Put A Sock In It: Foot & Ankle Anatomy

Chairperson:

Mark Yakavonis, MD, MMS, FAAOS

Assistant Professor, Orthopedic Surgery

Boston Medical Center

Monday, March 25th, 2024

1:10-2:00pm

Review of Foot & Ankle Anatomy

George H. Theodore, MD

Foot and Ankle Consultant: Boston Red Sox, New England Patriots, Boston Bruins, Boston Ballet, Harvard University

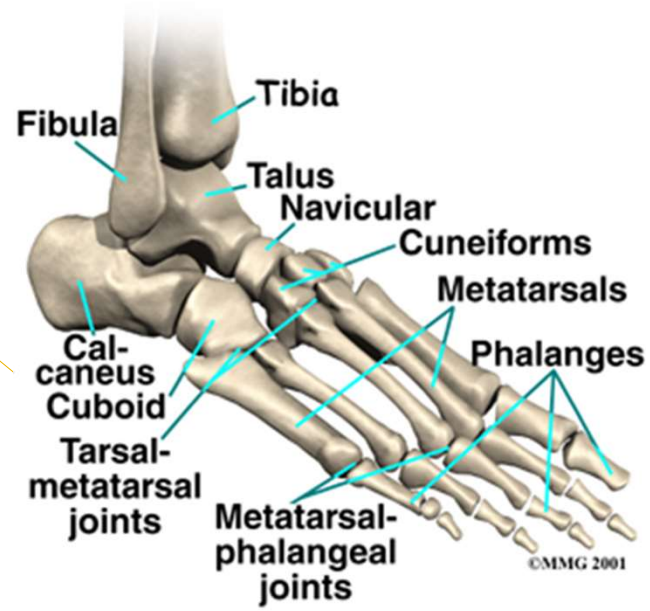
Massachusetts General Hospital, Sports Medicine Center, Boston, MA

Foot and Ankle Anatomy, Review and Updates

Review of Foot and Ankle Anatomy

Review of Foot and Ankle Anatomy

Bones



Ankle

- Tibia
- Fibula
  - 1/6 total body weight
- Talus
  - 3/5 cartilage
  - No muscle insertion

Foot

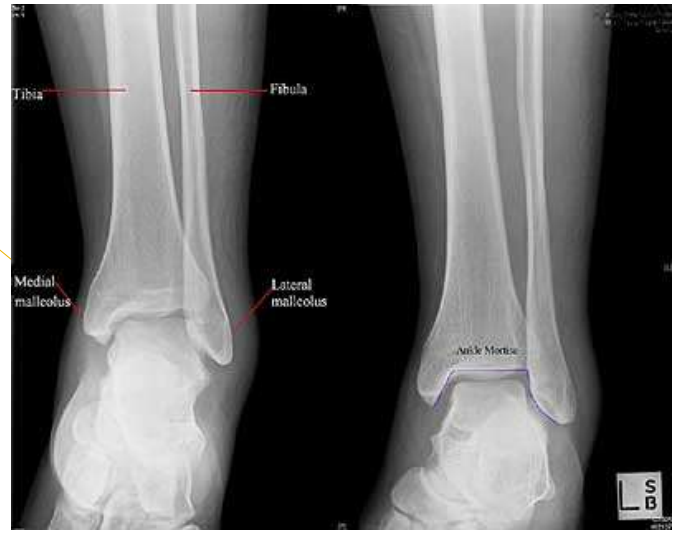
- 26 bones
- Calcaneus is largest
- 7 tarsal
- 5 Metatarsals
- 14 phalanges

Review of Foot and Ankle Anatomy

Bones

Radiographic anatomy

Typical ankle xray series: AP/Lat/Mortise views



Pathoanatomy

Disruption of ankle mortise

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Bones

Common foot xray views

AP/Lat/oblique

Conditions

Arthritis

Fractures

stress

direct impact

Alignment

Bone density

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Cartilage

Anatomy

Resilient type of connective tissue

Composed of cells (chondrocytes) and extracellular matrix (proteoglycans and collagens)

Does not contain nerves or vessels

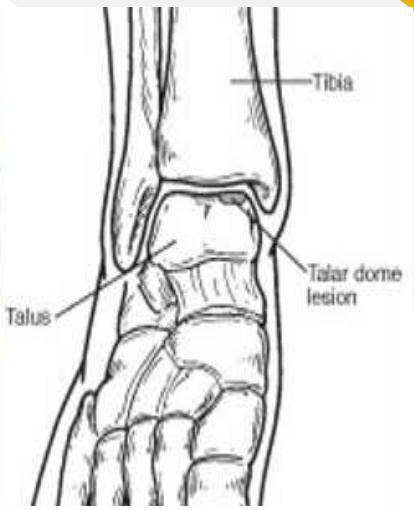
Provides cushioning in weight-bearing joints

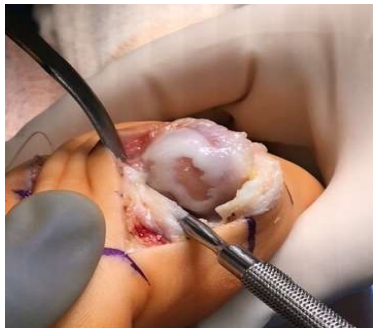
Disease

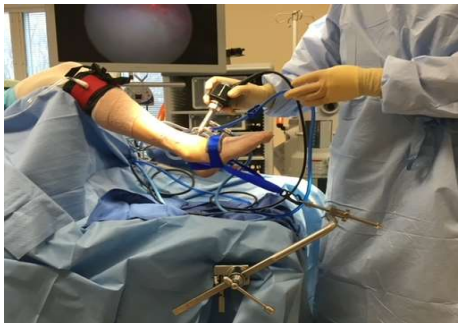
Osteoarthritis: articular cartilage is worn away

Traumatic detachment: osteochondral injury

ankle arthroscopy treatment







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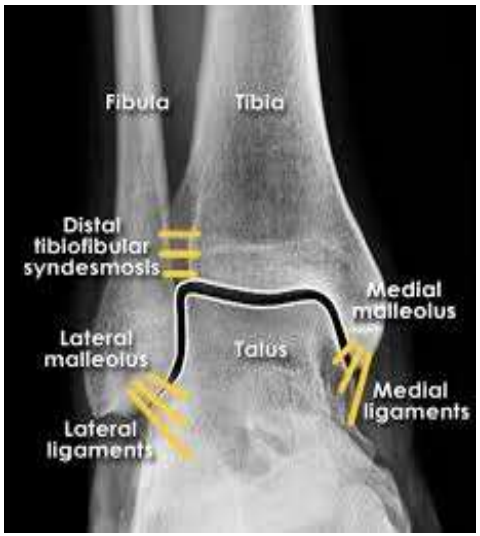
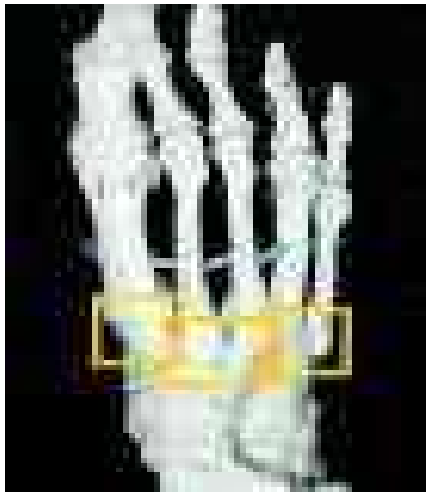
Ligaments





