Lecture: Lower Extremity- Foot, Ankle, Knee

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Objectives

1. Understand anatomy of the Knee from the OMM perspective as it relates to structure and function
2. Understand anatomy of the Foot & Ankle from the OMM perspective as it relates to structure and function
3. Develop understanding of typical somatic dysfunction patterns and compensatory patterns in the lower extremity
4. Identify components of the lower extremity physical exam that are augmented by an understanding of osteopathic principles
5. Apply concepts of the course to lower extremity pathology

OCOM

Osteopathic perspective on sports and exercise

The first rule of sports medicine is that you never know what your going to get so be prepared.

Although Somatic Dysfunction plays a prominent role in treating the athlete and insuring optimal performance ALWAYS complete a proper differential diagnostic evaluation for injury appropriate to the mechanism of injury.

Osteopathic perspective on sports and exercise

- An osteopathic perspective includes the ever so important relationship between structure and function WITH or WITH OUT the application of osteopathic manual therapy and allowing anatomy to be the basis upon which your differential is created.

Osteopathic perspective on sports and exercise

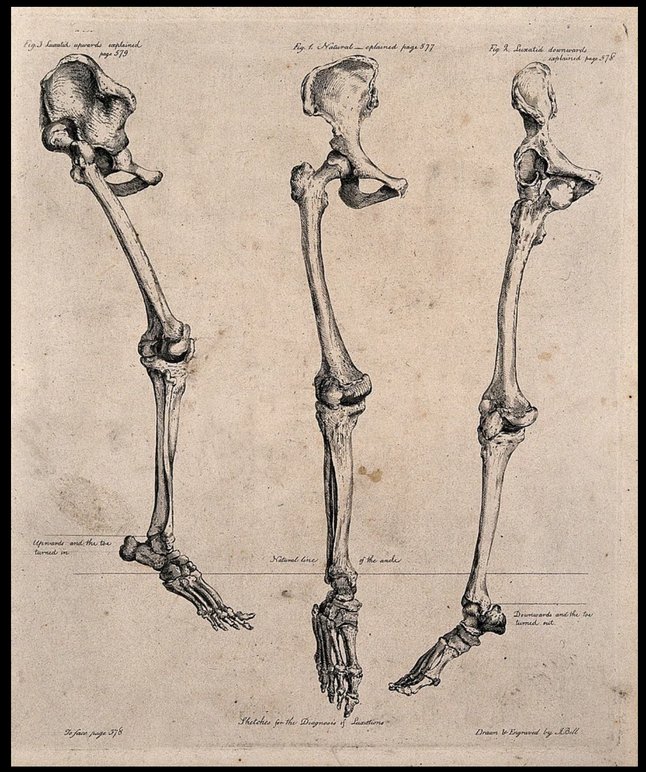
- Differential diagnosis should include a few non-competing perspectives
- Which type of structure is involved? ie myotomal, sclerotomal or dermatomal pain. All have characteristic referral patterns and exacerbating factors.
- Is it some other referral pattern?…
- Which types of injury are most common, which types can not be missed.

Osteopathic perspective on sports and exercise: “not to be missed”

- Example foot and ankle pain
- Common: lateral ankle sprain, plantar fasciopathy, tibiotalar arthropathy, peroneal tendinopathy.
- Less common: Posterior tibialis tendinopathy, tarsal tunnel syndrome.
- Not to be missed: Achilles rupture, osteochondral defect, osteomyelitis

Lower Extremity

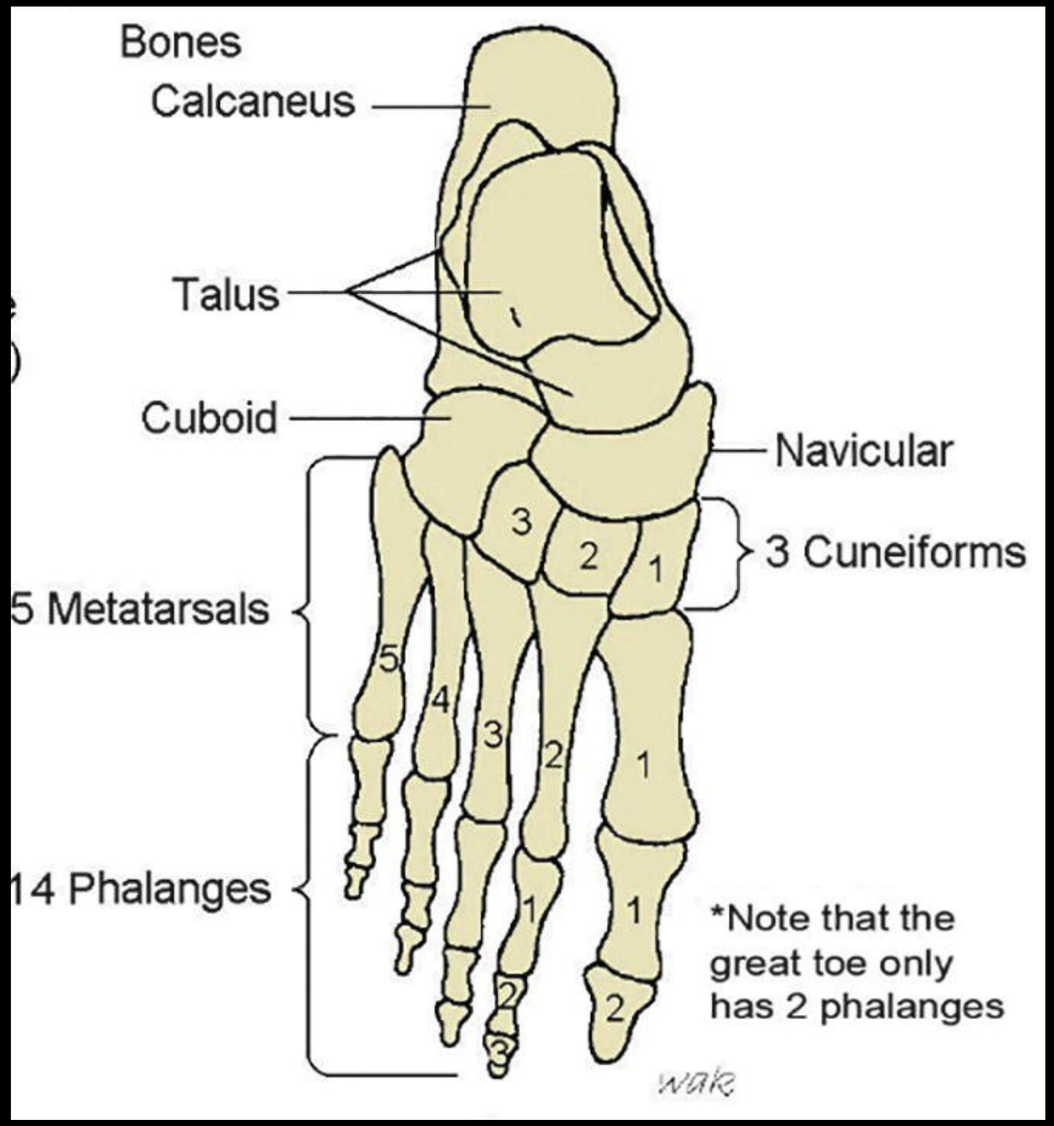
- 126 muscles/ligaments
- 33 joints
- 26 bones (not including sesamoids)



