

# Acquired Adult Flatfoot Deformity



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# Outline

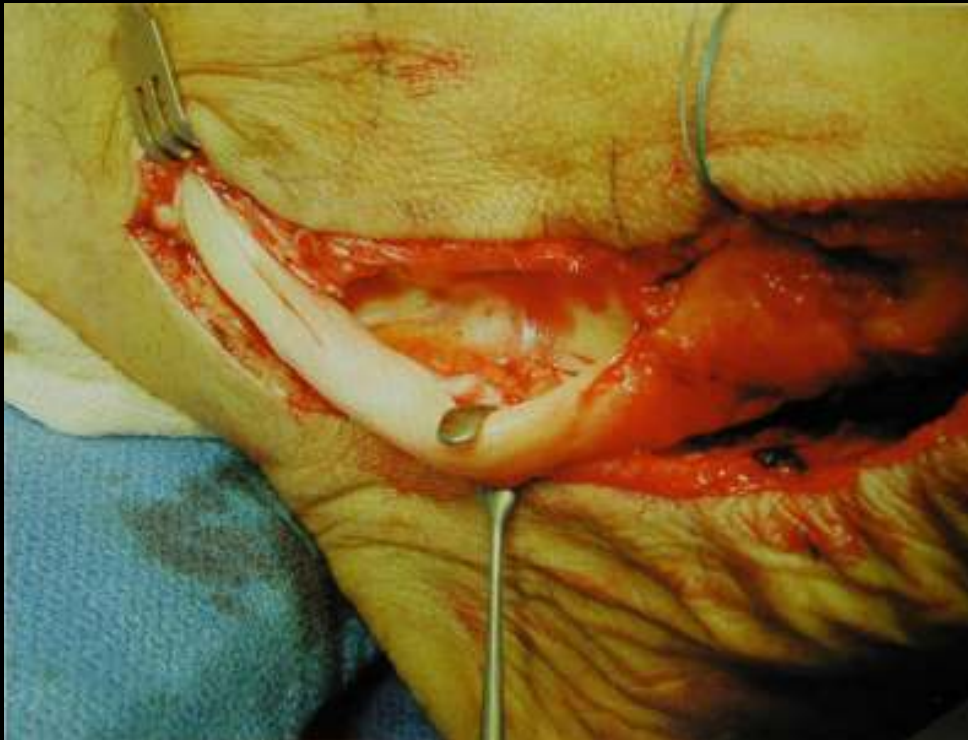


- Anatomy
- Pathology