Ligaments connect bone to bone

- Lateral
  - Anterior talofibular (ATFL)
  - Posterior talofibular (PTFL)
  - Calcaneofibular (CFL)
- Medial
  - Deltoid
- Syndesmotic
  - Anterior inferior tibiofibular (AITFL)
  - Posterior inferior tibiofibular (PITFL)
- Foot
  - Tarsometatarsal (Lisfranc)

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Ligaments

25,000 ankle ligaments injuries per day in the USA

Types

Grade 1: stretch

Grade 2: partial tear

Grade 3: rupture

Inversion injury

Low ankle sprain

90% sprains

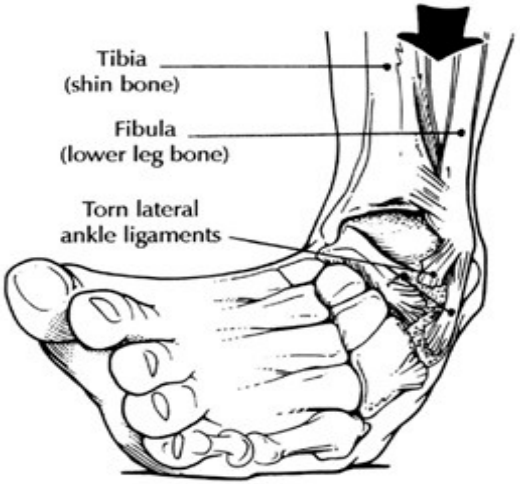
Injures ATFL and sometimes CFL

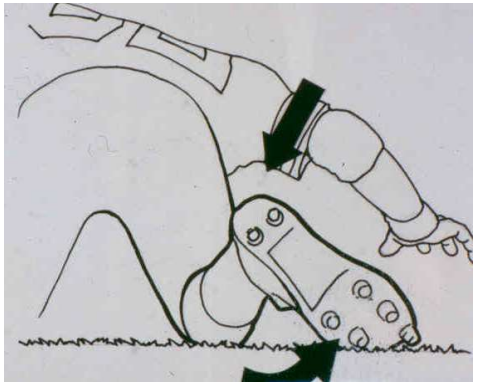
Eversion injury

High ankle sprain

10% sprains

Injures syndesmosis





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Ligament and bone injuries

Lisfranc injury

Lisfranc ligament connects the medial cuneiform to the base of the second metatarsal

Combined axial load and plantar flexion of the foot leads to injury

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Tendons

Connect muscles to bones

Anterior

Anterior tibial tendon: dorsiflexes the ankle

Extensor tendon: extends the toes

Lateral

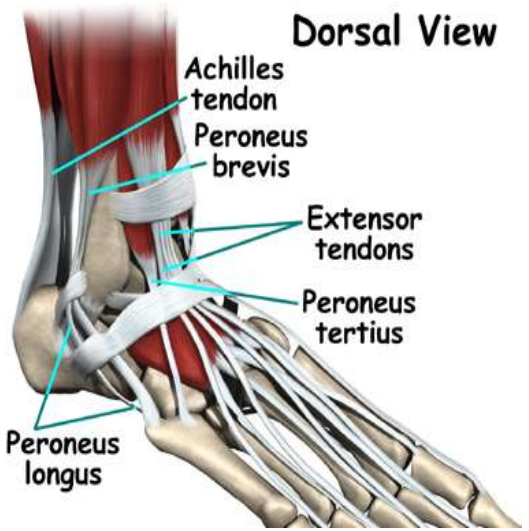
Peroneal tendon: everts and plantar flexes the foot

Medial

Posterior tibial tendon: inverts the foot and maintains arch

Posterior

Achilles tendon: plantarflexes the ankle



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Tendons

Achilles tendon

Connects the muscles of the leg to the calcaneus

Tendonitis

Inflammation of tendon sheath

Tendinosis

Degeneration of the tendon

Bursitis

Inflammation of fluid filled sacs

Rupture

Tear of the tendon

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Soft tissues and prominences

Plantar fascia

Thick fibrous band that runs from the calcaneus to the toes

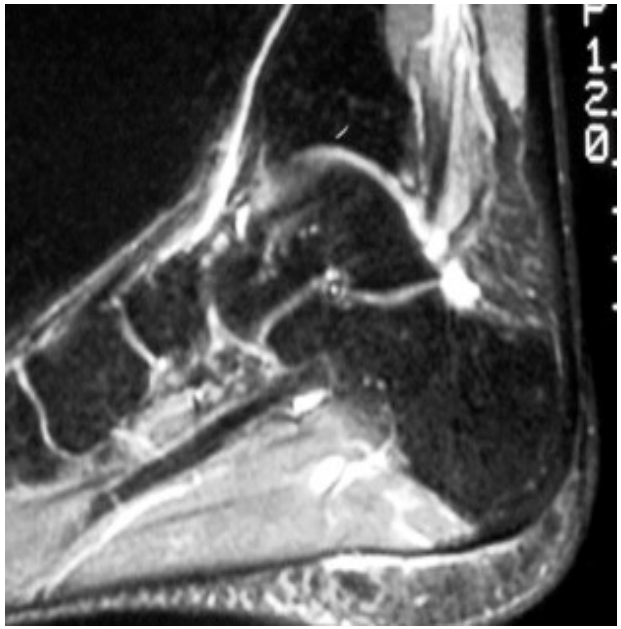
Commonly inflamed from a microtear (fasciitis)

Pain with the first steps in the morning

Bunions (hallux valgus)

Abnormal prominence first metatarsal

First metatarsal often assumes varus position



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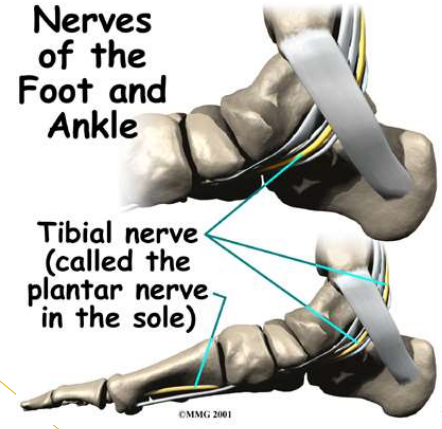