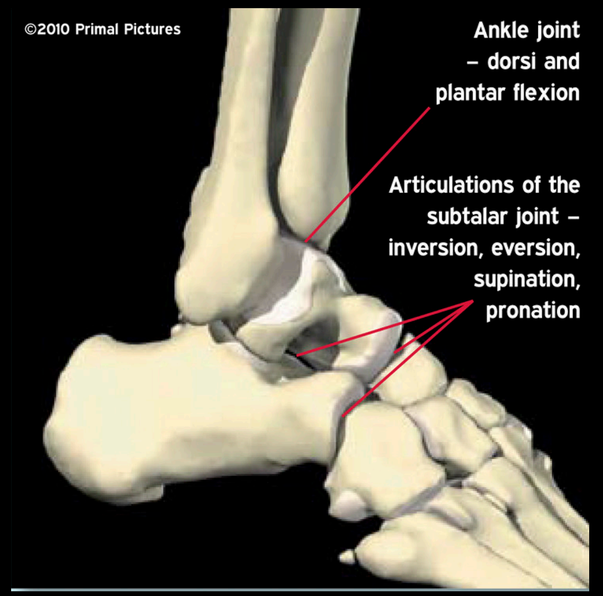
LE Function

- Balance
- Contribute to postural strategy
- Locomotion “pumps”
  - Venous return
  - Lymphatic return

Bony Anatomy



Bony Anatomy

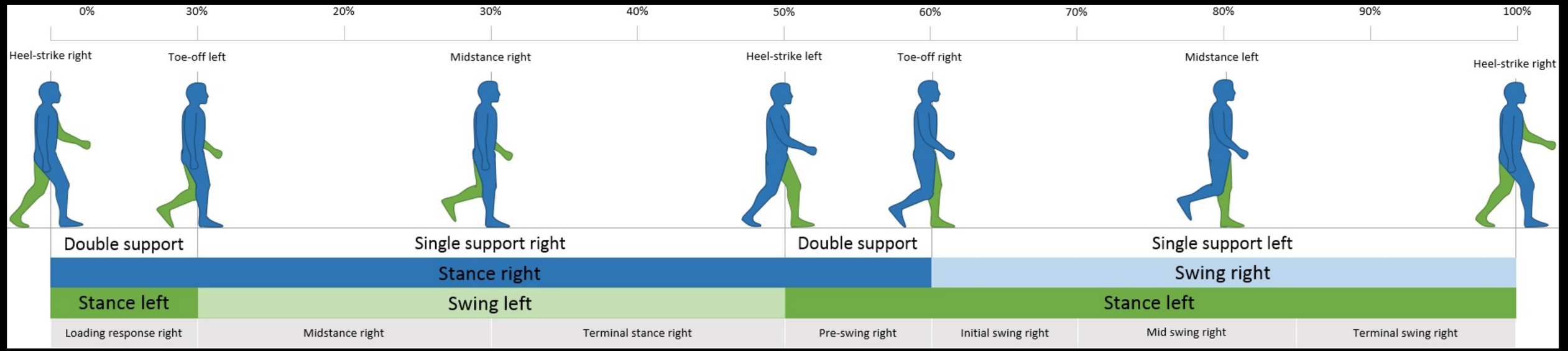


- Ankle functions from 2 joints
  - Tibiotalar (talocrural)
    - Major: Dorsi/plantarflexion, obliquely
      - Plantarflexion: 40 degrees
      - Dorsiflexion: 15 degrees
    - Minor: Dorsiflexion→ Posterior glide; Plantarflexion → Anterior glide
  - Talocalcaneal (subtalar)
    - Shock absorption
    - Triplanar motion
    - Transmits motion of the foot to the leg