- Biomechanics
- Clinical presentation
- Treatment options

# Anatomy

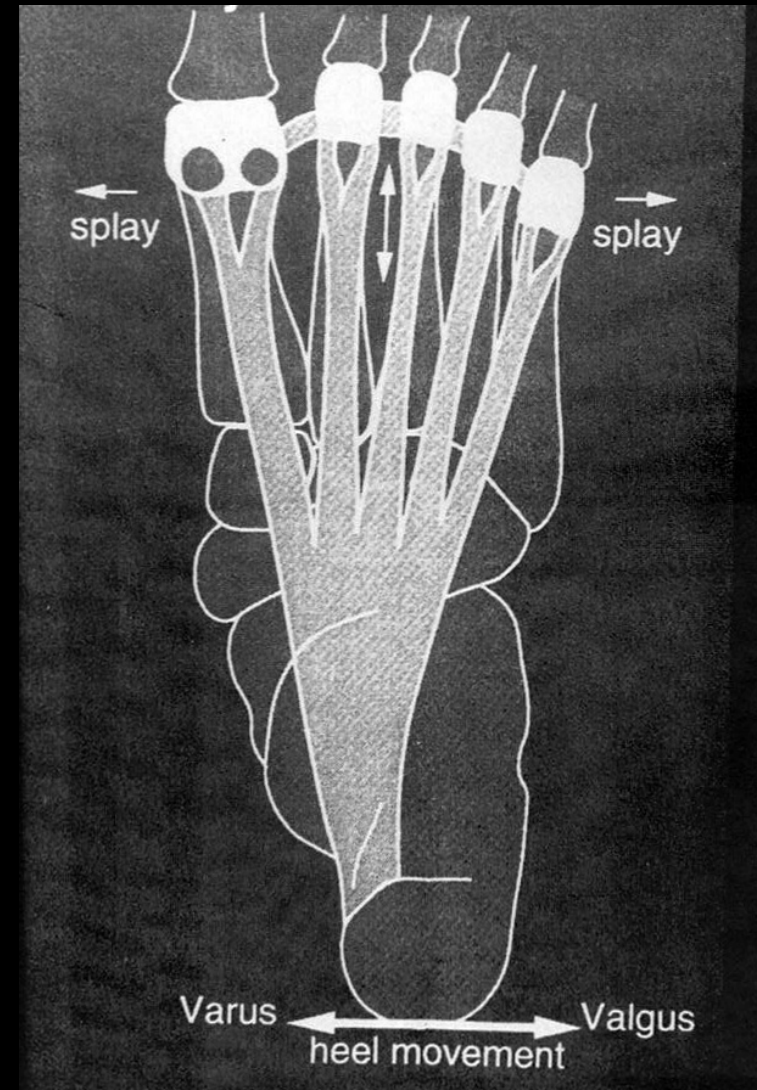
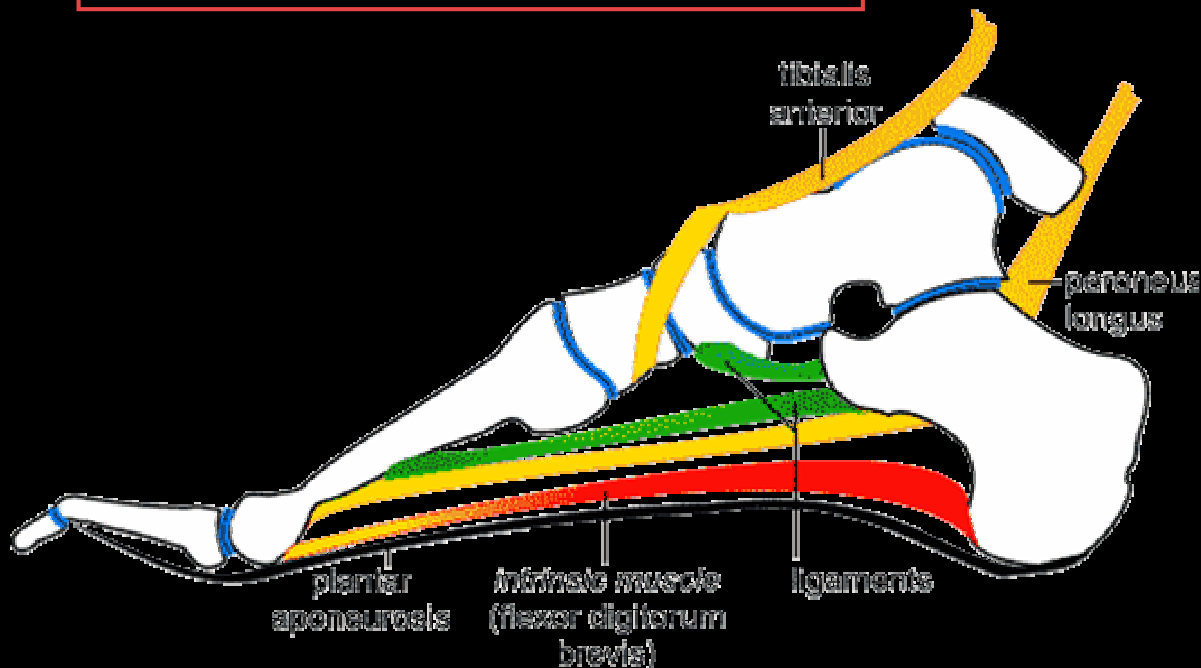
# Posterior Tibial Tendon

