

# Posterior Tibial Tendon Dysfunction



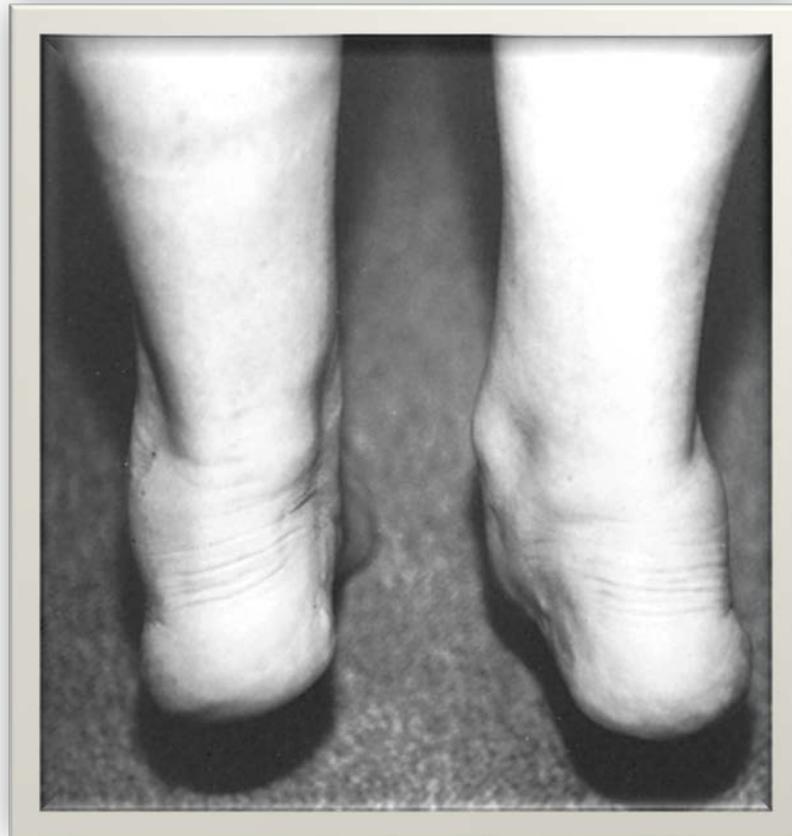
Timothy Epting, DO  
July 23, 2016

# Disclosures

- **None**

# PTT Dysfunction

- The most common cause of adult acquired flatfoot



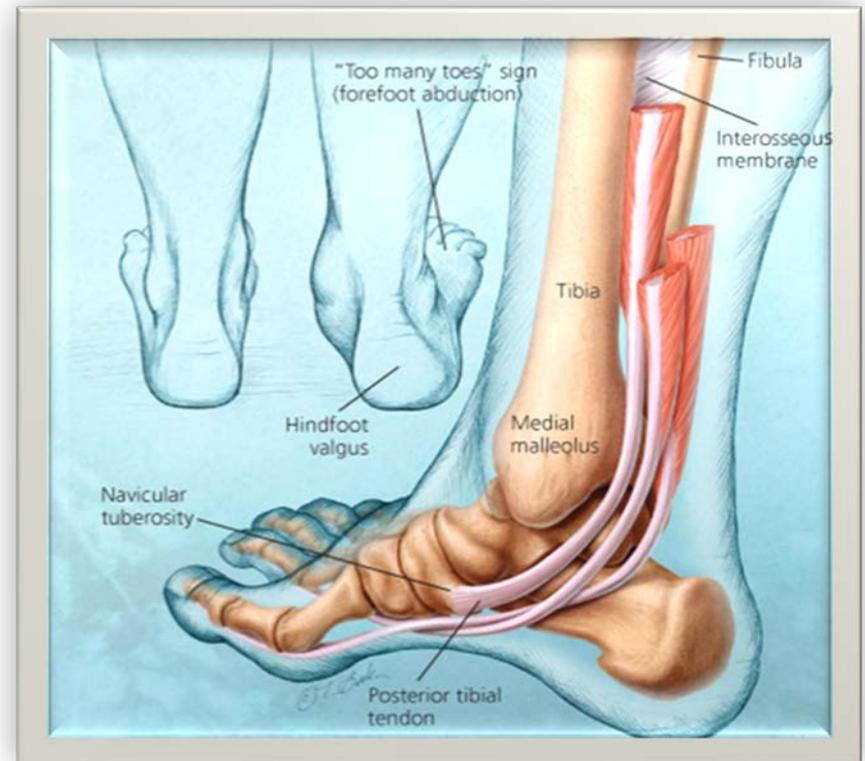
# Other Causes of Flat Foot

- **Primary Arthrosis**
- **RA**
- **Charcot**
- **Post Traumatic**
  - Fracture, tendon laceration
- **Tarsal Coalition**
- **Generalized Dysplasia**
  - Ligamentous laxity

# PTT Anatomy & Function

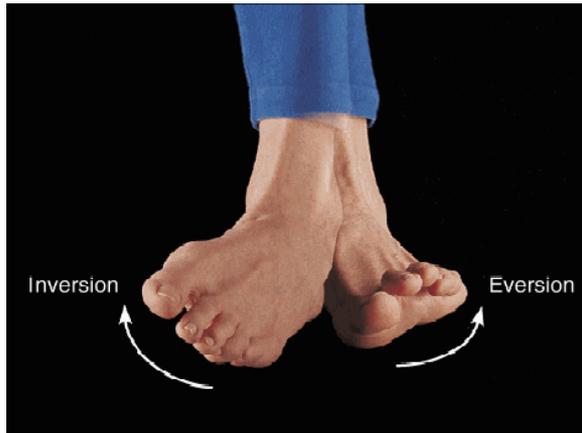
- **PTT Anatomy**

- Originates Proximal 1/3 tib/fib/IOM
- Tendon passes posterior to tibiotalar axis and medial to subtalar axis
- Inserts- Navicular
  - ✦ 3 cunieforms, 2-4 MT
  - ✦ Sustentaculum tali
  - ✦ Cuboid

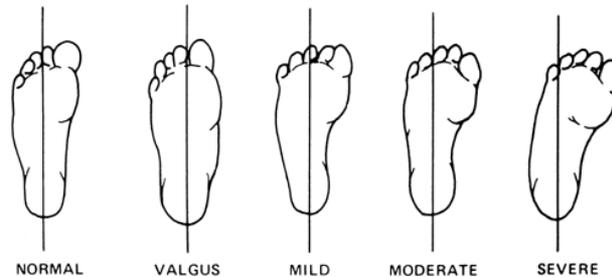


# PTT Anatomy & Function

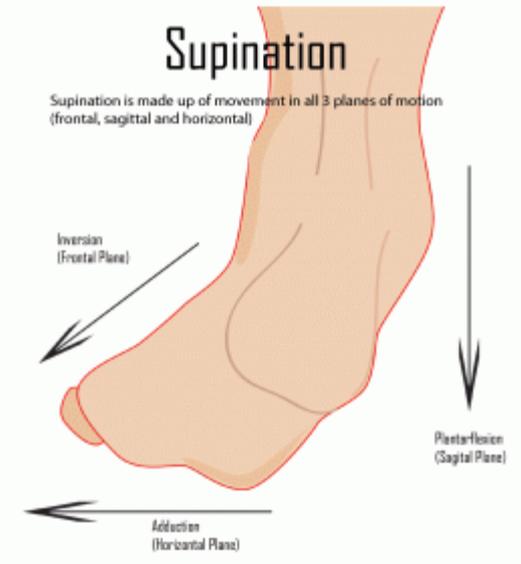
- PTT functions:
- Initiates heel rise (ankle PF)