Gait Cycle at the Ankle

- Weight bearing phase:
  - As dorsiflexion increases (talocrural joint), tibia rotates medially
  - Medial rotation → calcaneal eversion (subtalar joint)

- Toe off phase:
  - Tibia externally rotates → calcaneal inversion



Gait Cycle at the Ankle

- Plantar Flexion
  - Adduction, toeing-in, supination of the foot
  - Distal fibula moves anteriorly
  - Proximal fibula moves posteriorly, inferiorly
  - Talus glides anterior- Narrow portion in mortise (unstable)

- Dorsiflexion
  - Abduction, toeing-out, pronation of the foot
  - Distal fibula moves posteriorly
  - Proximal fibula moves anteriorly, superiorly
  - Talus glides posterior- Wider portion in mortise (more stable)

Subtalar Mechanics

- Inversion of calcaneus
  - Lateral rotation of the tibia
  - Talus glides posteriorly over calcaneus

- Eversion of calcaneus
  - Medial rotation of the tibia
  - Talus glides anteromedially over calcaneus

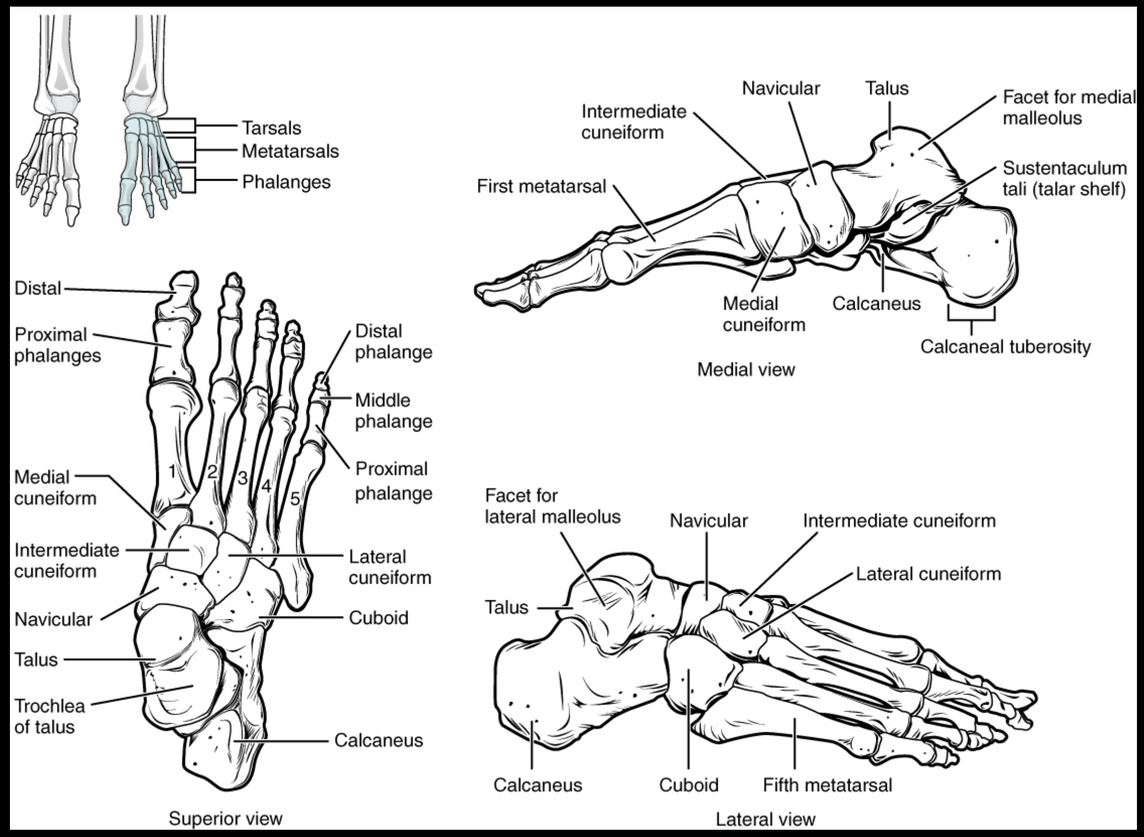
Ankle Somatic Dysfunction

- Most commonly seen in plantarflexion with reduced anterior glide against a restrictive barrier.

Transverse Tarsal Joint

- Two joints that act as a functional unit
  - Talonavicular
  - Calcaneocuboid

- Most active during stance phase



Gait Cycle

- Internal rotation of the leg + inversion of the heel
  - Talonavicular & calcaneocuboid axis coincide
  - This creates laxity in the transverse tarsal joint
    - Forefoot can not evert or invert to accommodation terrain

- External rotation of the leg + eversion of the heel
  - Transverse tarsal joint becomes rigid
  - Plantar flexion (heel rising): Rigid TT joint follows the movement about the subtalar axis and inverts with the heel to assist with toe-off

Foot Arches

- Non-Functional
  - Metatarsal Heads
  - Dysfunction usually secondary to dysfunction of the functional arches

- Functional
  - Longitudinal
    - Supported by tibialis posterior
    - Divided into medial & lateral components
  - Transverse
    - Supported by peroneus longus, tibialis anterior