- Hindfoot supinator
- Hypovascular zone

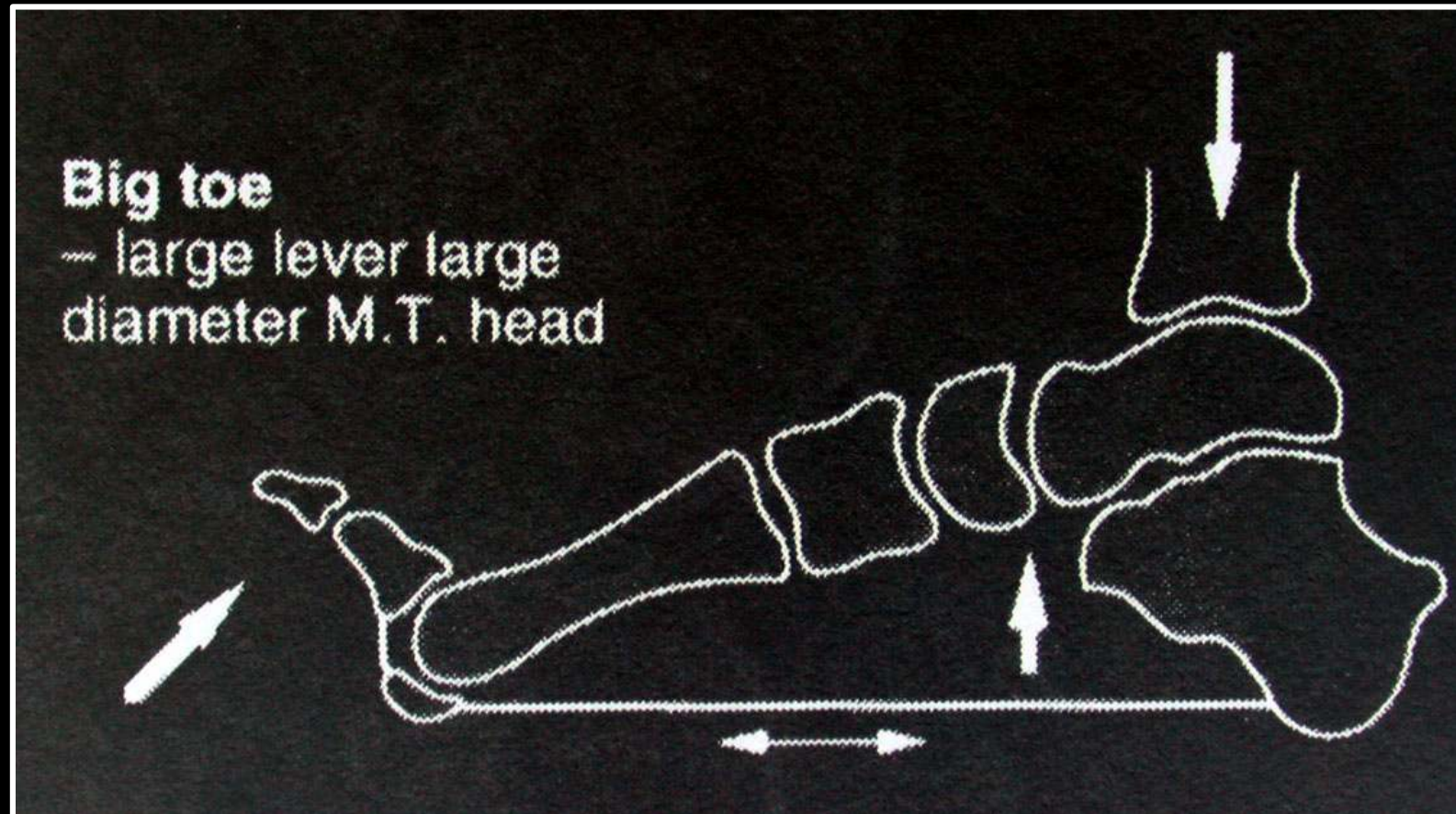


# Stabilisers

- Plantar fascia
- Spring ligament
- Deltoid ligament



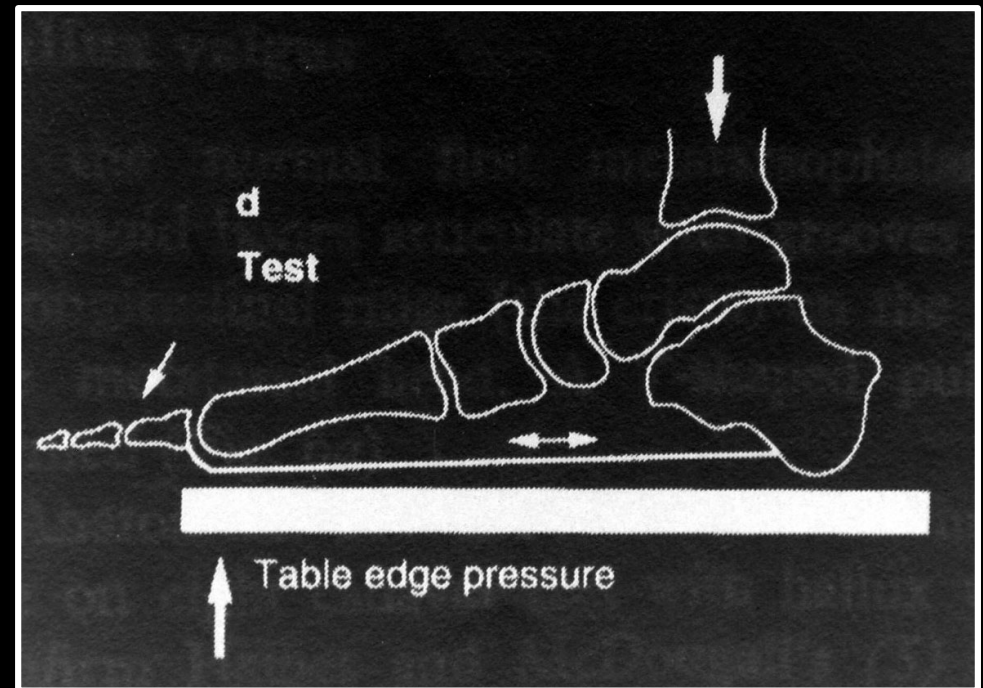
# Windlass mechanism





# Reversed windlass mechanism

- Probably the strongest flexor of the MTPJ's
