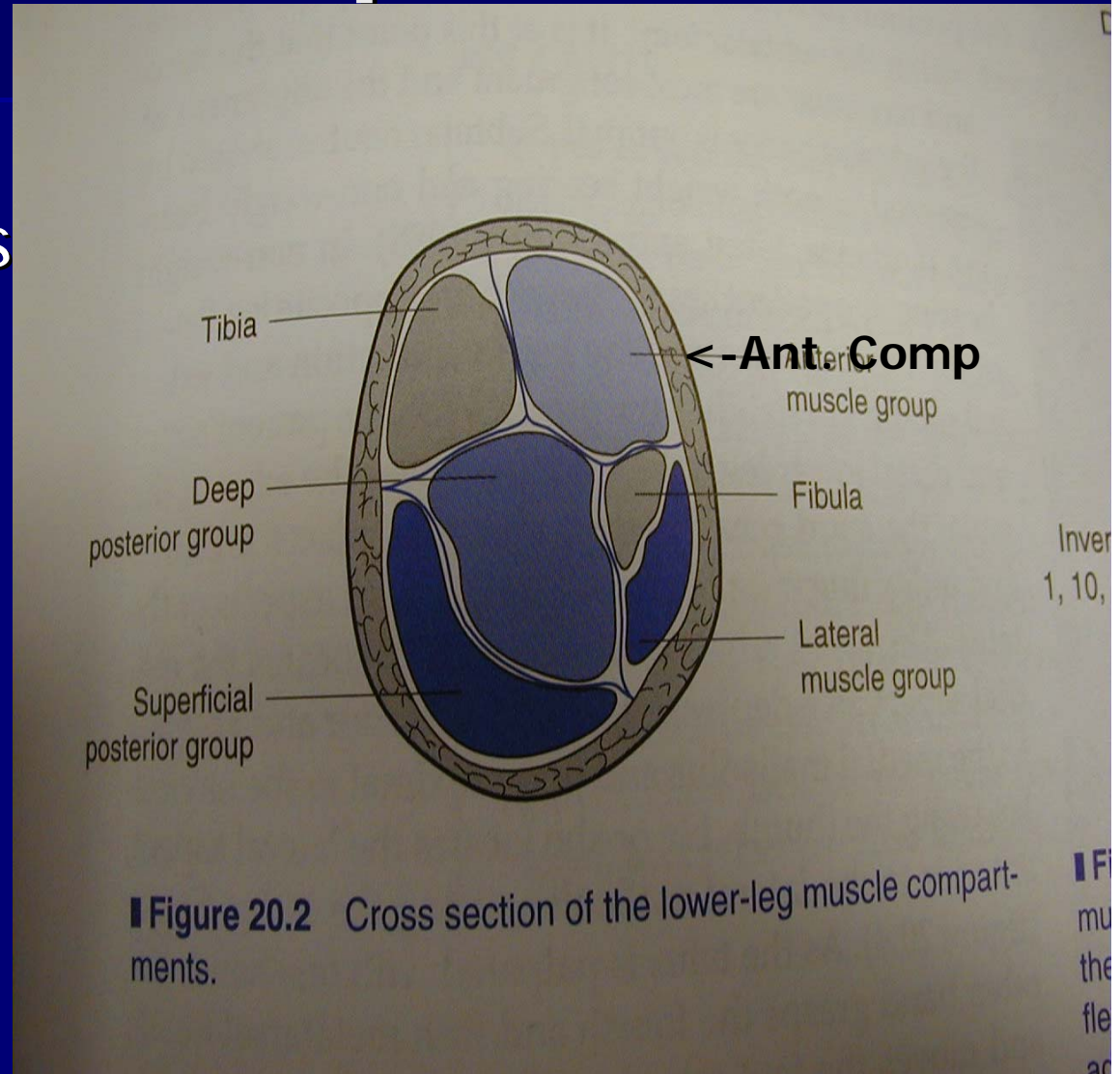
- There are 4 compartments that make up the lower leg that operate the motions of the ankle.
- Injury can cause swelling inside these compartments that can lead to tissue death or nerve damage.