Foot Arches

- Functional
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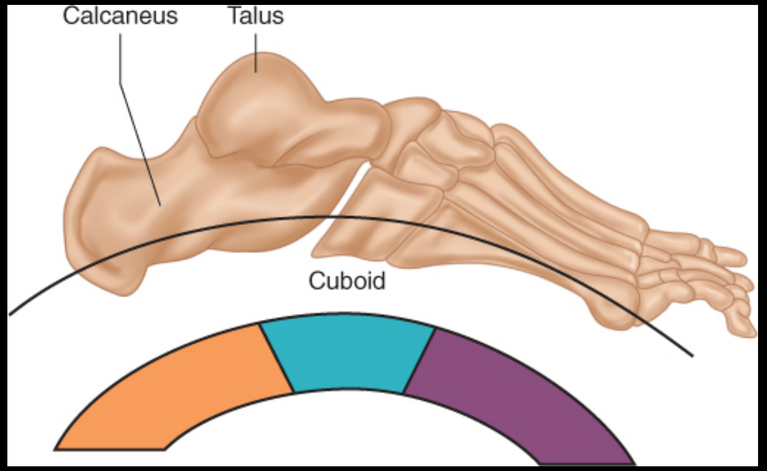
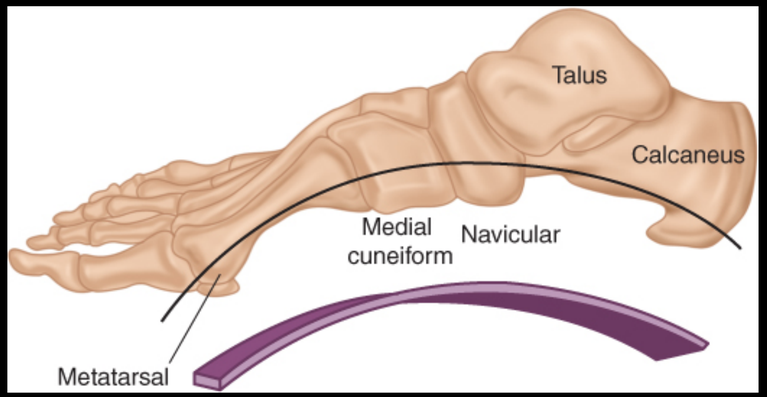
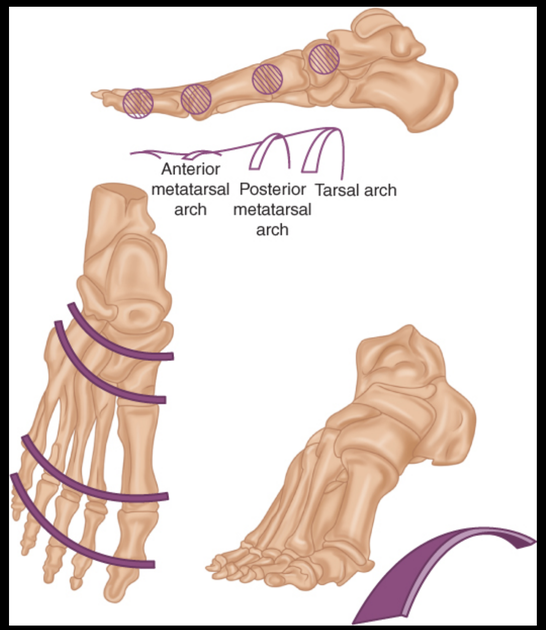