- Assists propulsion at toe-off



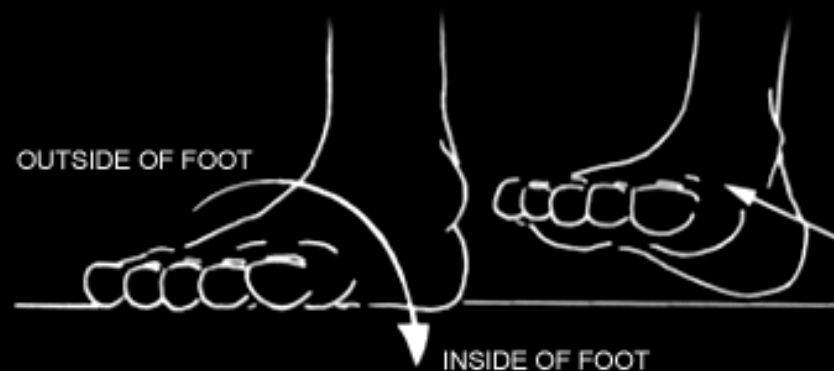
# Pathogenesis



# Theory 1 - Overpronation

## ■ Excess motion of medial column

- Causes forefoot supination
- Compensatory hindfoot pronation
- Leads to increased stress on medial soft tissues, including PTT