Subtalar Inversion



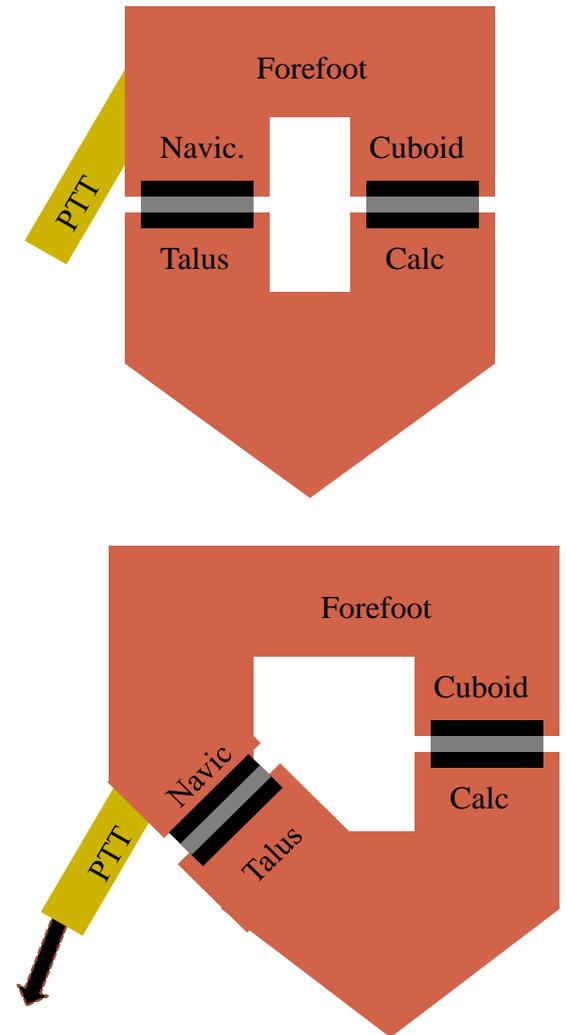
Forefoot Adduction



Forefoot Supination

# Transverse Tarsal Locking Mechanism

- Two-hinge system which is parallel when the PTT is relaxed, allowing transverse tarsal motion
- When the PTT fires, the hinges become divergent and cannot open and close as a unit.
  - This locks the transverse tarsal joint, creating a stable hindfoot for foot lift-off



# PTT Function/Biomechanics

- Initiates heel rise by inverting subtalar joint & locking transverse tarsal joints
- Gastroc-soleus most powerful inverter *after* inversion initiated by posterior tib
- Patients c/ PTT dysfunction
  - Unable to *initiate* heel rise
  - Able to *maintain* heel rise once on their toes

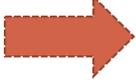
# PTT Dysfunction- Etiology

- “Critical zone of hypovascularity”
  - ✦ Medial malleolus to navicular
  - ✦ Incomplete mesotenon (major blood supply in synovial sheath)
  
- Diabetes
- Steroid Use
- Hypertension
- Obesity
  - Mann 1992
- Trauma
  - ✦ Acute
  - ✦ Repetitive



# PTT Dysfunction- Pathophysiology

- Unopposed pull of peroneus brevis
  - PB pulls on the lateral column (base of 5MT) to **evert**, **pronate** and **abduct**, so it is the **antagonist** of the PTT

Chronic, unopposed eversion force  Heel valgus  
 Eventual attenuation of medial ligamentous structures

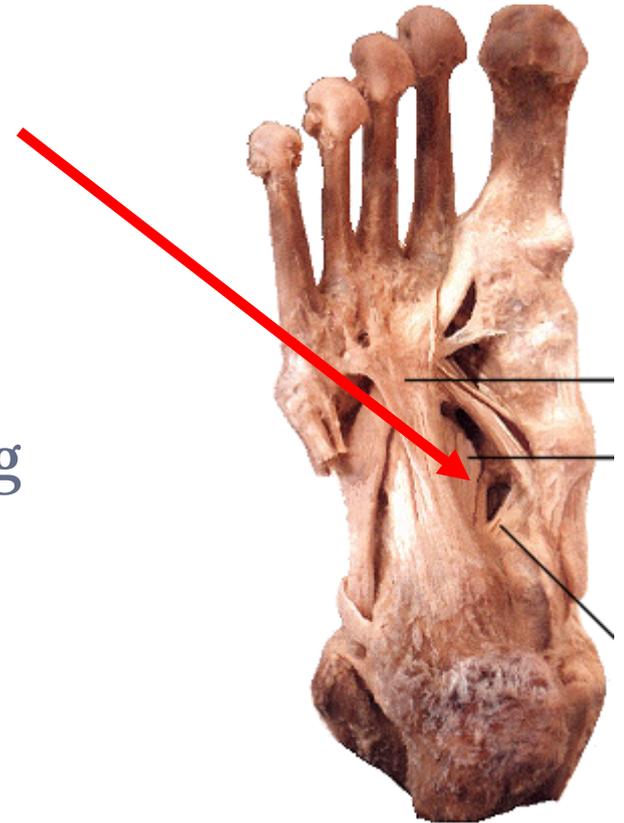
- Progressive collapse of arch
  - Calcaneus drifts into relative eversion, causing the talus to fall into plantar flexion as the spring ligament attenuates
- End stage
  - Marked calcaneal valgus
  - Talus PF
  - Forefoot abduction