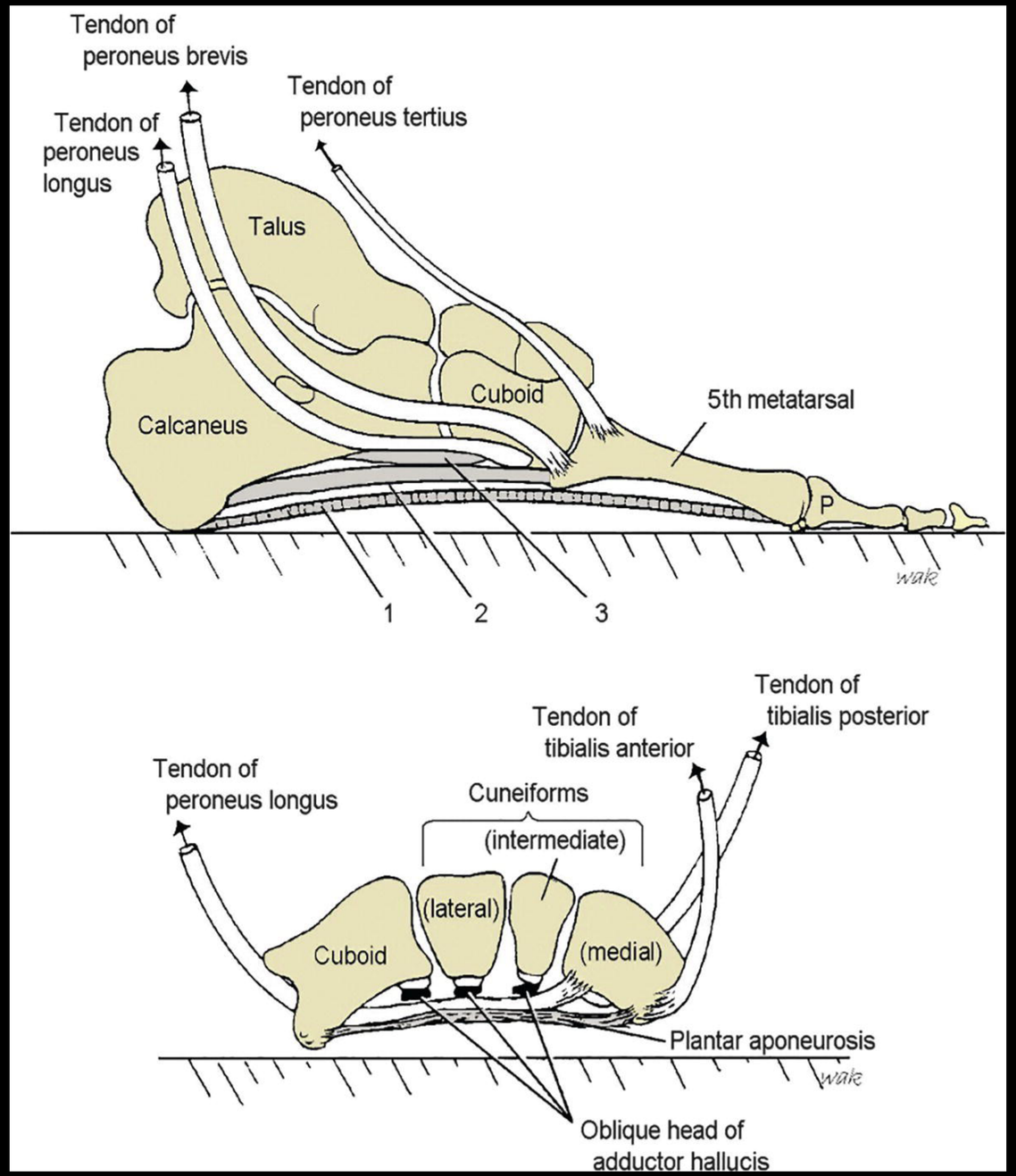




  - Transverse
    - Supported by peroneus longus, tibialis anterior

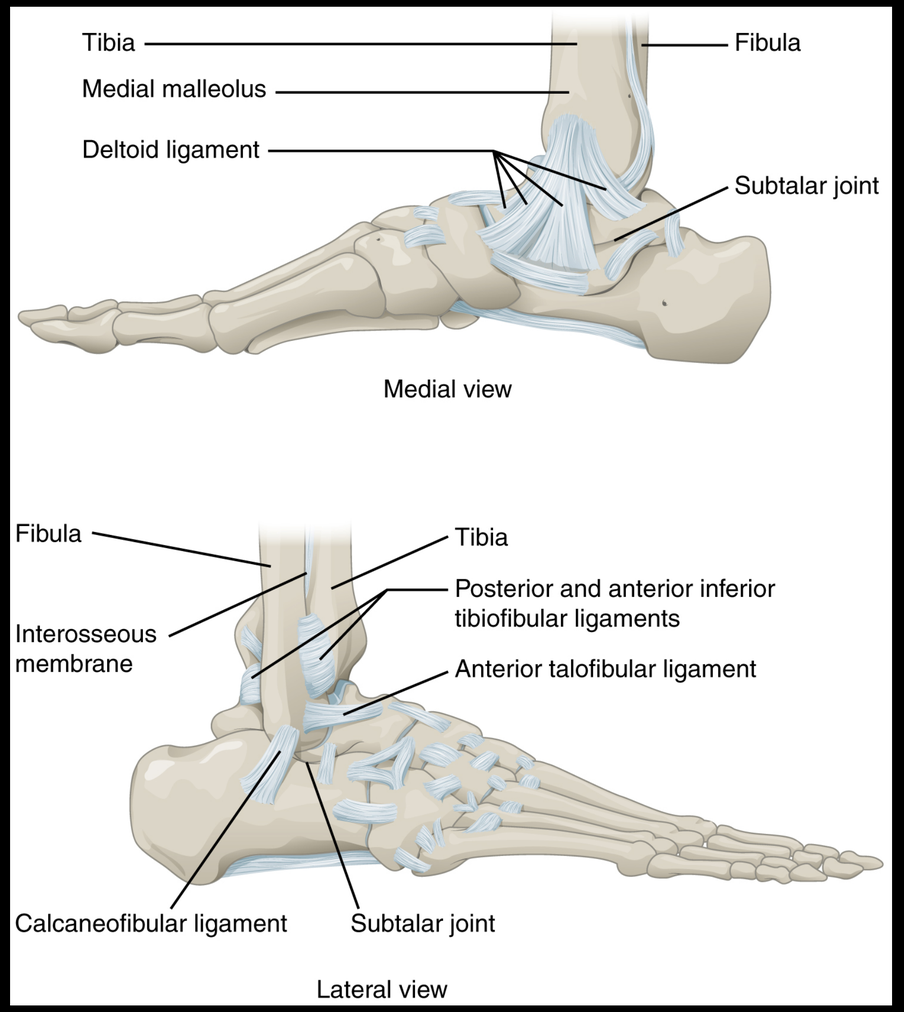
Foot Arches

- Supported by
  - Plantar ligaments