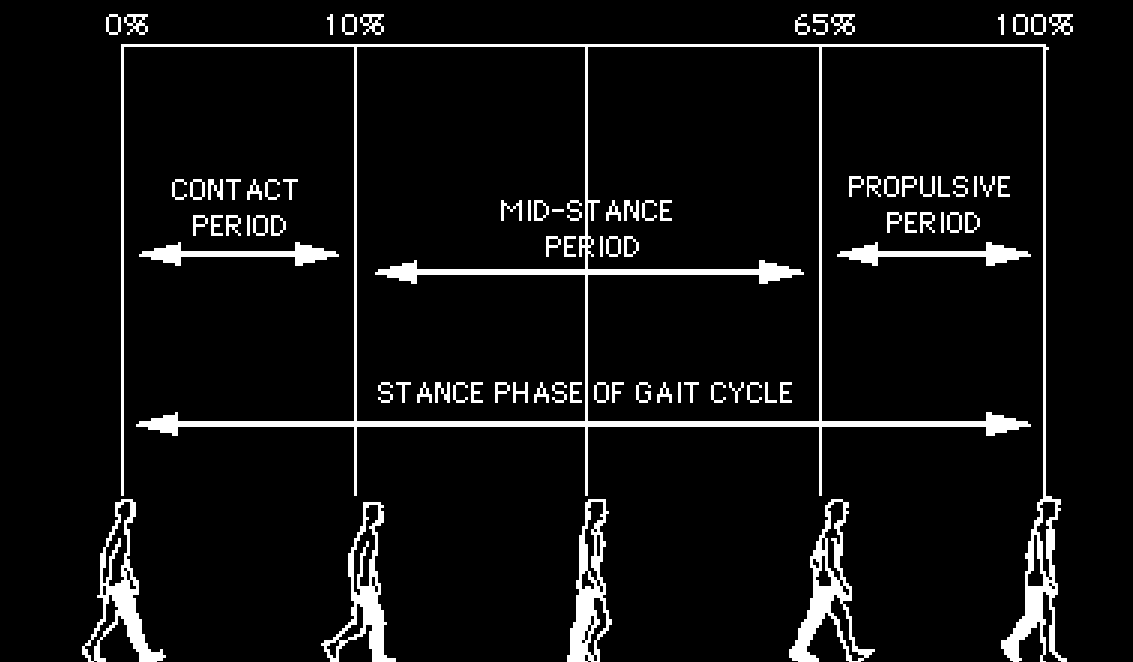


THE ARCH FLATTENS OUT AS THE FOOT STRIKES THE GROUND

# Theory 2 – Achilles tightness

## ■ Short gastrocnemius-soleus complex

- Maximal dorsiflexion of the foot is required at “Heel rise”
- Talonavicular joints don't reach neutral
- Leads to increased stress on posteromedial soft tissues