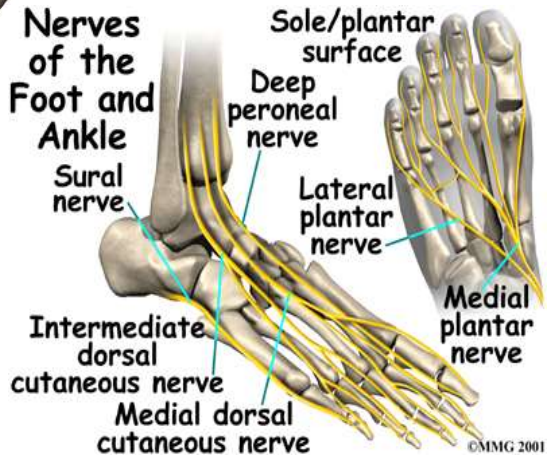

- Nerves
  - Medial
    - Tibial
      - Medial and lateral plantar nerves
      - Tarsal tunnel is created by medial malleolus, flexor retinaculum, and posterior talus-calcaneus
      - Terminates in the toes and can cause a neuroma
  - Anterior
    - Deep peroneal
    - Superficial peroneal
    - Can be injured by crush injuries to the foot
  - Lateral
    - Sural
    - Can be injured in calcaneus fractures

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Nerves

Chronic regional pain syndrome

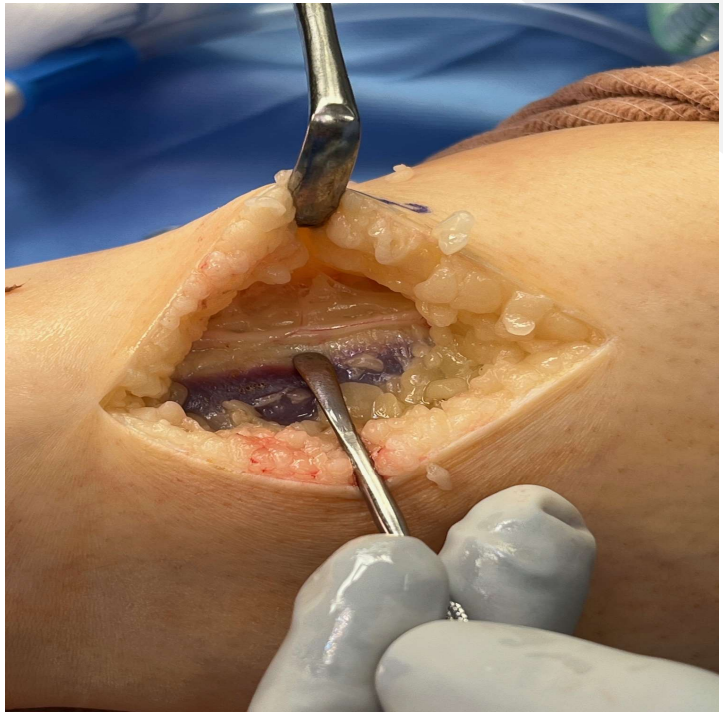
Results from autonomic dysfunction

Type 1

- not associated with nerve injury
- previously known as RSD
- accounts for 90% CRPS

Type 2

- associated with nerve injury
- previously known as causalgia
- may be amenable to repair



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Thank you

Common Foot & Ankle Work Injuries

Nathan Olszewski, MD

Associate Professor

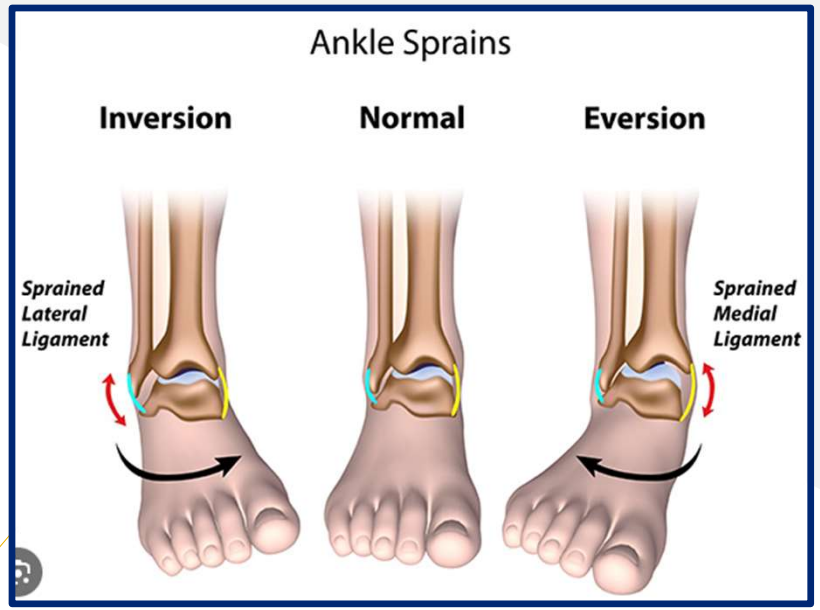
BU Orthopedics

Sprains, Strains & Fractures

- Burns
- Lacerations
- Amputations

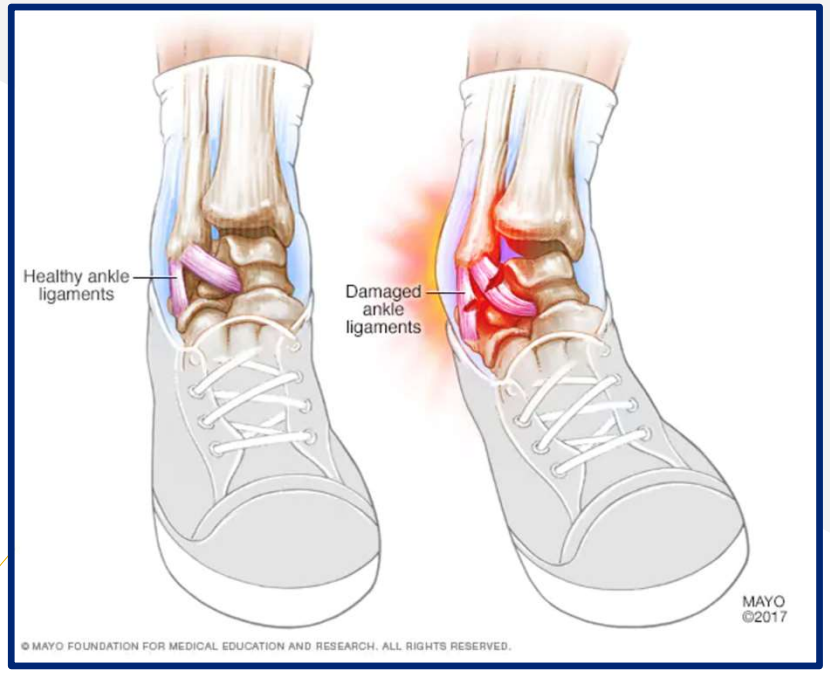
Mechanism of Injury

- Twisting
- Compression (Fall from height)
- Crush
- Repetitive Loading



Sprains

- Stretching or tearing of a ligament
- Ligament = tough band of fibrous tissue
  - Connects two bones
  - Spans across a joint