  - Plantar Aponeurosis

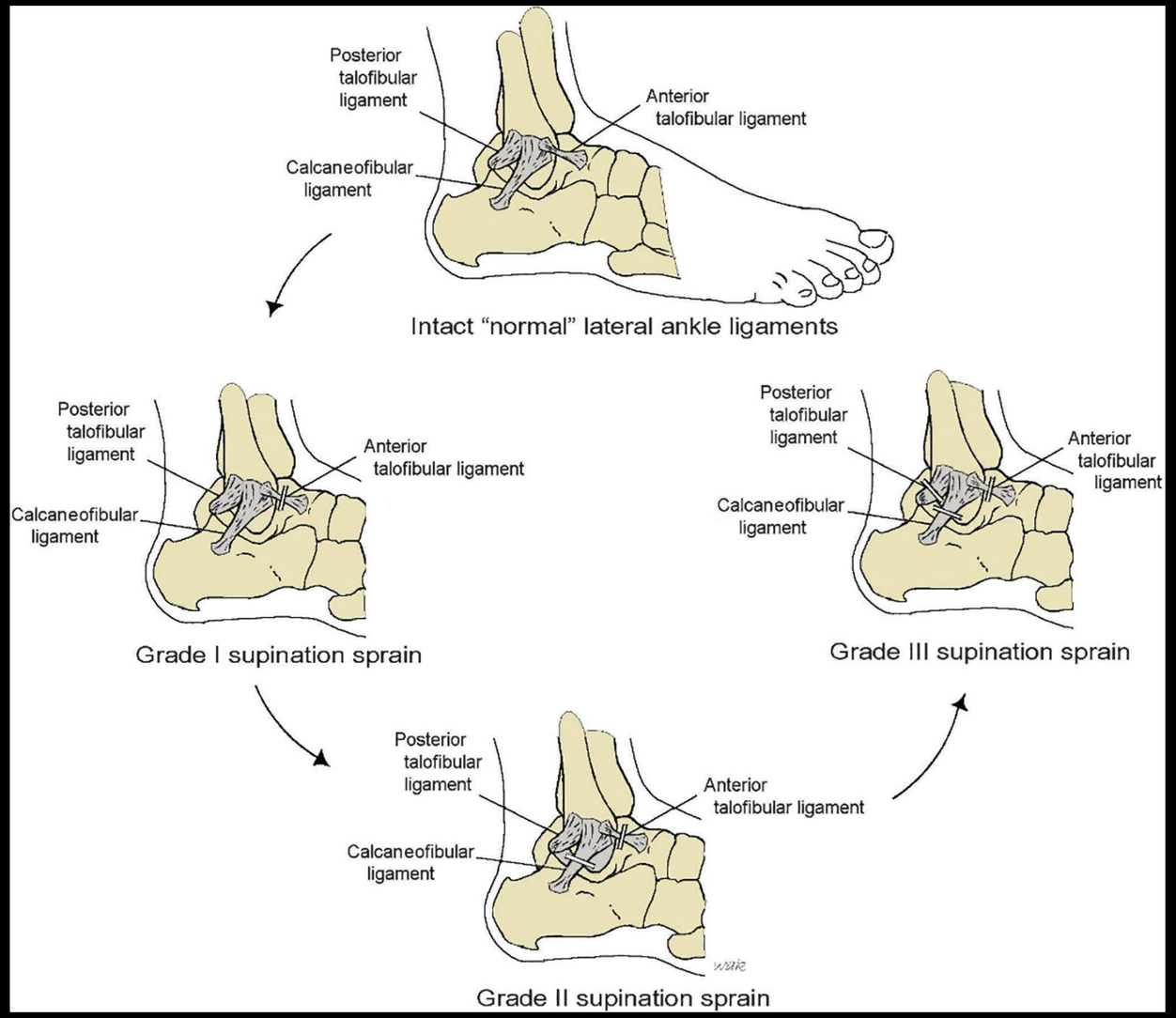


Supporting Structures

- Lateral stability of the ankle
  - Anterior talofibular ligament
  - Calcaneofibular ligament
  - Posterior talofibular ligament