# PTT Dysfunction- Pathophysiology

Superior Medial Calcaneonavicular

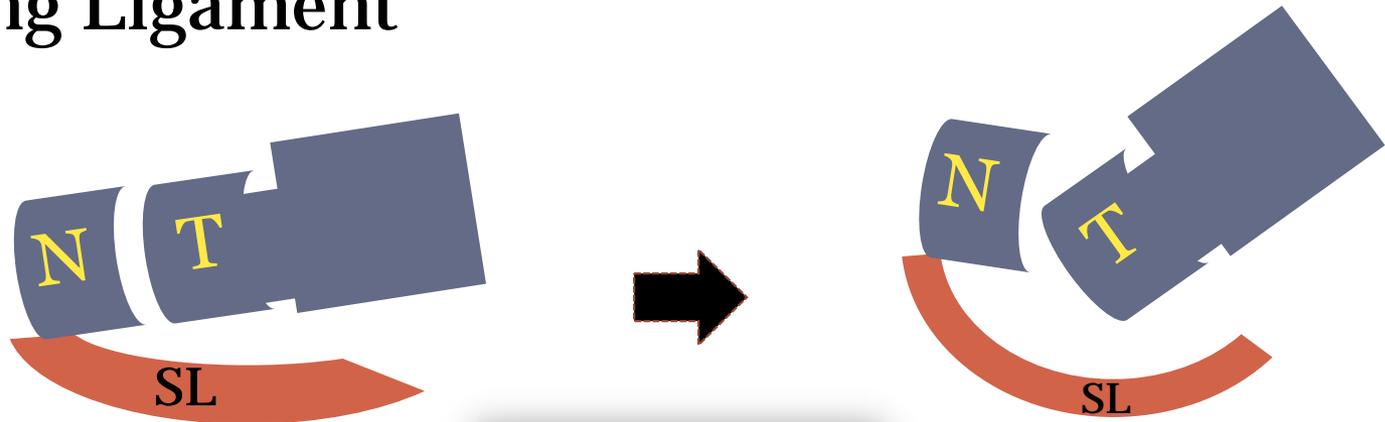
- ~~Spring~~ Ligament

- The hammock that supports the talonavicular joint
- Loss of PTT function -> forefoot abduction -> attenuation of spring ligament
- As the hammock collapses, the talonavicular joint falls



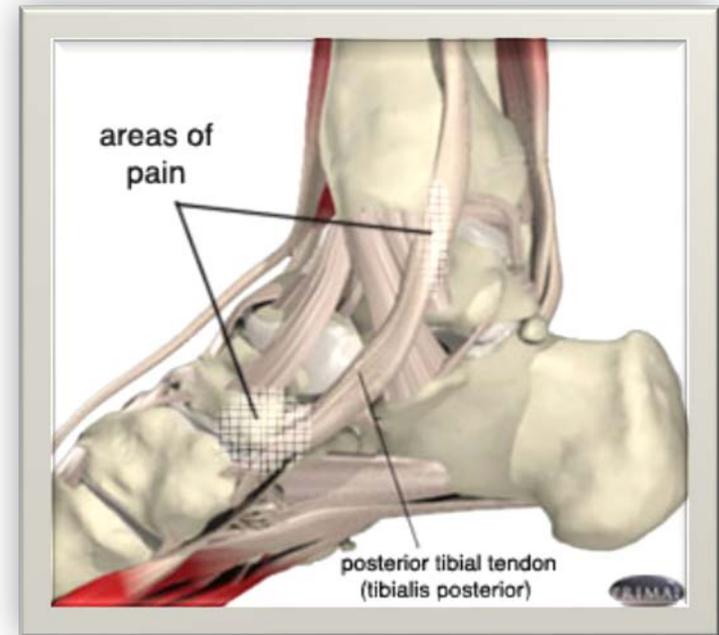
# PTT Dysfunction- Pathophysiology

- Spring Ligament



# PTT Dysfunction- Clinical Presentation

- **Stage I - Tenosynovitis**
  - Normal appearing foot
  - Pain and/or swelling about the PTT sheath
  - Mild weakness
  - Able to perform single toe raise (may be painful)



- Johnson & Strom Staging (1989)

# PTT Dysfunction- Clinical Presentation

- Stage IIA: PTT Elongation / Degeneration
  - **Flexible deformity**
  - Postural changes
    - ✦ Heel valgus, Loss of arch, Early forefoot abduction
  - **Normal** passive subtalar motion, weak active inversion
  - Single toe rise: Painful if early, Impossible if late



# PTT Dysfunction- Clinical Presentation

- Stage IIB: Complete PTT Incompetence / Rupture

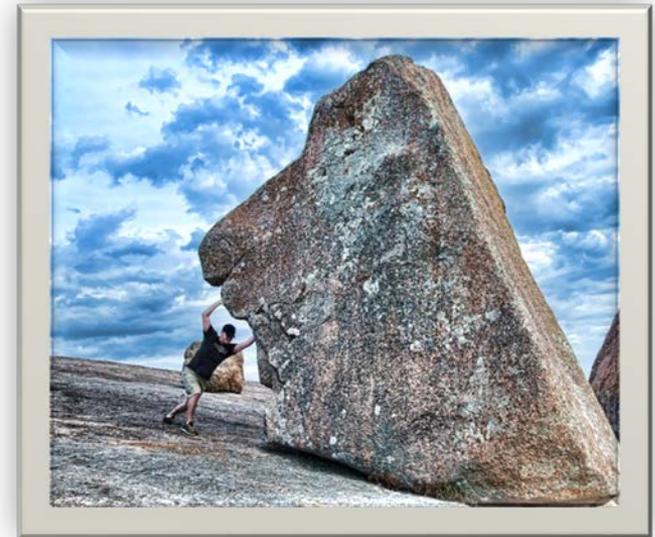
- **Flexible deformity**

- Presentation similar to Stage IIA
    - Includes subfibular impingement - Patients have *lateral* pain as well
    - Worsening forefoot abduction
      - ✦ Talonavicular uncoverage >40%



# PTT Dysfunction- Clinical Presentation

- Stage III: **Rigid deformity**
  - Continued deformity
    - ✦ Progressive hindfoot valgus does not correct to neutral
    - ✦ TT joint abduction
    - ✦ Fixed forefoot varus
  - Medial pain may improve as lateral impingement pain predominates
  - Arthritic pain worsens
  - Achilles contracture
  - Unable to single toe raise