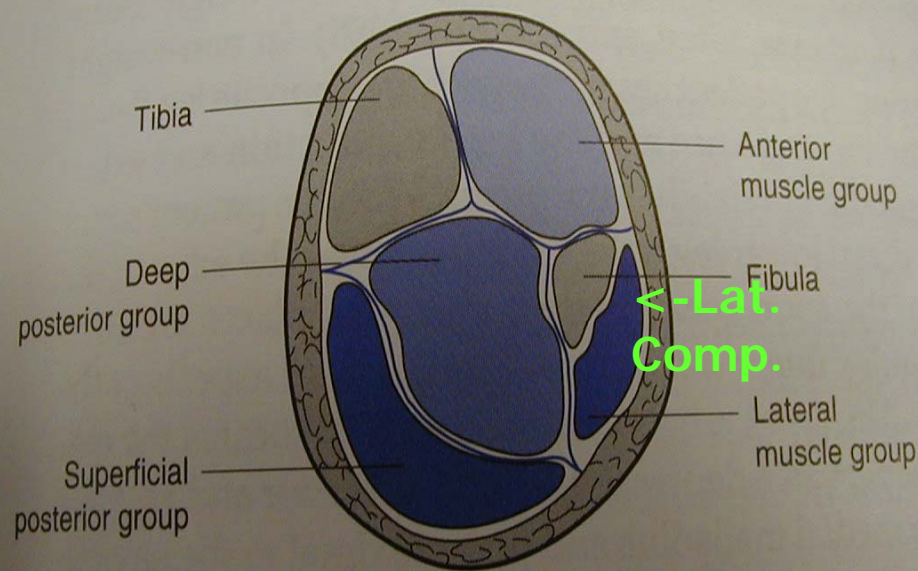
■ **Figure 20.2** Cross section of the lower-leg muscle compartments.

Anterior Compartment

- Ant. Tibialis
- Ext. Hallicus Longus
- Extensor Digitorum Longus
- Contains Ant. Tibial Nerve
- Contains Anterior Tibial Artery
- Dorsiflexors of the foot (lifts foot up)



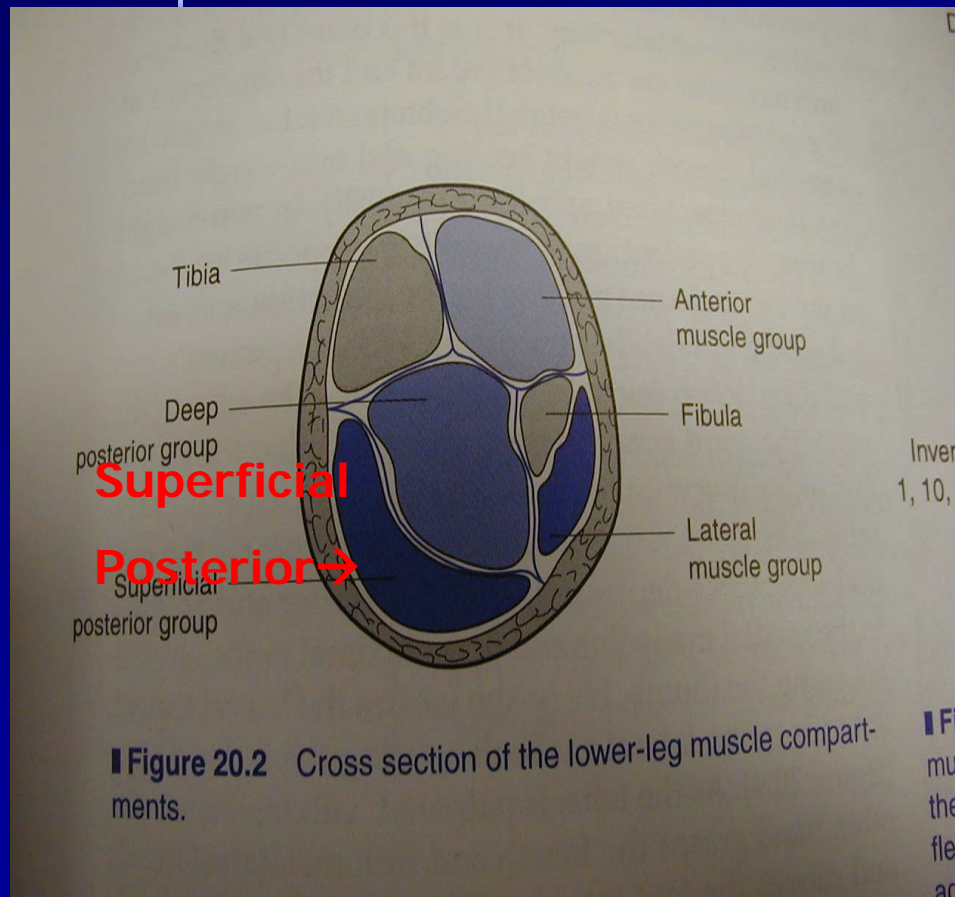
Lateral Compartment



■ **Figure 20.2** Cross section of the lower-leg muscle compartments.