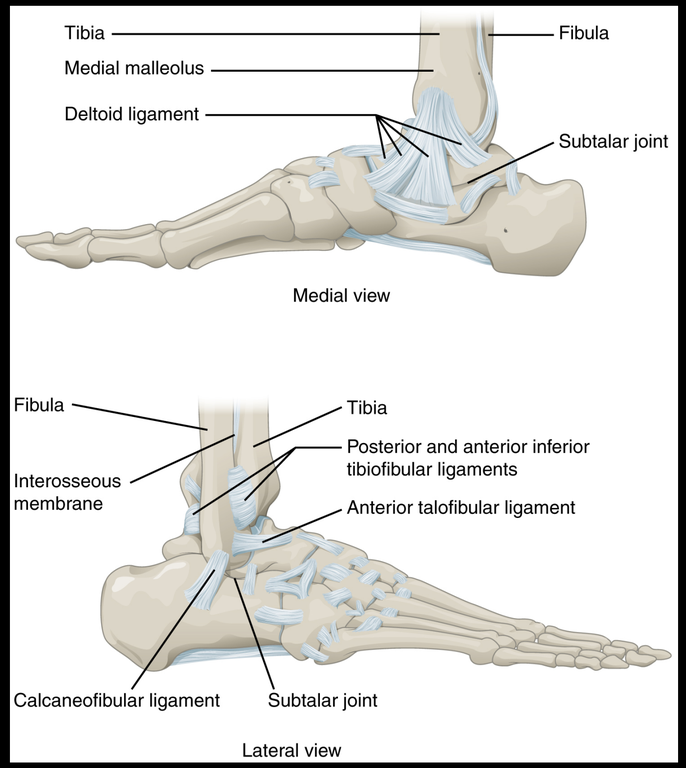


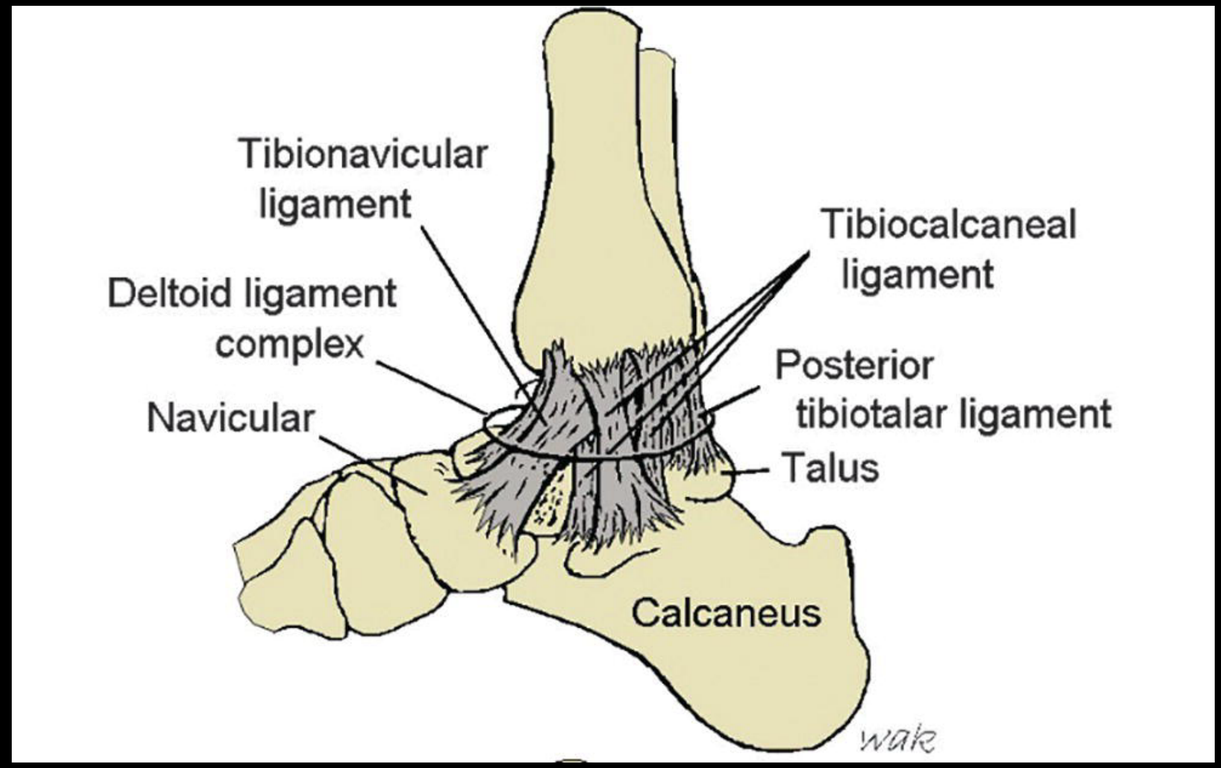
Supporting Structures



Supporting Structures

- Medial ankle: Stabilized by the Deltoid Complex (ligament)





Neural Considerations

- Leg, Foot, Ankle innervation provided by:
  - Posterior Tibial Nerve
    - Supplies Posterior Compartment and Foot Muscles
  - Common Peroneal Nerve
    - Superficial Peroneal Nerve
      - Supplies Lateral Compartment, Anterolateral Leg, Dorsal Foot
    - Deep Peroneal Nerve
      - Supplies Anterior Compartment, 1-2 Webspace

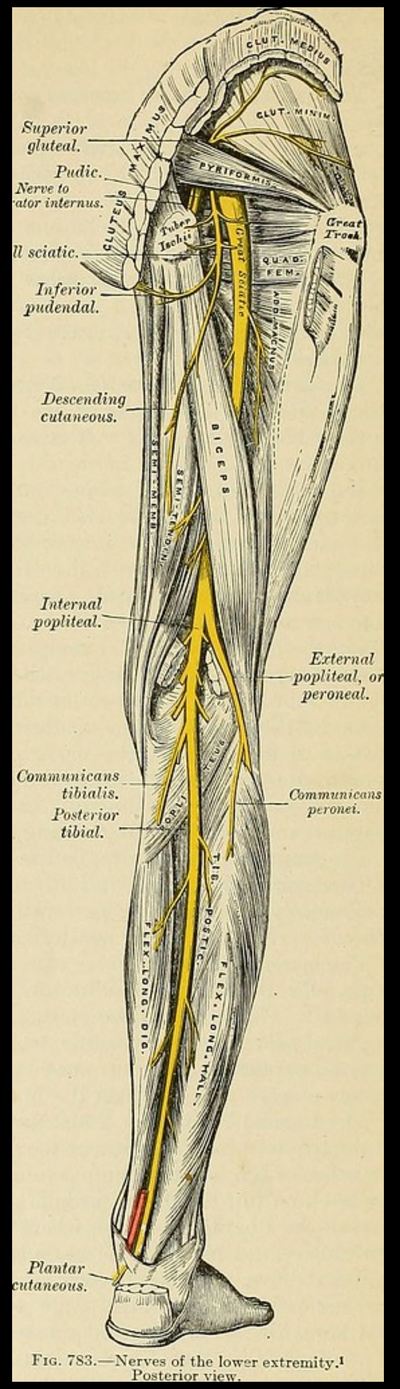
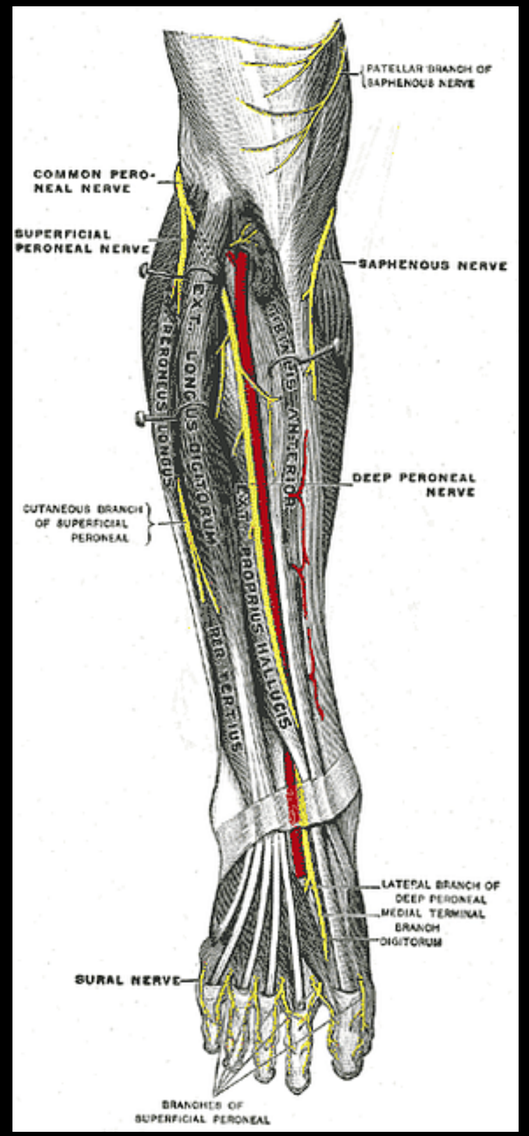