# PTT Dysfunction- Clinical Presentation

- Stage IV: Progression to ankle DJD

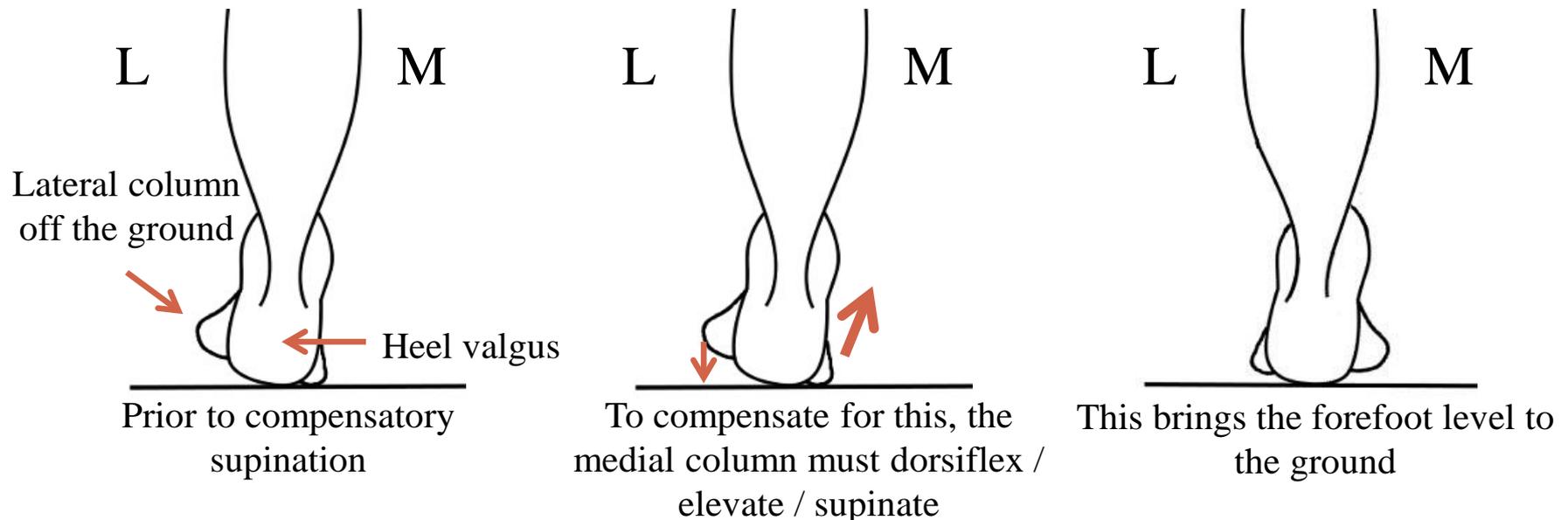
- **Rigid deformity**

- Deltoid ligament becomes incompetent and allows tibiotalar valgus
  - Major implications for treatment strategy
    - ✦ Always get an ankle series!
    - ✦ Added IV Myerson (1996)



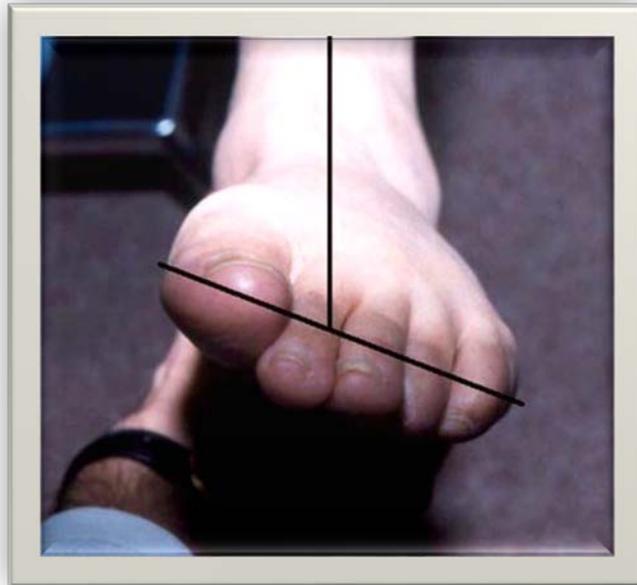
# PTT Dysfunction- Clinical Presentation

- A few words (and pictures) about compensatory forefoot supination
  - Can be a component of Stage II, III, or IV Deformity
  - May need to be addressed during surgery to achieve plantigrade foot



# PTT Dysfunction- Clinical Presentation

- If the hindfoot is still flexible and the forefoot has compensated into supination, correcting the heel makes the foot look like this: (forefoot varus)



# PTT Dysfunction- Physical Exam

- Observation (front & behind)
  - Deformity
  - Fullness behind medial malleolus
- Single-leg heel raise
- Evaluate TMT joints for arthrosis/hypermobility (mimics PTT dysfunction)



# PTT Dysfunction- Physical Exam

- Range of motion
- Muscle strength testing
- Swelling @ PTT
- Tenderness @ PTT/sinus tarsi



# PPT Dysfunction- X-rays

- **WB AP Foot**
  - Look for lateral subluxation of TN joint (uncoverage)