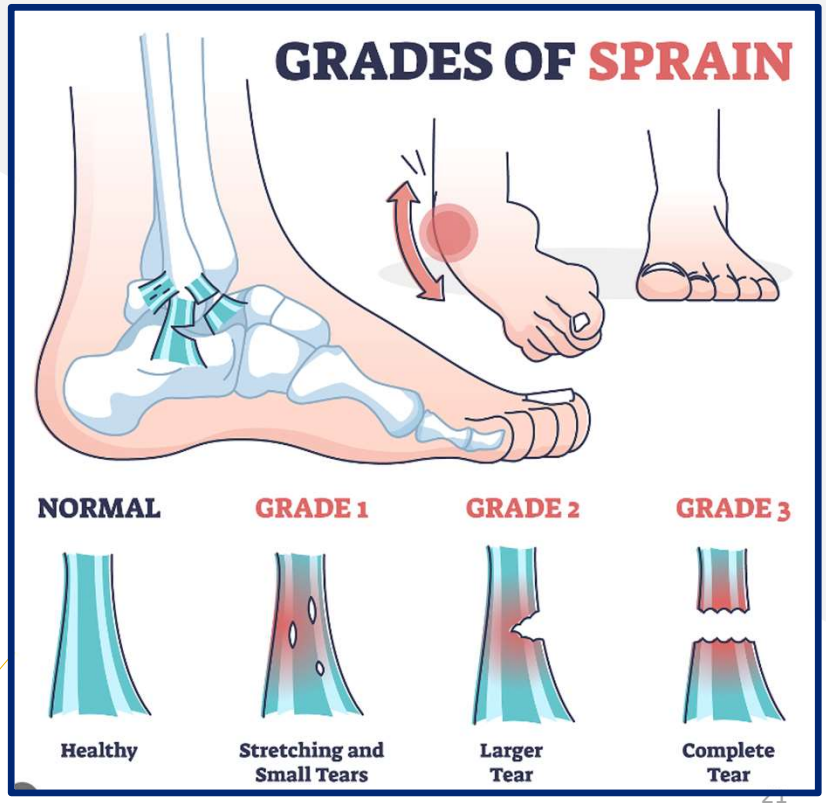


Sprains

- Various Grades of Sprains

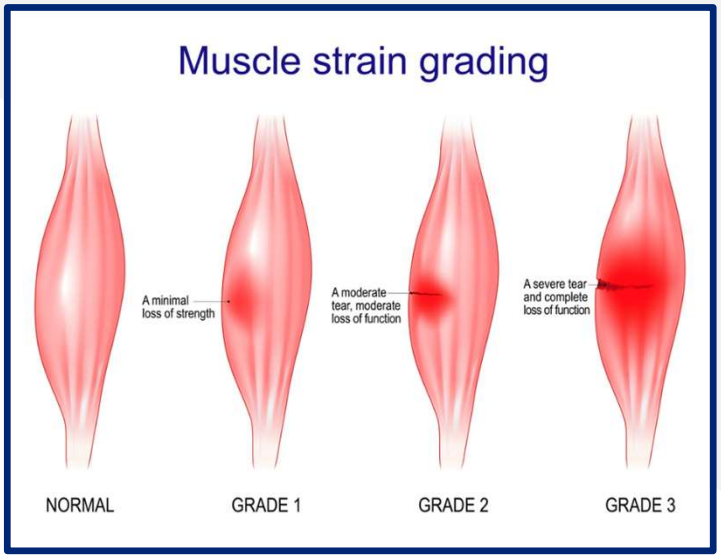
- Normal = healthy tissue
- Grade 1 = stretching and small tears
- Grade 2 = larger tears of the tendon
- Grade 3 = Complete tears

- The higher the grade the more symptomatic and longer the recovery



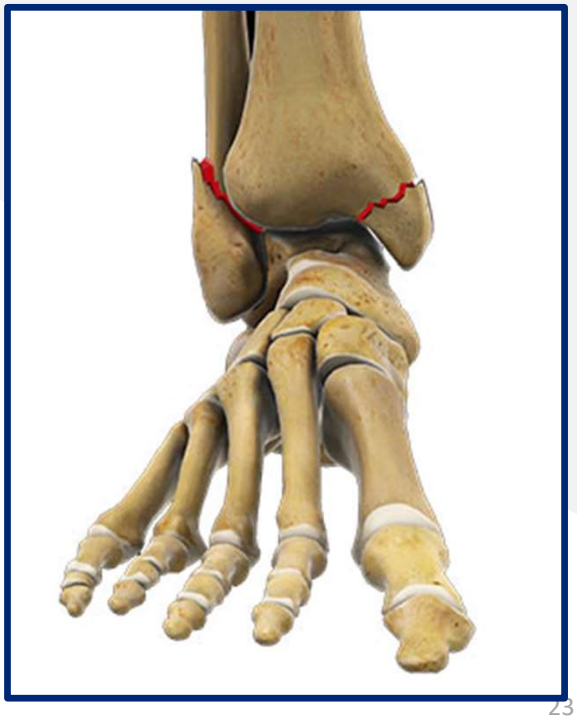
Strains

- Tearing of the muscle or tendon
- Due to overstretch of the muscle or tendon
- Tendon is connective tissue that connects the muscle to bone
- Muscle is connective tissue that has the ability to contract



Fractures

- Break in the bone
- Bone = connective tissue that is mineralized for extra strength



Burns

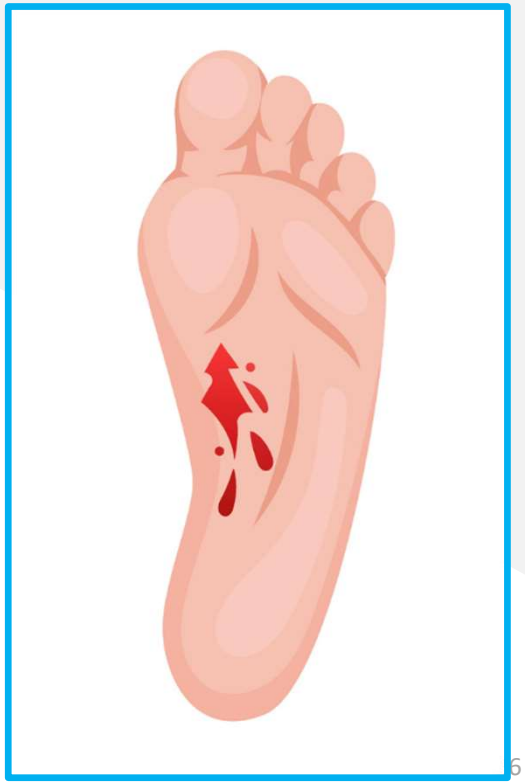
- Damage of the skin
- Can be caused by higher temperatures and electricity
- Can be devastating injury
- If severe enough may need amputation

Amputations

- Usually due to crush injuries or higher energy injury
- Results in significant soft tissue damage and boney injury
- “Unsalvageable” Situation