Fig. 783.—Nerves of the lower extremity.[1] Posterior view.



LE Observational Examination

- Standing with eyes open vs closed
- One legged stork
- Squatting
- Walking
- Toe standing, walking
- Heel standing, walking
- Active ROM

LE Hands-On Examination

- Landmark palpation
- ROM: End feel
- Strength
- Stability
- Flexibility
- Standing Flexion Test

LE Special Tests

- Neural
- Lymphatic
- Vascular

Foot & Ankle Inspection

- Varying Positions
  - -Seated
  - -Standing
  - -Throughout Ambulation
- Skin Findings
- Nail Findings

Foot & Ankle Inspection

- Skin Findings
- Nail Findings
- Bony Deformities
- Positional Findings
  - - Medial Arch Height
    - - Anatomic vs Functional Abnormalities
  - -Toe In/Out

Foot & Ankle Inspection

- Movement Patterns
  - Ambulation
    - Heel Strike
    - Roll Laterally
    - Roll Medially Across Mid-Foot
    - Great Toe Push Off

Foot & Ankle Palpation

- Landmark Palpation
  - Tissue Texture Changes
  - Tenderness
  - Swelling
  - Asymmetry
  - Arthritic Changes

Foot & Ankle Palpation

- ROM: End Feel
  - Start with Asymptomatic Side
  - Cardinal Movements
    - Dorsiflexion, Plantarflexion
    - Abduction, Adduction
    - Calcaneal Inversion, Eversion
    - Cuboid Motion
    - Metatarsal Motion
    - Navicular Motion
    - Cuneiform Motion
    - Phalangeal Motion

Foot & Ankle Palpation

- Strength
- Flexibility (Active, Passive)

Foot & Ankle Special Tests

- Stability

- Neural
- Lymphatic
- Vascular

Lower Extremity OMM Lab: Sports medicine

Dorsiflexion	□ Patient: Supine, seated, or prone □ Physician: Standing on side being treated, at the level of the foot Technique: □ The physician grasps the patient's ankle with one hand at the level of the malleoli □ Physician's other hand is placed over the dorsum of the foot □ The patient's foot is brought into plantar flexion, to the barrier □ The patient is instructed to push into dorsiflexion. The physician provides isometric resistance for 3 – 5 seconds □ The patient is instructed to relax then the physician repositions the patient into the new barriers □ The procedure is repeated until normal motion is accomplished or approximated
Plantar Flexion	□ Patient: Supine, seated, or prone □ Physician: Standing on side being treated, at the level of the foot Technique: □ The physician grasps the patient's ankle with one hand at the level of the malleoli □ The physician's other hand is placed under the plantar surface of the patient's foot □ The patient's foot is brought into dorsiflexion, to the barrier □ The patient is instructed to push into plantarflexion. The physician provides isometric resistance for 3 – 5 seconds □ The patient is instructed to relax and then the physician repositions the patient into the new barriers □ The procedure is repeated until normal motion is accomplished or approximated

Eversion/Inversion Dysfunction	□ Patient: Supine □ Physician: Standing at foot of table Technique: □ Physician grasps the patient's foot on the side of the dysfunction, placing one hand on the dorsal mid-tarsal region and using the other to grasp the calcaneus □ Physician applies traction to the patient's leg □ If an inversion somatic dysfunction is present, the physician exerts a rapid long-axis traction through calcaneus with simultaneous hyper-eversion of the ankle □ If an eversion somatic dysfunction is present, the physician exerts a rapid long-axis traction through calcaneus with simultaneous hyper-inversion of the ankle
Cuboid-Navicular Dysfunction	□ Patient: Prone □ Physician: Standing at foot of table, on the side of the dysfunction Technique: □ Physician flexes the patient's hip and knee on the dysfunctional side and then drops the leg off the side of the table □ Physician grasps the patient's foot with both hands and places their thumbs in a "V" shape over the plantar surface of the cuboid or navicular, whichever it is that is in a dropped position relative to the other tarsals □ Physician exerts a downward thrust through their thumbs while simultaneously inducing a whip-like action at the patient's ankle and knee □ The dysfunction is reevaluated

Questions???