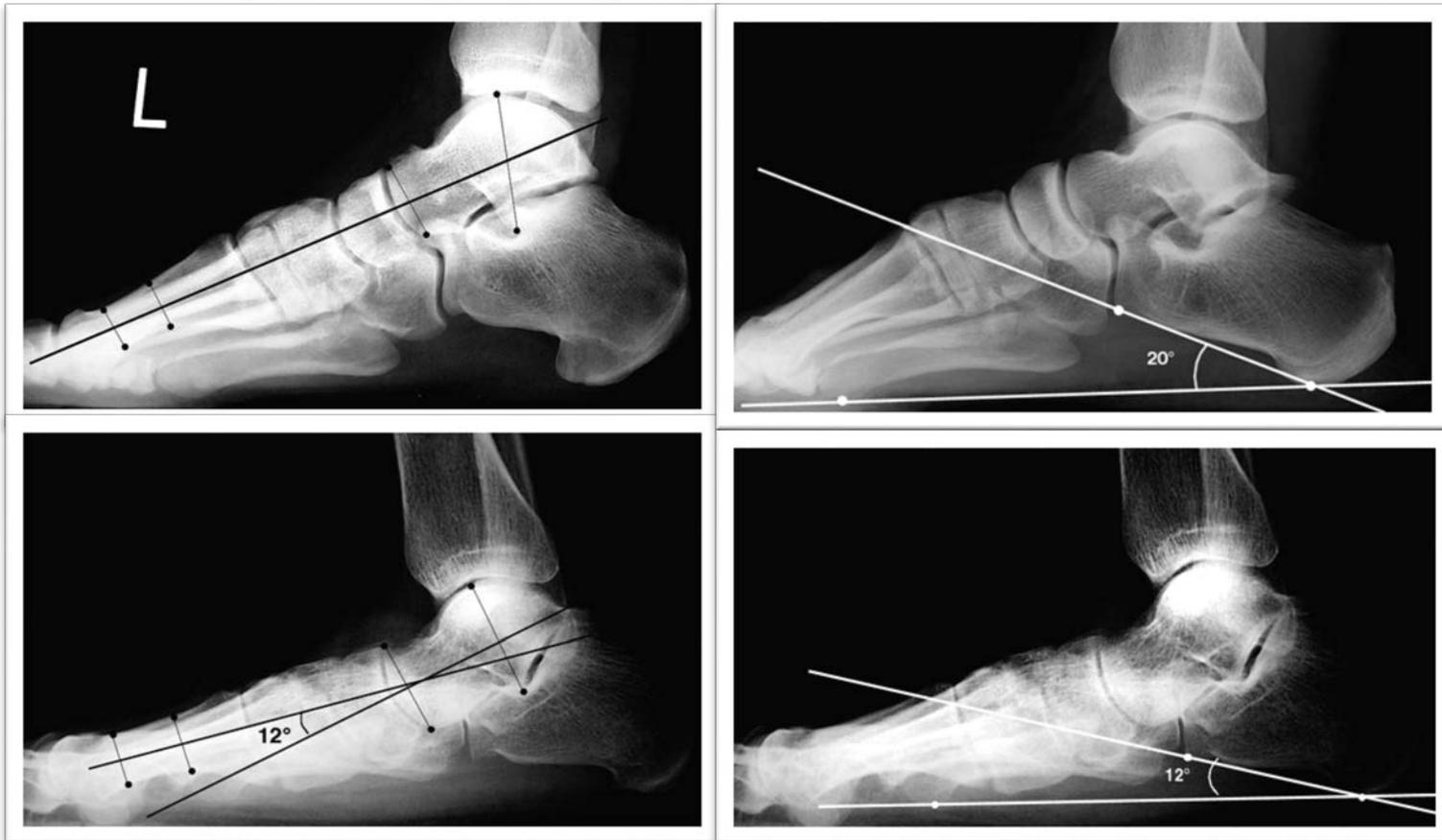


# PPT Dysfunction- X-rays

- **WB Lateral Foot**

- **TN Sag (Meary's angle)**

- **Calcaneal Pitch**



# PPT Dysfunction- X-rays

- **WB Ankle Series – look for ankle valgus or DJD**
- **MRI - Controversial**



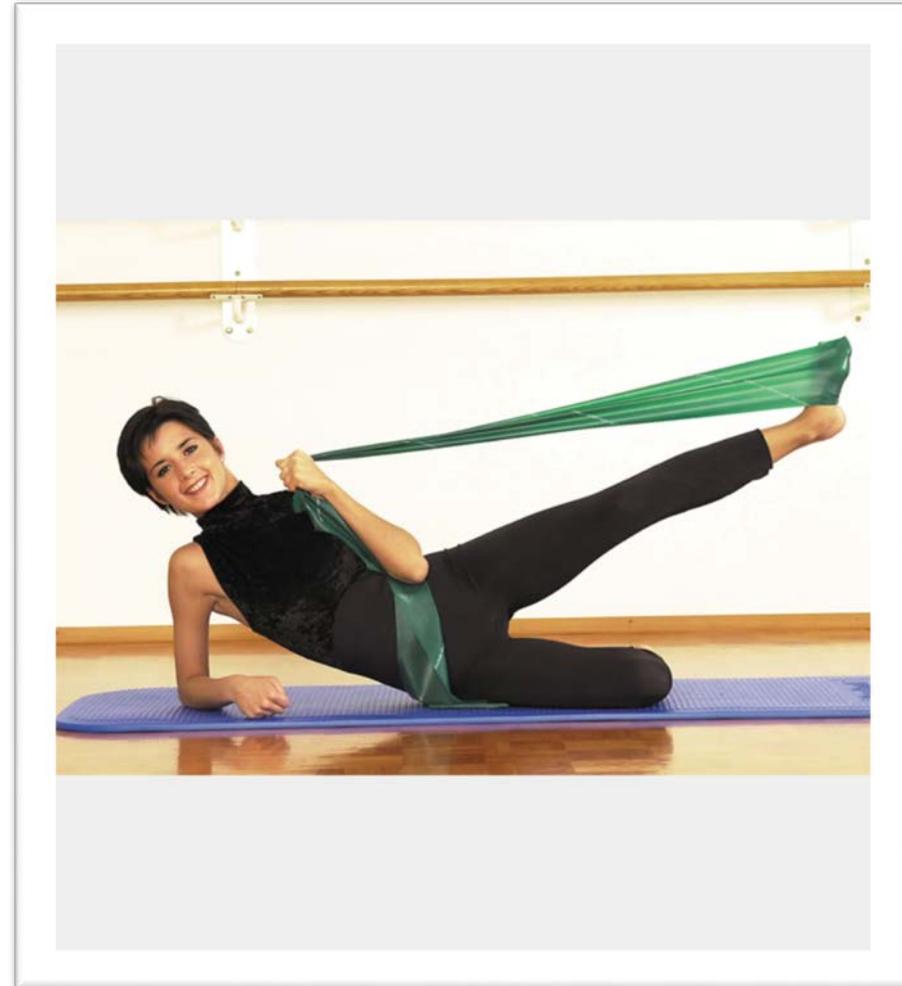
# PTT Dysfunction- Conservative Treatment

- **Stage I – Tendinitis / Tenosynovitis**
  - **Concept: Rest the tendon!**
    - ✦ Lace-up brace (inversion)
    - ✦ CAM boot
    - ✦ SLWC
  - **Concept: Reduce Inflammation**
    - ✦ NSAIDS (**not** steroids)



# PTT Dysfunction- Conservative Treatment

- **Stage I – Tendinitis / Tenosynovitis**
  - **Concept: Graduated therapy**
    - ✦ Start with iontophoresis or cryotherapy
    - ✦ Pulsed US to avoid heat and increased inflammation
    - ✦ GS Complex Stretching
    - ✦ Gradual progression to strengthening (Therabands) once pain is gone
      - Adduction-greatest PTT activation (Kulig, 2004)



# PTT Dysfunction- Conservative Treatment

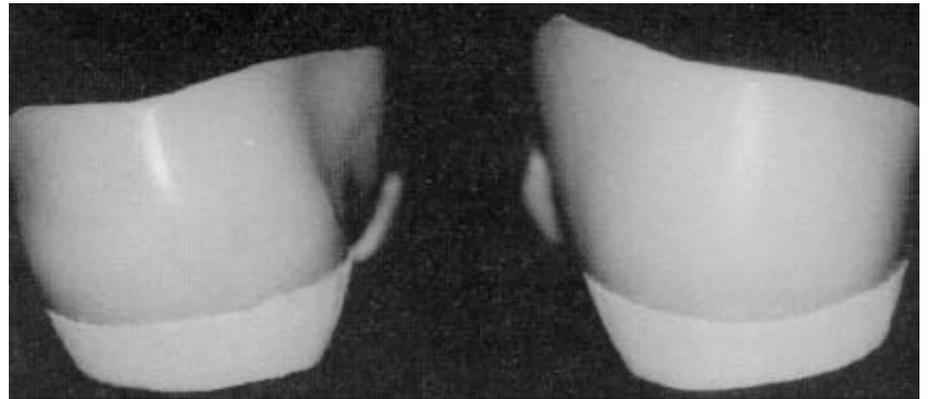
- **Stage II**

- **Concept:** If the foot is still flexible, hold it in the correct orientation
  - ✦ **Medial Posted Heel Wedge:** Restores subtalar neutral and eliminates heel valgus
  - ✦ **Medial Arch Support:** Shores up the sagging arch
  - ✦ **Lateral Forefoot Restraint:** Blocks abduction of the forefoot