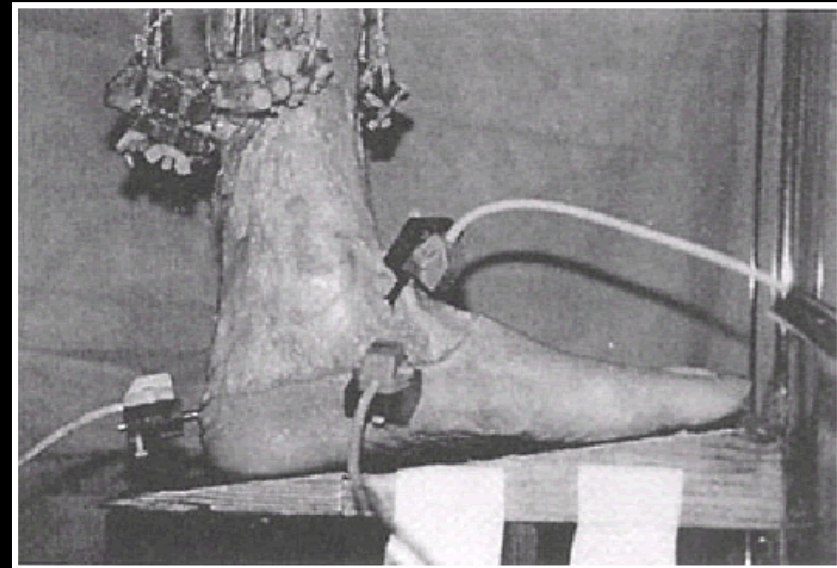


# Biomechanics

Sangeorzan et al.  
Foot and Ankle International 2001; 22(4): 292-300

Compared the kinematic orientation of the four-bone hindfoot complex in normal feet with:

- 1) PTT loaded (normal), and
- 2) Unloaded (simulating dysfunction).
- 3) Repeated with attenuation spring ligament



Sangeorzan et al.

Foot and Ankle International 2001; 22(4): 292-300

- ◆ Intact osteoligamentous structures are initially able to maintain normal alignment
- ◆ Once the soft tissues have been weakened... restoring PTT function had little effect
- ◆ Early treatment may prevent flatfoot deformity development

Sangeorzan et al.

Foot and Ankle International 2001; 22(4): 292-300

- Nonsurgical treatment of the PTT deficient foot (such as bracing) should either:
  - Provide support during heel rise or
  - Maintain the foot in a position wherein the PTT is minimally loaded.



# Pathology

# PTT dysfunction



- PTT overloading
- Chronic microtrauma
- Inflammatory response
- Weakening of PTT
- Failure of static stabilisers
- Arch collapse

# Differential Diagnosis



- Inflammatory arthropathy
- Degenerative arthritis of the hindfoot
- Malaligned Lisfranc arthritis
- Tarsal coalition
- Traumatic injury to the plantar fascia or ligaments

# Clinical Presentation



- Posteromedial heel pain
- Maybe a history of trauma
- Usually gradual onset
- Weakness or easy fatigue with walking
- Progressive flattening of arch
- Unable to run or stand on tip toe
- Later, lateral heel pain and stiffness

# Patient factors



- Most common age 30 to 50
- Often female
- More commonly obese
- Inflammatory arthropathy
- Often been flat-footed in the past
- Also enquire about:
  - Smoking
  - Diabetes
  - Steroid use