Lacerations and Punctures

- Can require surgical intervention
- May cause injury to other structures



Crush Injuries

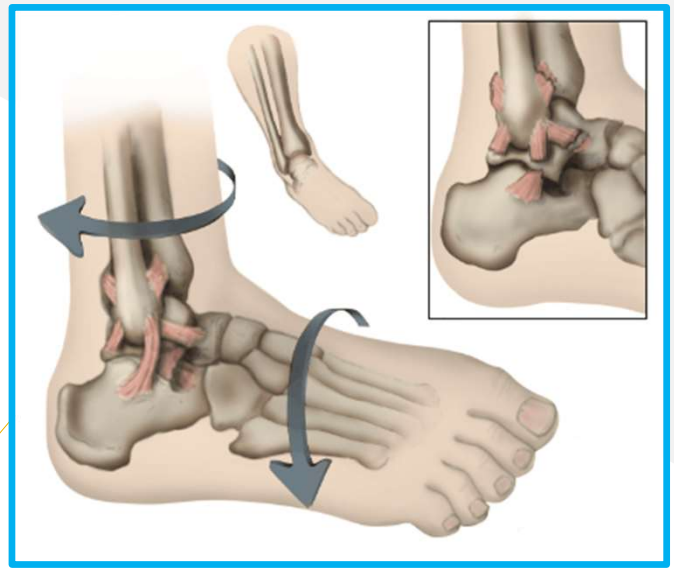
- Can result in substantial soft tissue damage
- Large amount of swelling
- Structures get crushed
- Can be a devastating injury even with “negative tests”

Combination of injuries

- Open fractures
  - Damage to bone and skin
- Fractures and ligament injuries

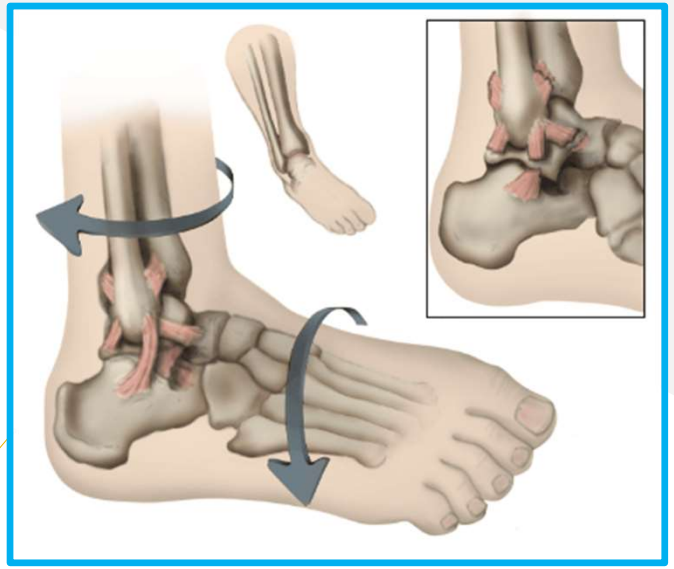
Most Common Sprains

- Ankle Sprains
- High Ankle Sprains
- Midfoot Sprains



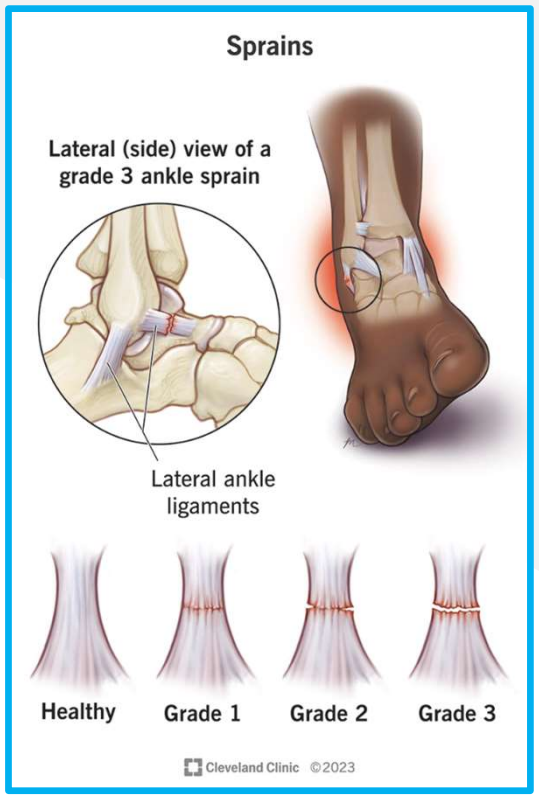
Ankle Sprains

- Are the most common
- Sprains of the ligaments around the ankle
- Usually involve the ligaments around the ankle
- Different severities



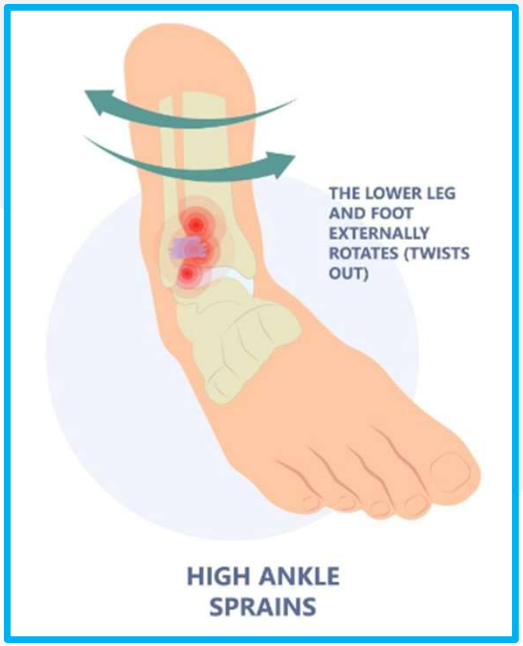
Ankle Sprains

- Severity of the injury depends on the damage to the ligament
- Most recover with time
- Best Outcomes with physical therapy
- In most severe cases surgery maybe necessary



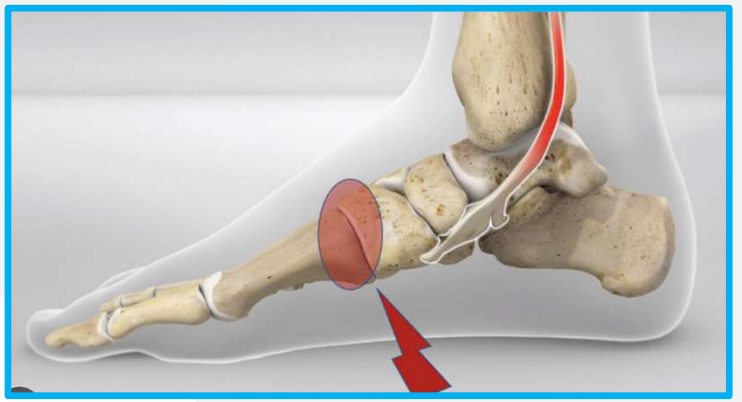
High Ankle Sprains

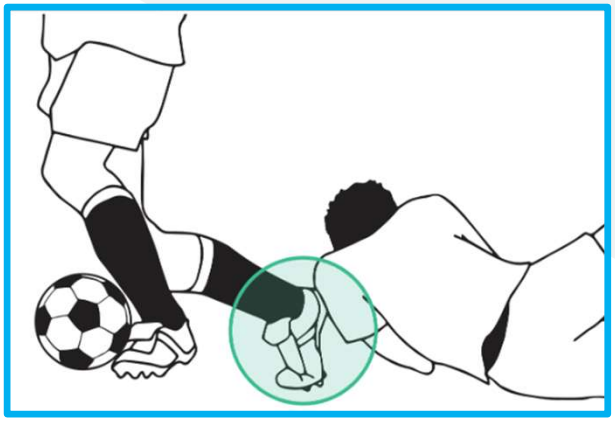
- Injury to the syndesmotic ligaments
- Usually take longer to recover from than regular ankle sprain
- Physical therapy aids in recovery
- Majority recover without surgery