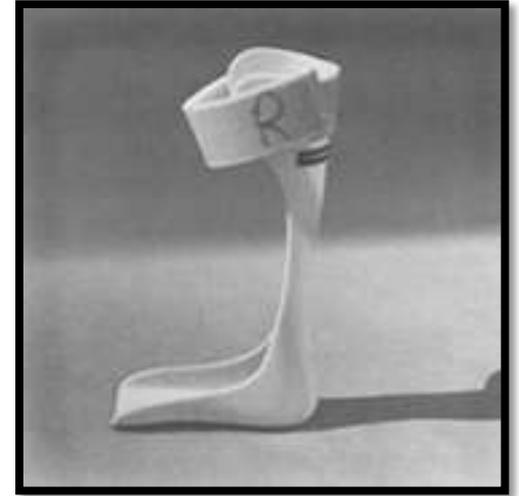
# PTT Dysfunction- Conservative Treatment

- **Stage II**
  - UCBL Orthosis
    - ✦ Combines all three of these supports



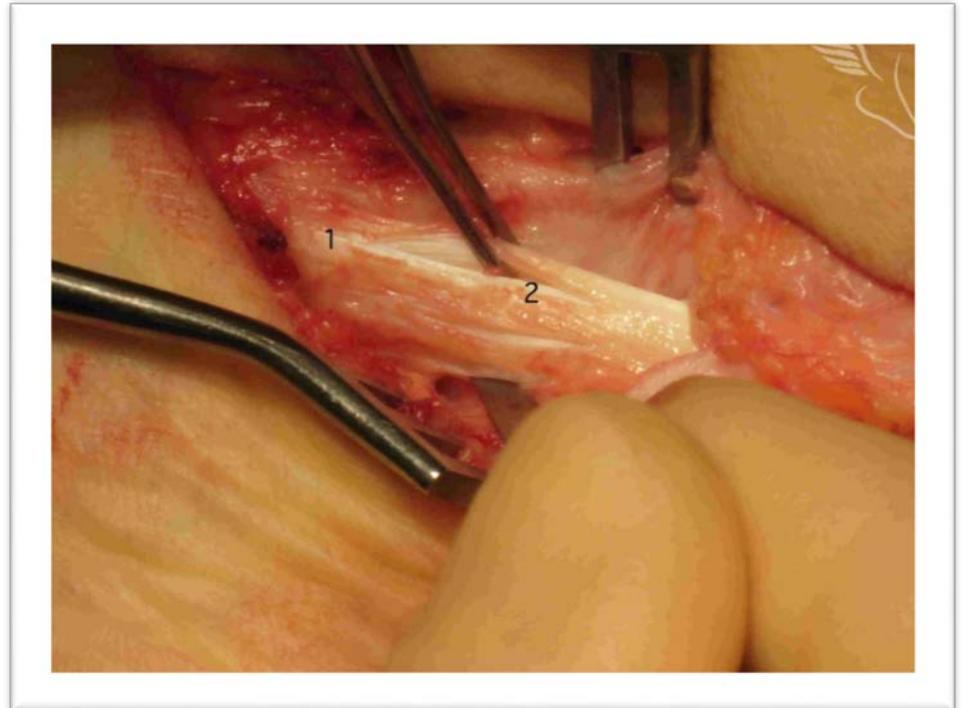
# PTT Dysfunction- Conservative Treatment

- Stage III-IV
  - Concept: Accommodate the deformity rather than trying to correct it (it's **rigid!**)
    - ✦ MAFO Brace
    - ✦ Articulating AFO
    - ✦ Arizona brace
  - In situ molding



# PTT Dysfunction- Surgical Treatment

- **Stage I**
  - If patients fail 6 months of conservative treatment
  - Synovectomy
  - Repair any fissuring of tendon, if present



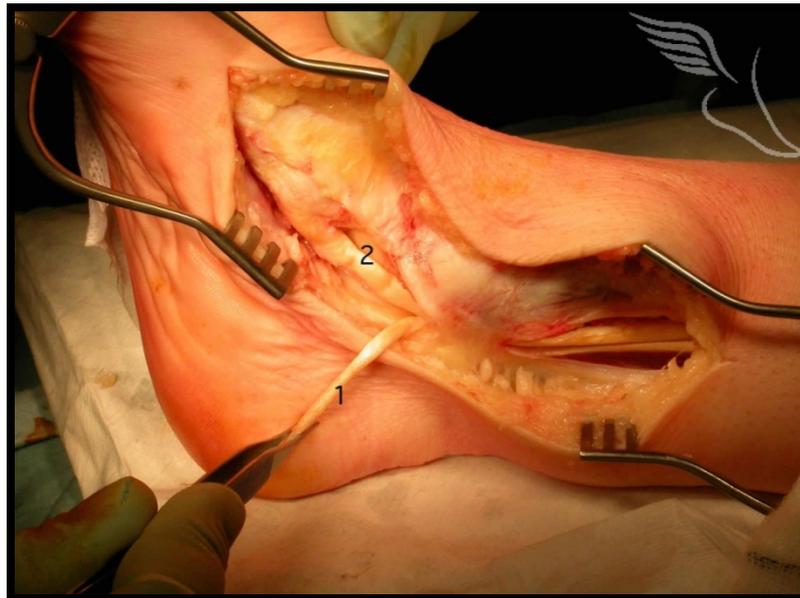
# PTT Dysfunction- Surgical Treatment

- Stage II:

- ✦ FDL transfer

- ✦ FDL in phase with PTT, matches PB strength

- ✦ Doesn't work for a rigid deformity!



# PTT Dysfunction- Surgical Treatment

## ○ FDL transfer

### ✦ **Results** (Mann & Thompson)

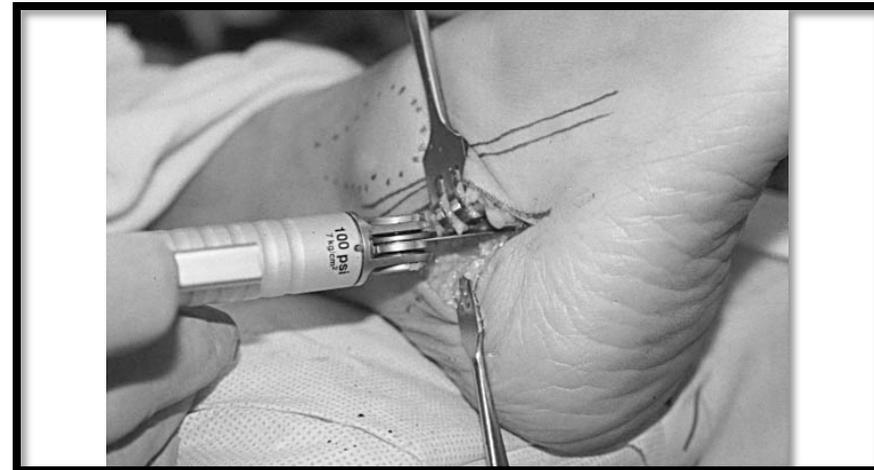
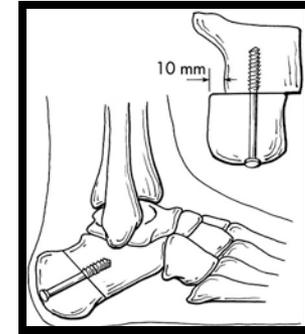
- 88% satisfied
- 7/11 not satisfied had fixed hindfoot or forefoot deformity
- No significant improvement in arch height radiographically