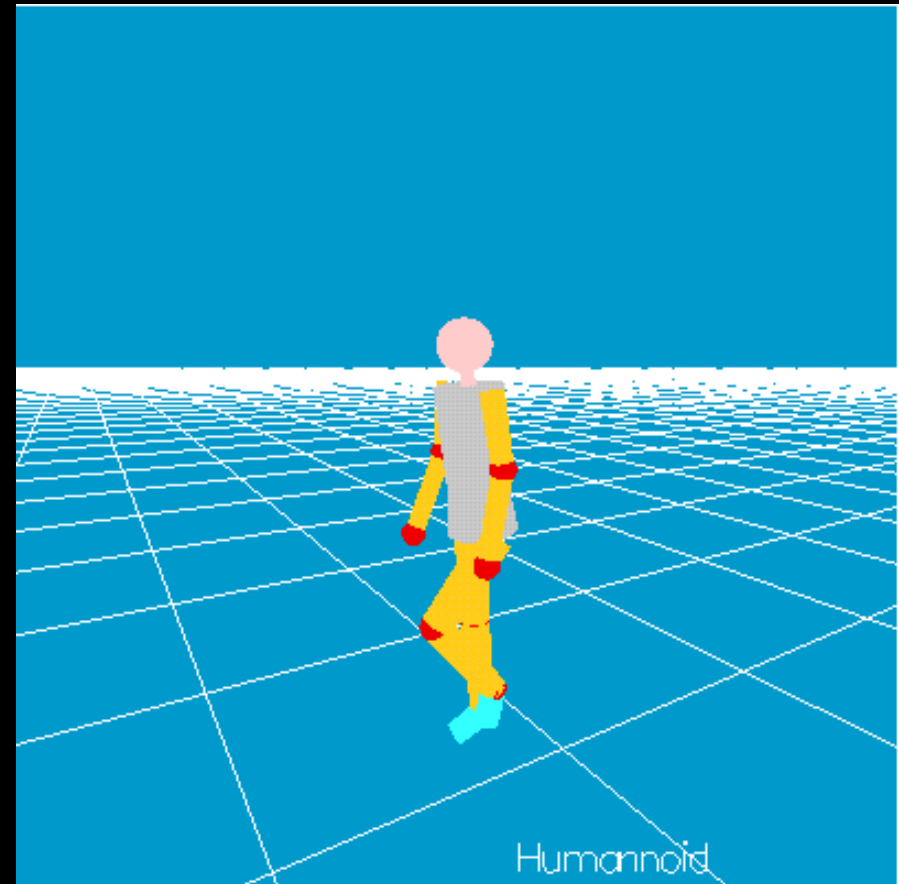
# Examination

- Look.Feel.Move
- Range of motion
- Flexibility
- Gastrocnemius tightness
- Hindfoot to forefoot alignment
- PTT strength
- Neurovascular examination



# Gait

- Antalgic
- Short stride
- Flat foot
- Poor or absent heel rise



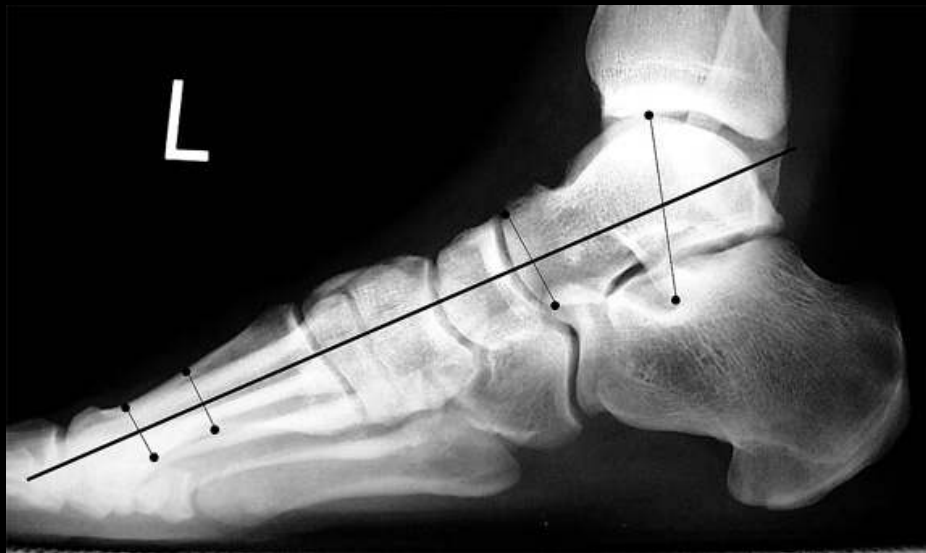
# Single-leg heel rise

- Fatigues
- Persistent hindfoot pronation
- Unable to do
- Too painful



# Radiology – wt. bearing

## Lateral talometatarsal angle (Meary's)



# Radiology -AP talonavicular coverage angle

The angle between the articular surfaces of the talus and the navicular is less than 7 degrees.