- Everters of the foot (turns foot outward)
- Peroneus Longus
- Peroneus Brevis
- Peroneus Tertius
- Contains the superficial peroneal nerve

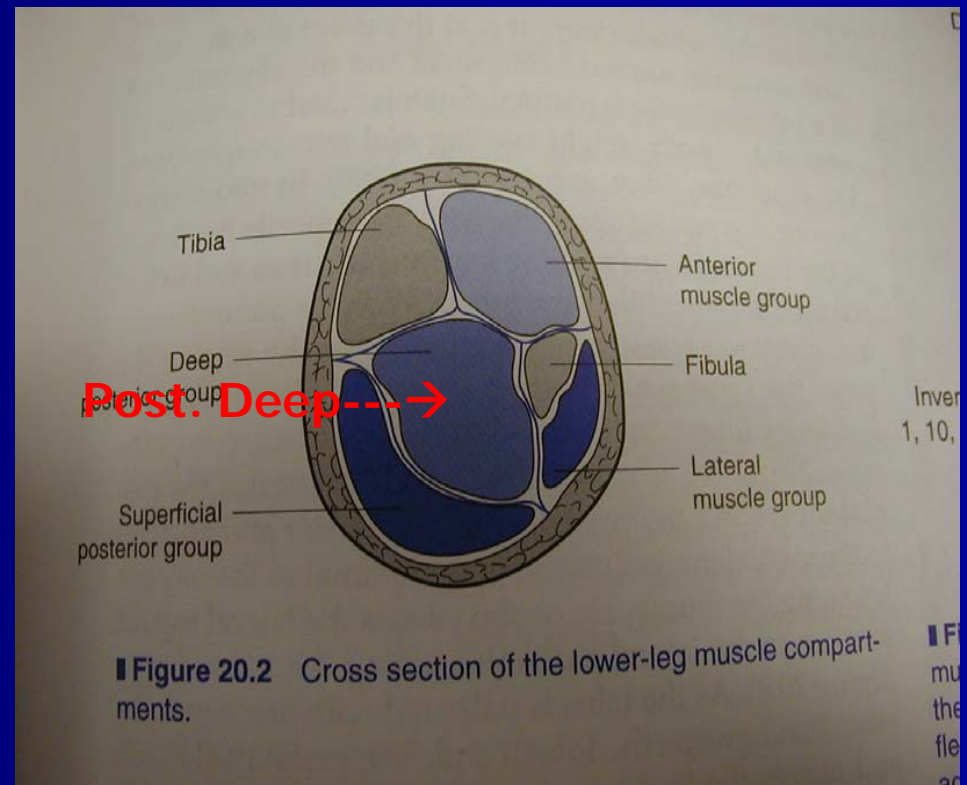
Posterior Superficial Group



- Plantar flexors (pushes foot downwards)
- Gastrocnemius
- Soleus

Posterior Deep

- Assists with Plantarflexion
- Tibialis Posterior
- Flexor Hallicus Longus
- Flexor Digitorum Longus
- Posterior tibial artery



Assessing the Lower Leg and Ankle

■ History

- Past history
- Mechanism of injury
- When does it hurt?
- Type of, quality of, duration of pain?
- Sounds or feelings?
- How long were you disabled?
- Swelling?
- Previous treatments?

■ Observations

- Postural deviations?
- Is there difficulty with walking?
- Deformities, asymmetries or swelling?
- Color and texture of skin, heat, redness?
- Patient in obvious pain?
- Is range of motion normal?

- Percussion and compression tests
 - Used when fracture is suspected
 - Percussion test is a blow to the tibia, fibula or heel to create vibratory force that resonates w/in fracture causing pain
 - Compression test involves compression of tibia and fibula either above or below site of concern
- Thompson test
 - Squeeze calf muscle, while foot is extended off table to test the integrity of the Achilles tendon
 - Positive tests results in no movement in the foot
- Homan's test
 - Test for deep vein thrombophlebitis
 - With knee extended and foot off table, ankle is moved into dorsiflexion
 - Pain in calf is a positive sign and should be referred