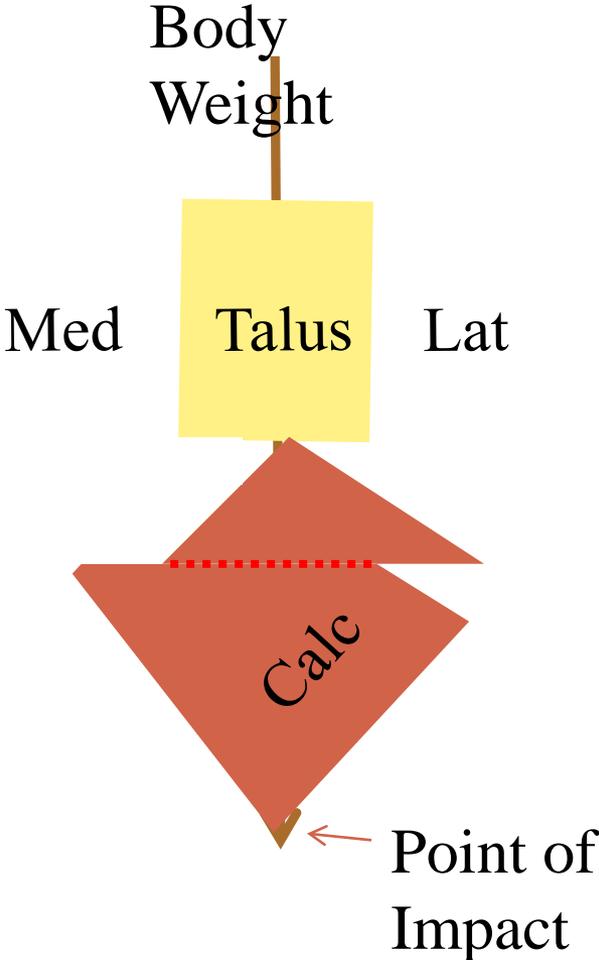
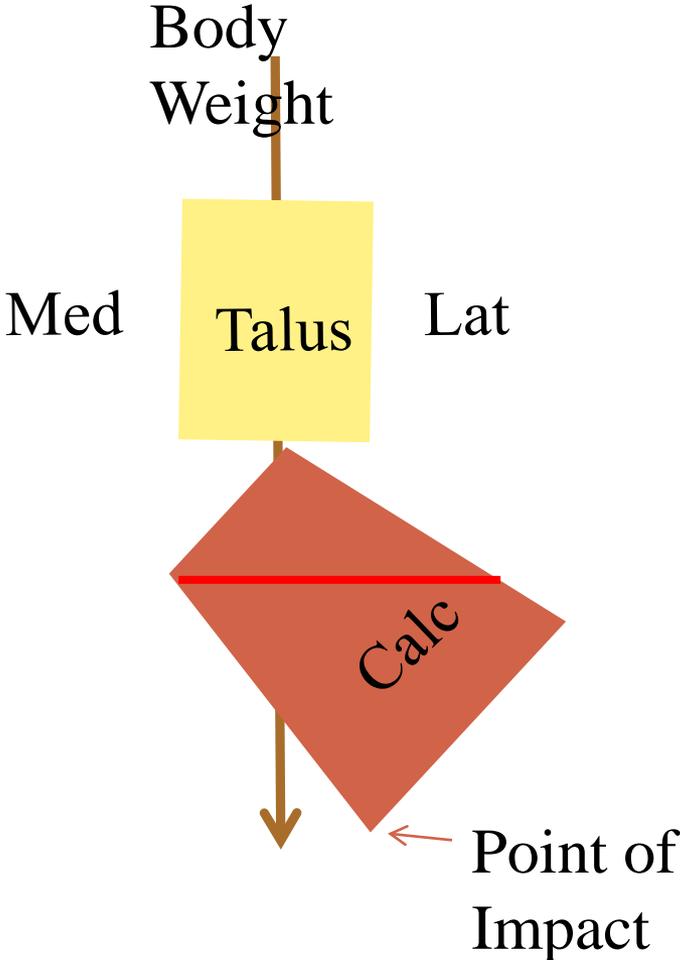
# PTT Dysfunction- Surgical Treatment

- **Medial-Displacement  
Calcaneal Osteotomy**

- ✦ Generally performed with FDL Transfer
- ✦ 50% isolated FDL failed 1 yr
  - Michelson (1992)
- ✦ Moves weightbearing axis of the heel in line with that of the tibia
- ✦ Medializes Achilles Insertion, allowing for greater push-off strength and inversion

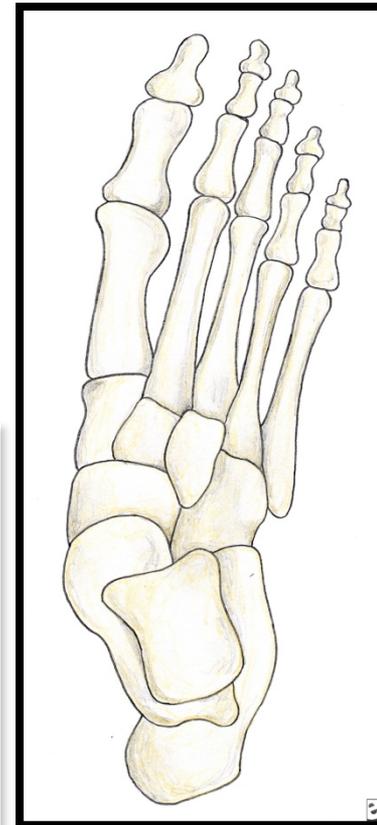
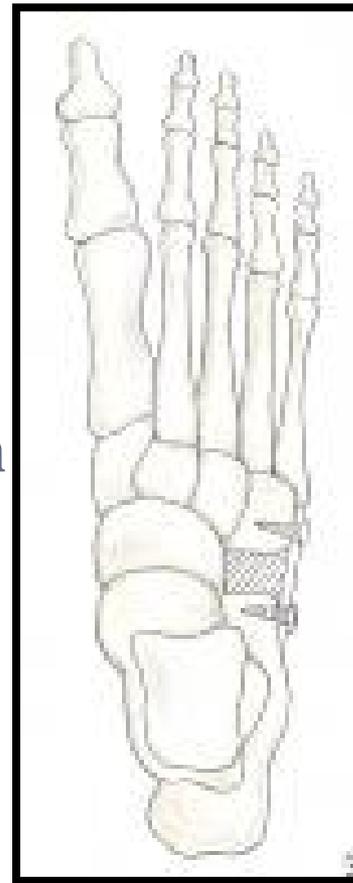