Midfoot Sprains

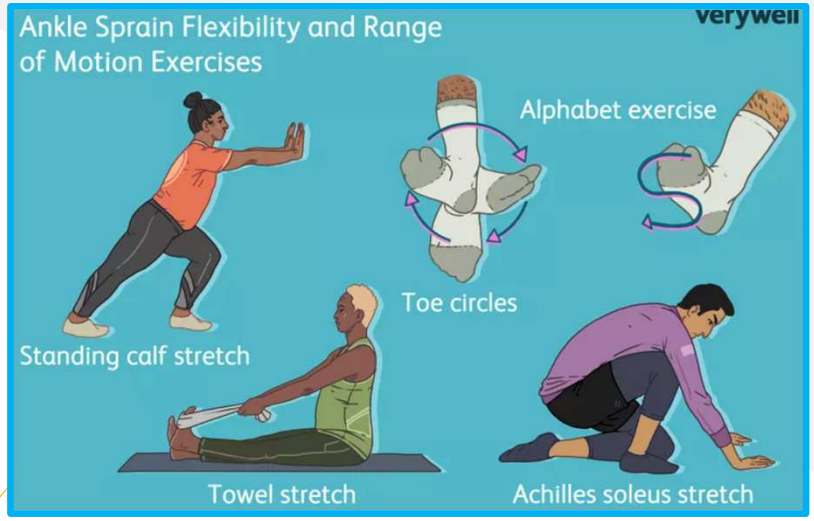
- Involves the ”Lisfranc” ligament
- Needs Close monitoring and may need advanced imaging
- May Require prolonged immobilization
- Takes longer to recover from than an ankle sprain





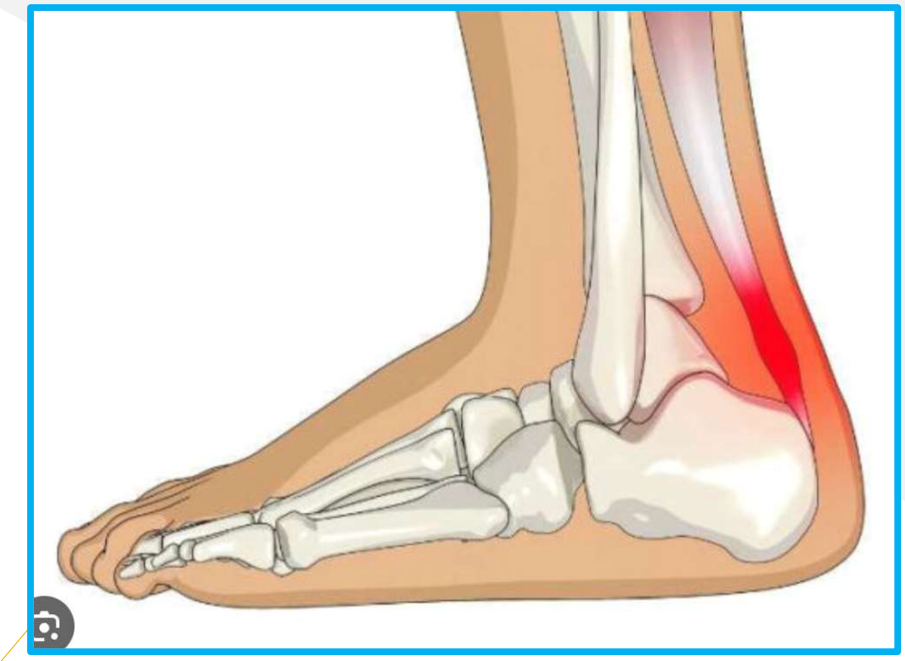
Sprains Summary

- Injury Severity based on the amount of damage to the ligament
- May involve multiple ligaments
- Most Recover without surgery



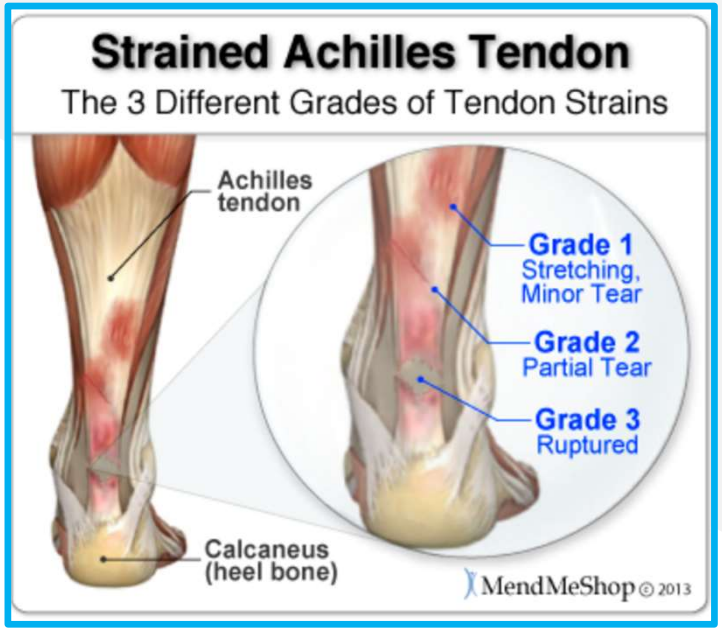
Strains

- Achille Tendon
- Gastroc Muscle
- Posterior Tibial Tendon
- Peroneal Tendons
- Plantar Fascia