Compression Test



Percussion Test



Homan's Test



Thompson Test

■ Ankle Stability Tests

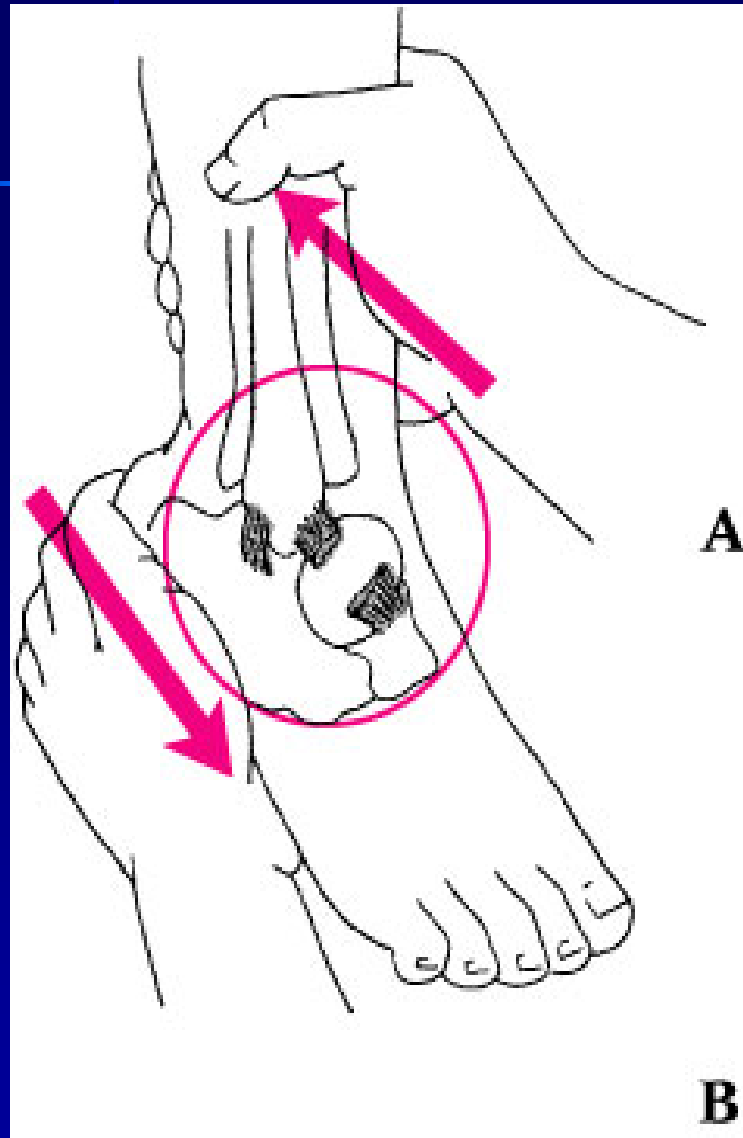
– Anterior drawer test

- Used to determine damage to anterior talofibular ligament primarily and other lateral ligament secondarily
- A positive test occurs when foot slides forward and/or makes a clunking sound as it reaches the end point