# Treats Heel Valgus

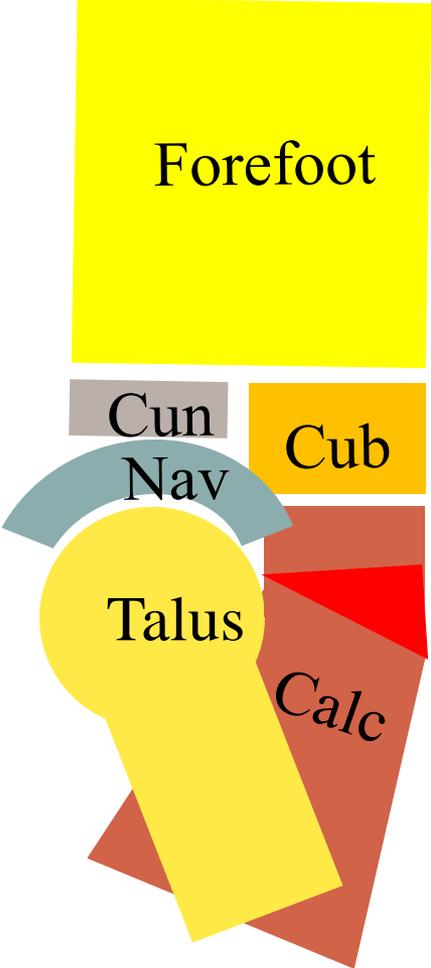
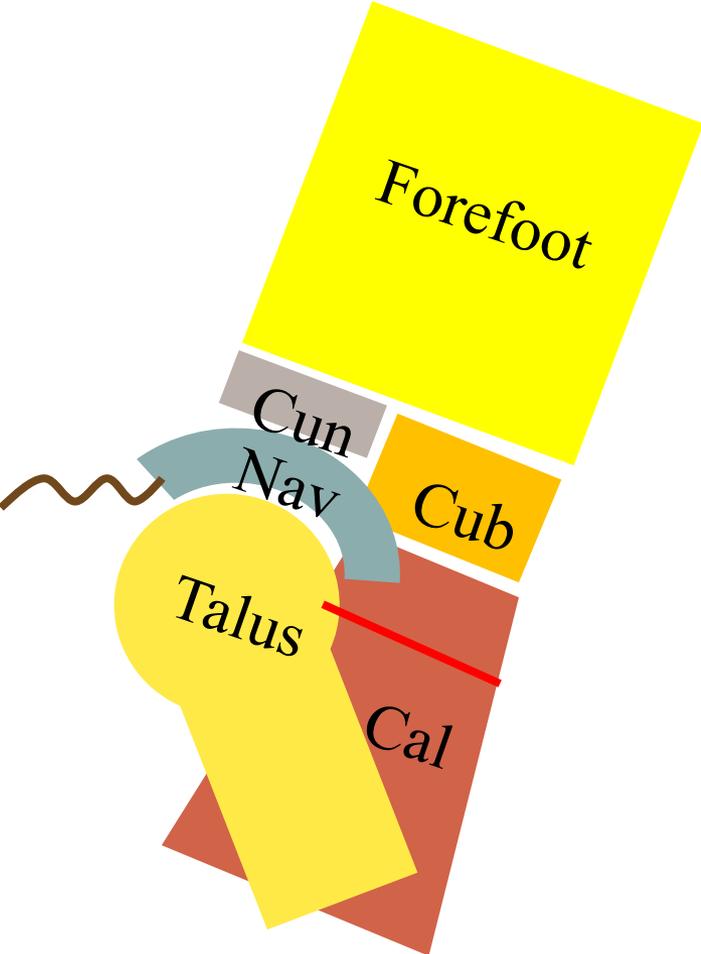


# PTT Dysfunction- Surgical Treatment

- **Stage II – Some but not all**
  - Lateral column lengthening
    - ✦ Used in cases of forefoot abduction
    - ✦ Evans procedure
      - Opening wedge calcaneal osteotomy
    - ✦ Performed through CC joint
      - Loss 30-50% subtalar motion
      - Complete loss transverse tarsal motion

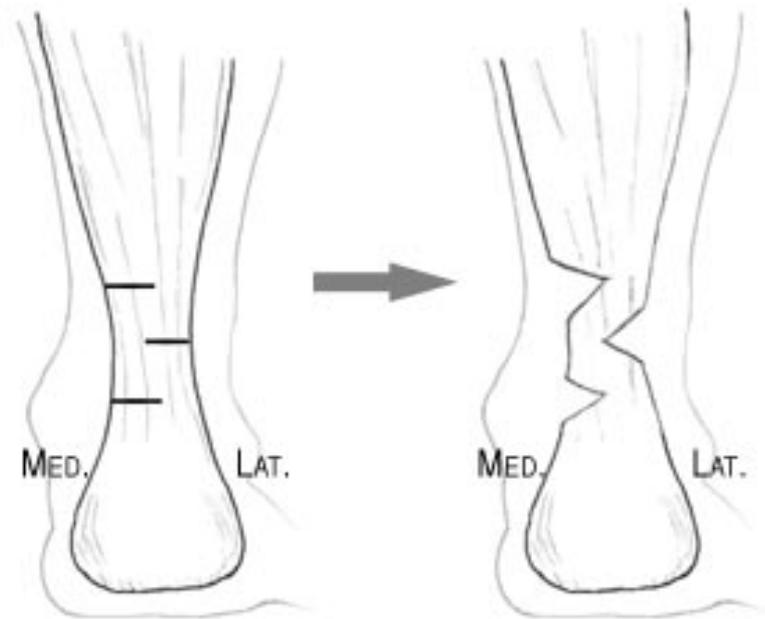


Treats Forefoot **ABduction**



# PTT Dysfunction- Surgical Treatment

- **Stage II – Some but not all**
  - Tendo – Achilles Lengthening vs Gastrocnemius
    - ✦ For patients with equinus



# PTT Dysfunction- Surgical Treatment

- Stage III – **Rigid**  
Deformities
  - Subtalar Arthrodesis
    - ✦ Allows TTJ motion
      - Must have TTJ flexibility
      - Must have  $< 10^\circ$  forefoot varus
    - ✦ Fuse in  $5^\circ$  heel valgus



# PTT Dysfunction- Surgical Treatment

- **Stage III**

- **Triple arthrodesis**

- ✦ **For fixed heel deformity + fixed forefoot abduction or fixed forefoot varus**
  - Must correct heel to 5° valgus
  - Must correct TTJ to neutral



Thank you