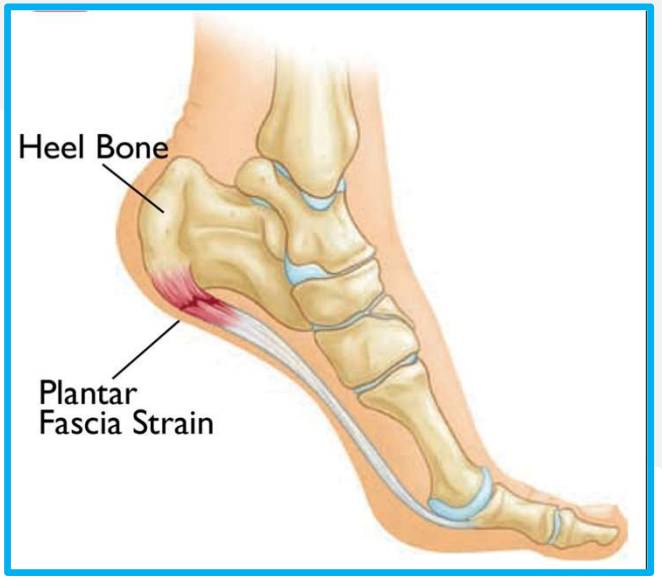
Achille Tendon Strains

- Grade 1 & 2 can usually be managed non-operatively w/ PT
  - Eccentric Strengthening
  - Recalcitrant cases may be managed with surgery
- Ruptures can be managed with or without surgery
- Can have prolonged recovery



Plantar Fascia Strain

- Usually due to repetitive stress
- Heel and arch pain
- Usually treated with stretching and PT
- Most Recover



Fractures

- Ankle fractures
- Calcaneus Fractures
- Pilon Fractures
- Midfoot Fractures
- Forefoot Fractures

Ankle Fractures

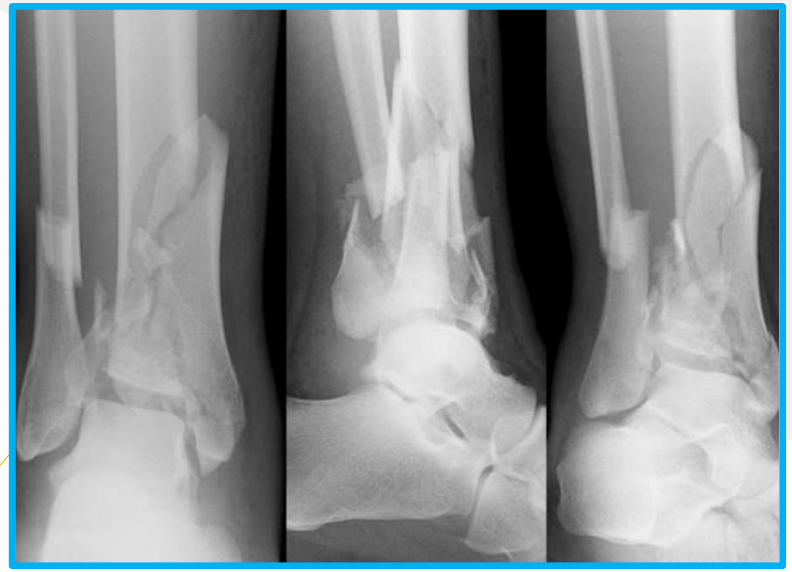
- Variable fracture patterns
- Can have boney and ligamentous injuries
- May or may not need surgery
- Most recoveries take 5-6 Months, but can be longer

Calcaneus Fractures

- Due to compression forces
- Devastating injuries
- Most patients never reach preinjury levels
- Max Recovery can take 1.5-2 yrs

Pilon Fractures

- Due to compression forces of talus into tibia
- Devastating injuries as well
- Require surgical intervention
- Very difficult to reach preinjury levels
- Max Recovery can take 1.5-2 yrs



Summary

- Various Injuries with different severities
- Not all injuries are the same
- Recovery is injury and patient dependent
  - Not always obvious who will do well and who won't

PHYSICAL EXAMINATION OF THE FOOT AND ANKLE

Mark Yakavonis, MD

Assistant Professor of Orthopaedic Surgery

Boston Medical Center

GENERAL INSPECTION

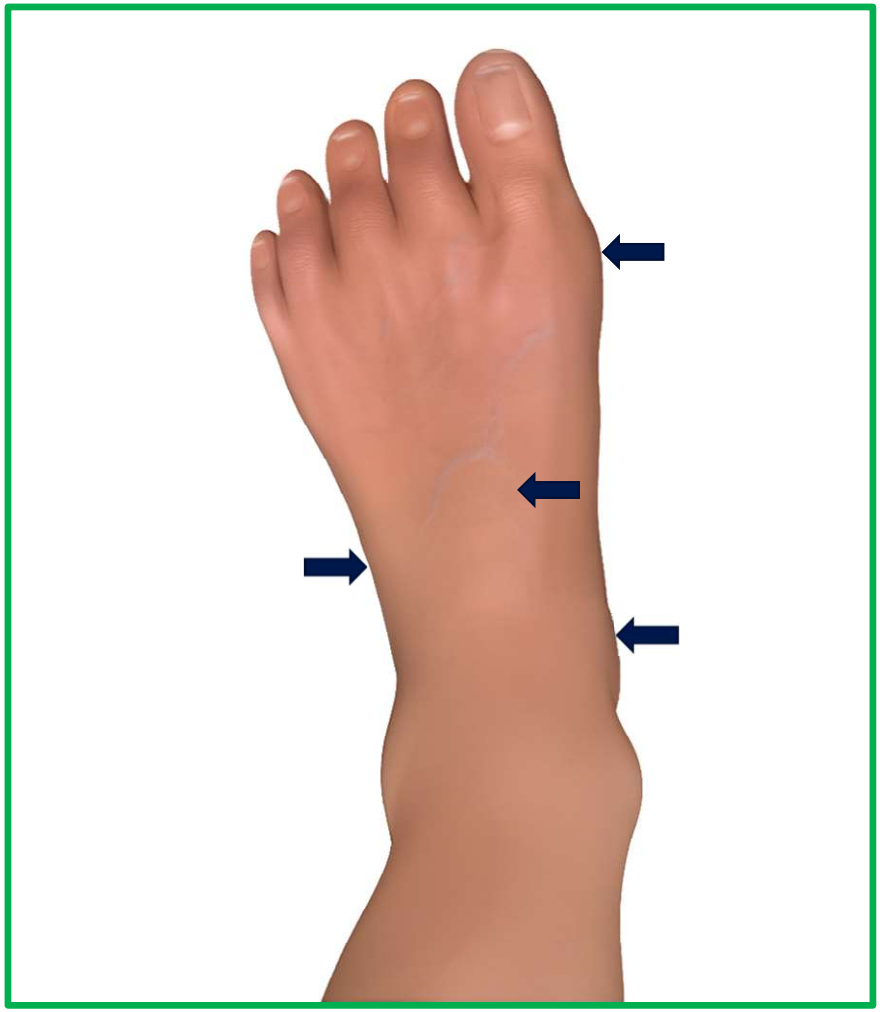
- Skin changes
- Symmetry
- Swelling
- Atrophy
- Distribution of hair