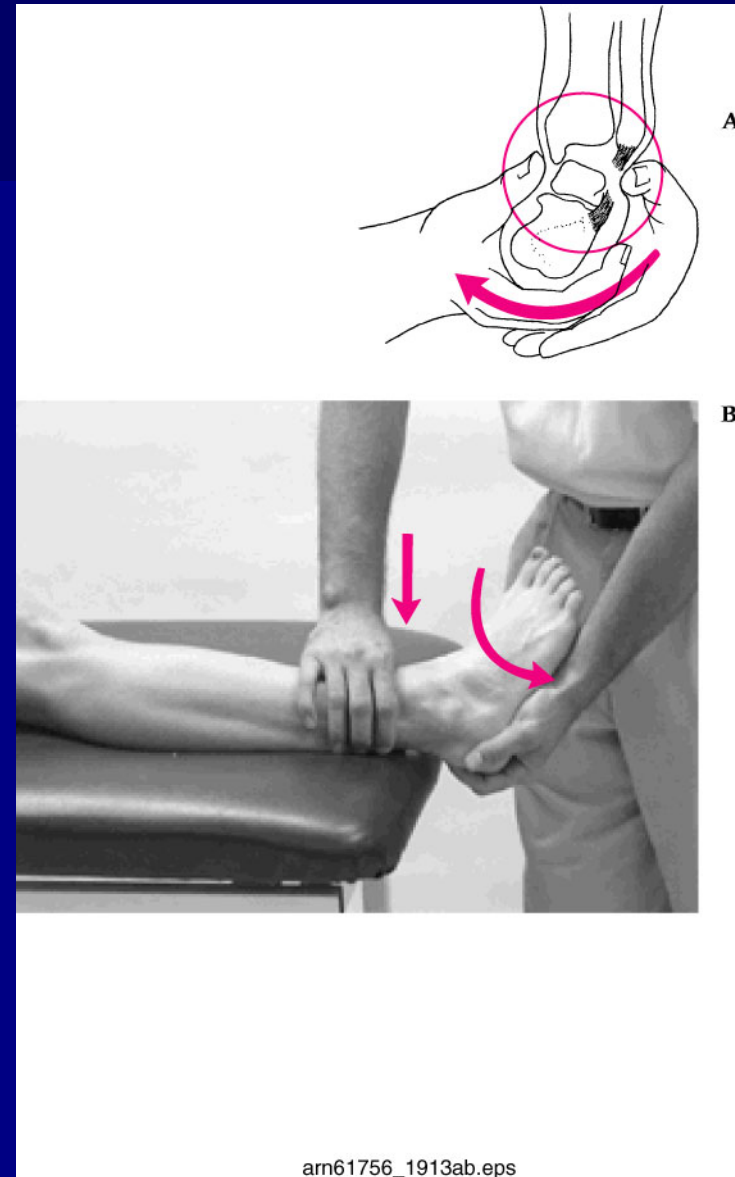
– Talar tilt test

- Performed to determine extent of inversion or eversion injuries
- With foot at 90 degrees calcaneus is inverted and excessive motion indicates injury to calcaneofibular ligament and possibly the anterior and posterior talofibular ligaments
- If the calcaneus is everted, the deltoid ligament is tested

Anterior Drawer Test



Talar Tilt Test



– Kleiger's test

- Used primarily to determine extent of damage to the deltoid ligament and may be used to evaluate distal ankle syndesmosis, anterior/posterior tibiofibular ligaments and the interosseus membrane
- With lower leg stabilized, foot is rotated laterally to stress the deltoid

– Medial Subtalar Glide Test

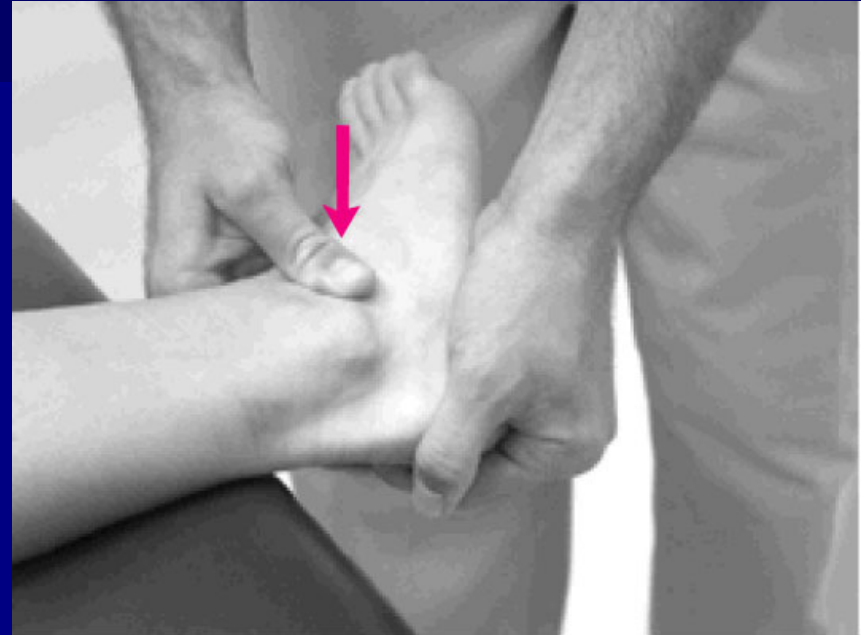
- Performed to determine presence of excessive medial translation of the calcaneus on the talus
- Talus is stabilized in subtalar neutral, while other hand glides the calcaneus, medially
- A positive test presents with excessive movement, indicating injury to the lateral ligaments

Kleiger's Test



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Medial Subtalar Glide Test



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■ Functional Tests

- While weight bearing the following should be performed
 - Walk on toes (plantar flexion)
 - Walk on heels (dorsiflexion)
 - Walk on lateral borders of feet (inversion)
 - Walk on medial borders of feet (eversion)
 - Hops on injured ankle
 - Passive, active and resistive movements should be manually applied to determine joint integrity and muscle function
- If any of these are painful they should be avoided

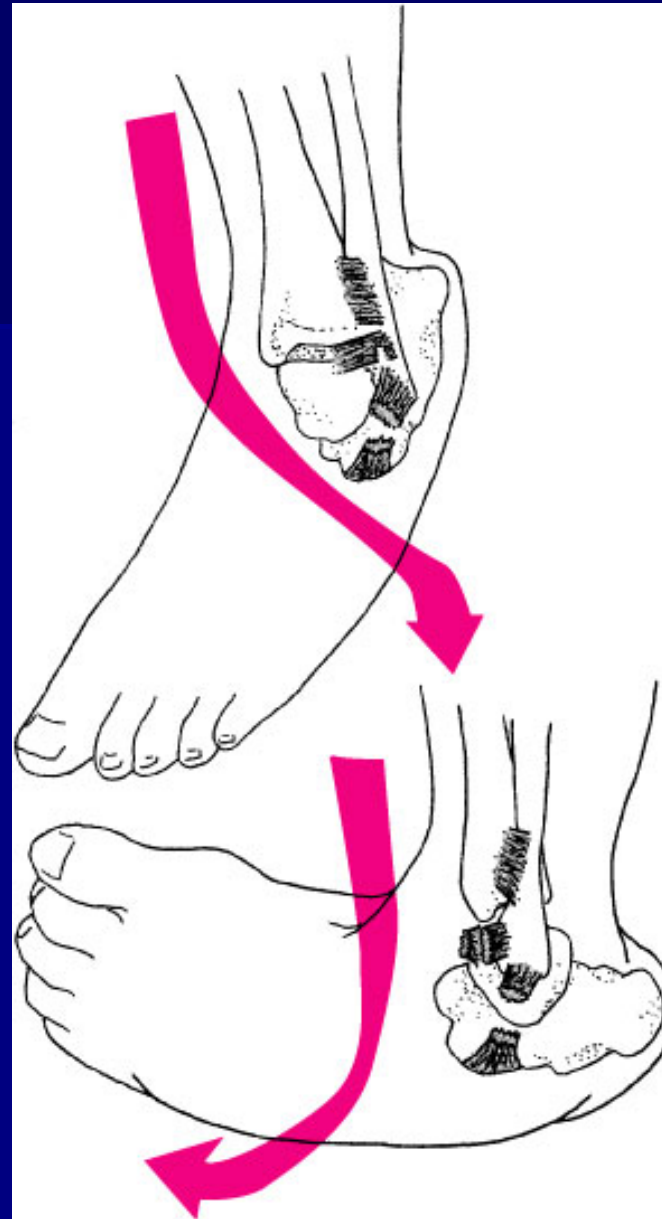
Prevention of Injury to the Ankle

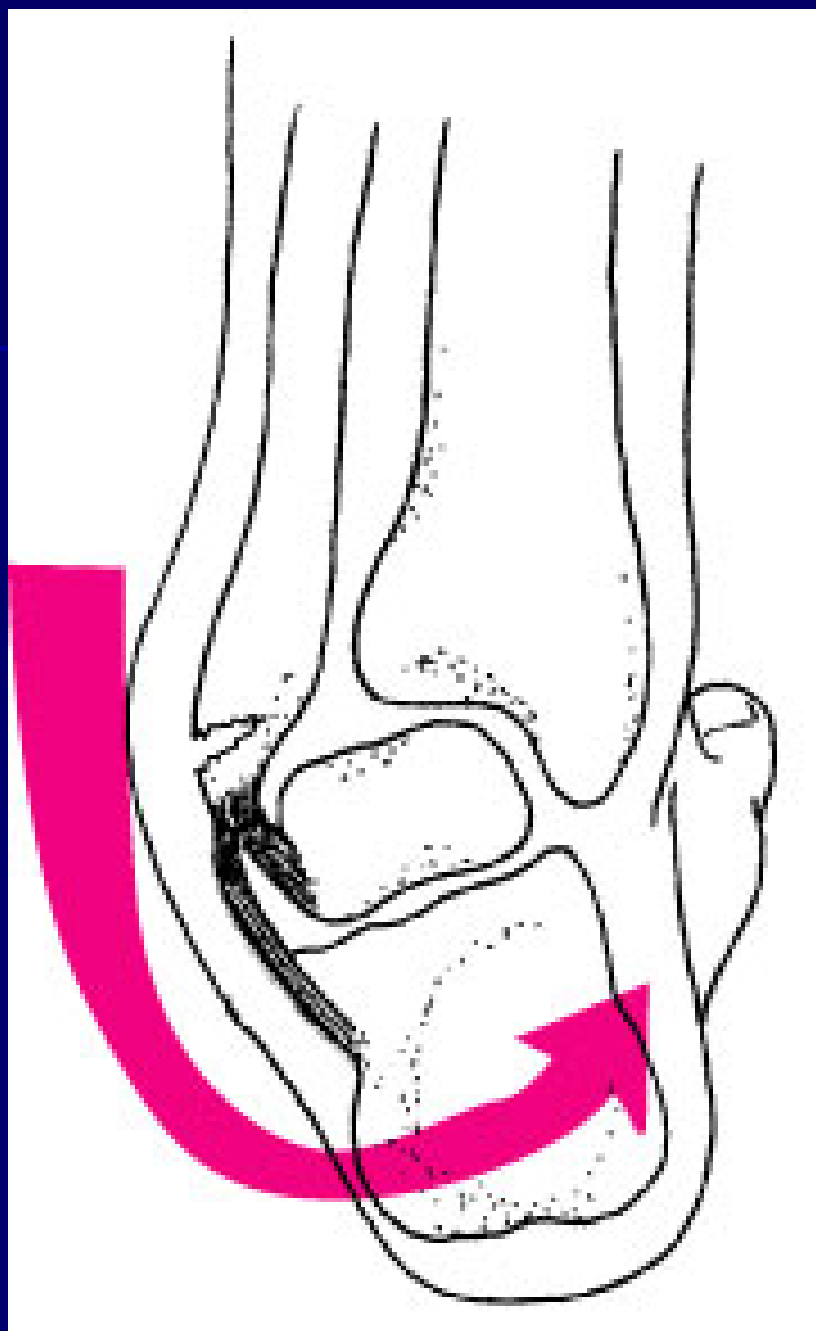
- Stretching of the Achilles tendon
- Strengthening of the surrounding muscles
- Proprioceptive training: balance exercises and agility
- Wearing proper footwear and or tape when appropriate

Specific Injuries

- Ankle Injuries: Sprains
 - Single most common injury in athletics caused by sudden inversion or eversion moments
- Inversion Sprains
 - Most common and result in injury to the lateral ligaments
 - Anterior talofibular ligament is injured with inversion, plantar flexion and internal rotation
 - Occasionally the force is great enough for an avulsion fracture to occur w/ the lateral malleolus

- Severity of sprains is graded (1-3)
- With inversion sprains the foot is forcefully inverted or occurs when the foot comes into contact w/ uneven surfaces





■ Grade 1 Inversion Ankle Sprain

– Etiology

- Occurs with inversion plantar flexion and adduction
- Causes stretching of the anterior talofibular ligament

– Signs and Symptoms

- Mild pain and disability; weight bearing is minimally impaired; point tenderness over ligaments and no laxity

– Management

- RICE for 1-2 days; limited weight bearing initially and then aggressive rehab
- Tape may provide some additional support
- Return to activity in 7-10 days

■ Grade 2 Inversion Ankle Sprain

– Etiology

- Moderate inversion force causing great deal of disability with many days of lost time

– Signs and Symptoms

- Feel or hear pop or snap; moderate pain w/ difficulty bearing weight; tenderness and edema
- Positive talar tilt and anterior drawer tests
- Possible tearing of the anterior talofibular and calcaneofibular ligaments

– Management

- RICE for at least first 72 hours; X-ray exam to rule out fx; crutches 5-10 days, progressing to weight bearing

– Management (continued)

- Will require protective immobilization but begin ROM exercises early to aid in maintenance of motion and proprioception
- Taping will provide support during early stages of walking and running
- Long term disability will include chronic instability with injury recurrence potentially leading to joint degeneration
- Must continue to engage in rehab to prevent against re-injury

■ Grade 3 Inversion Ankle Sprain

– Etiology

- Relatively uncommon but is extremely disabling
- Caused by significant force (inversion) resulting in spontaneous subluxation and reduction
- Causes damage to the anterior/posterior talofibular and calcaneofibular ligaments as well as the capsule

– Signs and Symptoms

- Severe pain, swelling, hemarthrosis, discoloration
- Unable to bear weight
- Positive talar tilt and anterior drawer