GAIT EVALUATION

- Steppage Gait
- Crouched Gait

Palpation

Palpation

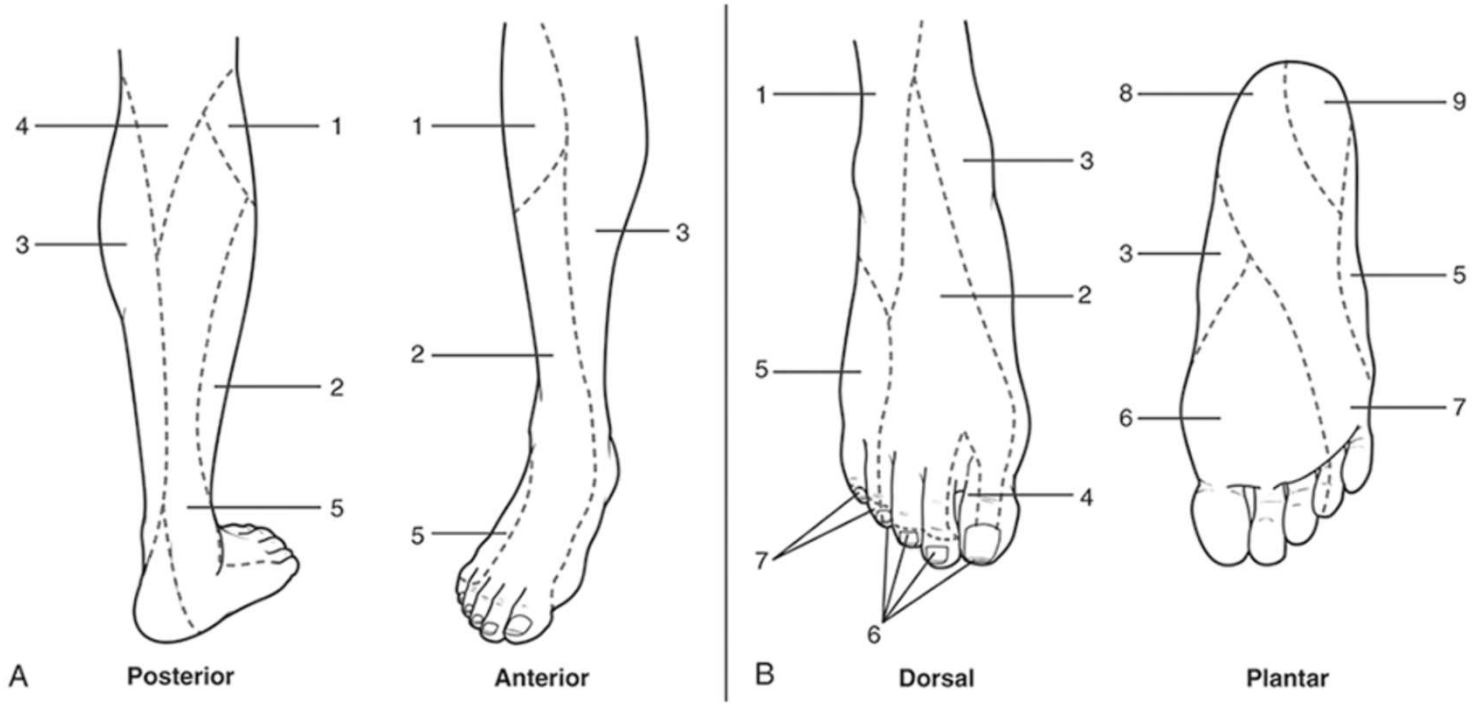


Inspection

RANGE OF MOTION

- Ankle
- Subtalar
- Midtarsal
- MTP

NERVES


4
1
3
2
5
A
Posterior
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3
2
5
Anterior
1
3
2
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4
7
6
B
Dorsal
8
9
3
5
6
7
Plantar

MOTOR EXAMINATION

- Dorsiflexion
- Plantar flexion
- Inversion
- Eversion

VASCULAR EXAMINATION

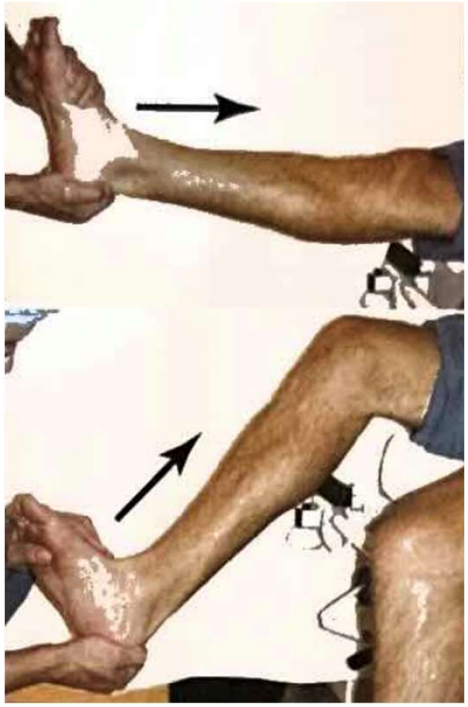
- Pulses
- Temperature

ANKLE STABILITY TESTS

SYNDESMOTIC EXAMINATION

- External rotation test
- Squeeze test
- Tape stabilization test

SILVERSKIOLD

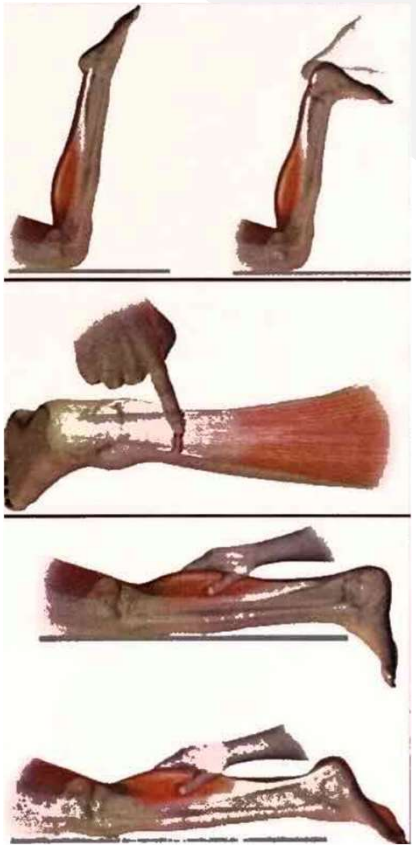


IMPINGEMENT

- Anterior
- Posterior

ACHILLES EXAMINATION

- Thompson test
- Palpation for gap
- Matles test for relative resting position of foot



PERONEAL SUBLUXATION

POSTERIOR TIBIAL TENDON

- Palpation
- Heel rise

PIANO KEY TEST

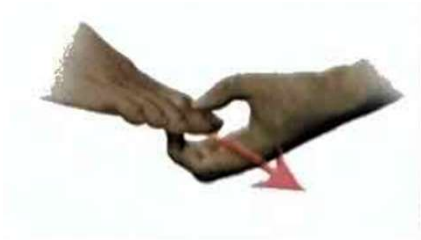
MORTONS NEUROMA

- SQUEEZE TEST

- MULDERS CLICK

MTPJ INSTABILITY

- DRAWER



QUESTIONS?

THANK YOU