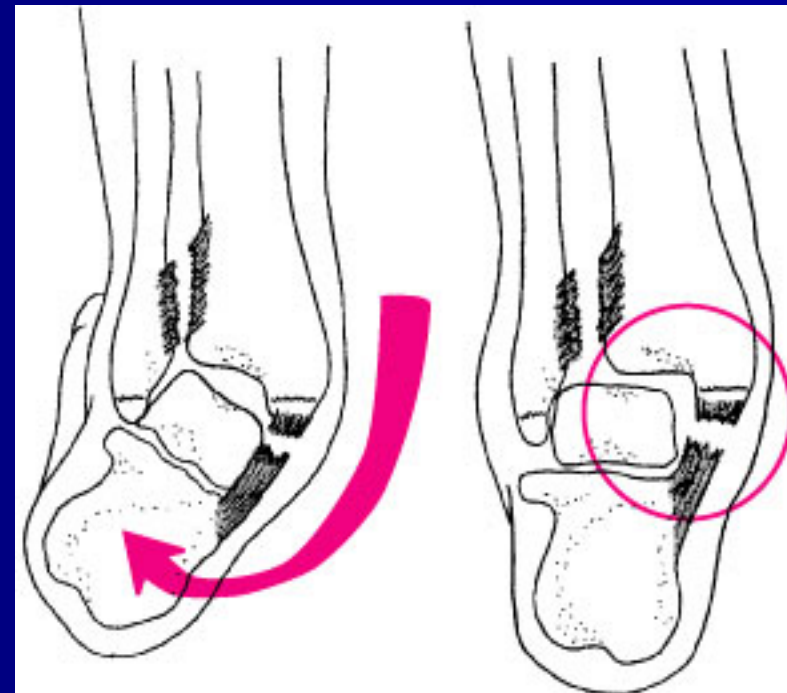
– Management

- RICE, X-ray (physician may apply dorsiflexion splint for 3-6 weeks)
- Crutches are provided after cast removal
- Isometrics in cast; ROM, PRE and balance exercise once out
- Surgery may be warranted to stabilize ankle due to increased laxity and instability

- **Eversion Ankle Sprains**
 - (Represent 5-10% of all ankle sprains)

- **Etiology**

- Bony protection and ligament strength decreases likelihood of injury
- Eversion force results in damage to deltoid ligament and possibly fx of the fibula
- Deltoid can also be impinged and
centrally with





THAT'S GOTTA HURT ...

Pittsburgh Steelers running back Destry Wight lies injured on the field Sunday night after he dislocated his right ankle and broke his right leg.





Injury Prevention

- Strength training allows the supporting musculature to stabilize where ligaments may no longer be capable of holding the original tension between bones of the joint. This will also help prevent reinjury.

Chronic Ankle Injury “the vicious cycle”

- Why are some people prone to ankle re-injury over and over?
- Most commonly due to lack of rehabilitation, but more importantly lack of neuromuscular training.
- This means the person has not retrained the body to recognize where the ankle and foot are during motion.
- This sets up the body part to be re-injured due to improper feedback to the brain about body position.

Injury Prevention

- Neuromuscular Control is the ability to compensate for uneven surfaces or sudden change in surfaces. It is retrained by using balance and agility exercises such as a BAPS board or standing on one leg with eyes closed as well as using a single leg on a mini trampoline.

- Neuromuscular Control Training
 - Can be enhanced by training in controlled activities
 - Uneven surfaces, BAPS boards, rocker boards, or Dynadiscs can also be utilized to challenge athlete



Injury prevention

- Tight Achilles tendons can predispose someone to injuring the ankle. Tendonitis, plantar fasciitis, and other disorders may occur due to a tight Achilles tendon.

Injury Prevention

- Footwear is something often overlooked but improper footwear can predispose someone with a foot condition such as pes planus (flat feet) to be more prone to having problems with their feet and ankles.

Preventative Taping and Orthosis

- Taping is often post injury treatment. Some will argue that taping will weaken the ankle. This has not been proven without a doubt but exercise and strengthening of the ankle is always advised.
- Orthotics will help rectify conditions that are permanent and will not be fixed by any other means.

Tape vs. Brace

- Why choose one over another
- Taping may be more time consuming over brace
- Braces may or may not allow more support over tape
- Tape allows more functional movement and often feels more stable
- Tape will loosen with time
- Braces will often loosen with time
- It really is based on the quality of the brace vs. the ability of the person to tape. Both have advantages and disadvantages.