# Investigations

- MRI
- CT scan
- Ultrasound





# Classification

# Johnson and Strom

- Simple classification
- Complexity added later
- Untreated patients progress from Stage 1 to 4
- Stage is a good guide to management

# Classification (Johnson and Strom)

Stage	Description
I	Tenosynovitis without deformity
II	Ruptured PTT and flexible flatfoot
IIA	Midfoot flexibility
IIB	Midfoot supination correctable
IIC	Midfoot supination fixed
III	Rigid hindfoot valgus
IV	Ankle valgus

# Management

Depending on Stage and patient  
factors

# Stage I

- Inflamed or partially ruptured,
- Minimal or no deformity
- Continuity of the tendon is maintained.
- Pain dominant feature



# Stage I - No deformity

- Removable cast/boot
- Walking cast
- Orthosis
- Physiotherapy





# Stage I - Surgery

- Limited role
- For failed conservative management
- Options:
  - Tenosynovectomy??
  - Tendon transfer and augmentation

# Stage II

- PTT tendon rupture
- Clinically apparent flatfoot,
- Inability to single leg heel rise.
  - A. Hindfoot valgus. minimal if any residual forefoot supination.
  - B. Flexible forefoot supination.
  - C. Fixed forefoot supination.

# Stage II - Conservative

- Arizona AFO
- UCBL
- Off the shelf AFO + medial heel wedge and arch support
- Physiotherapy



# Arizona AFO — Augustin et al.

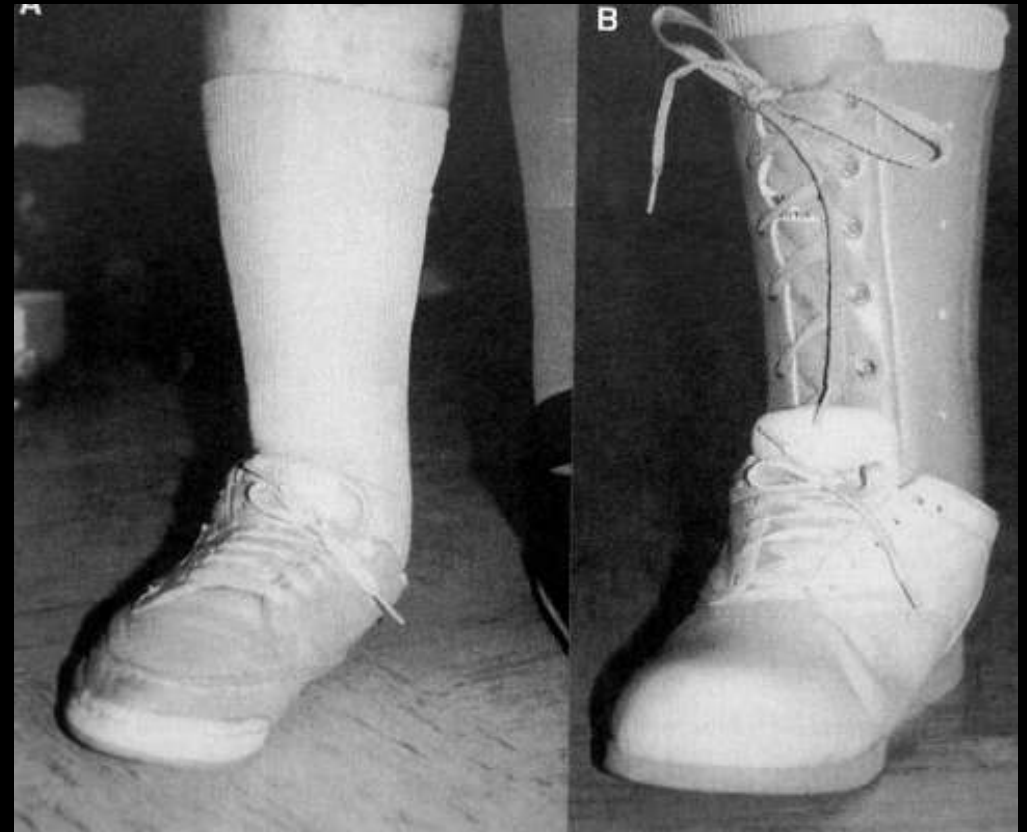
Foot ankle Clinics of North America Vol 8 (2003)

21 patients:

- stage I (6)
- stage II (12)
- stage III (5)

Mean age 57 years (34 to 84)

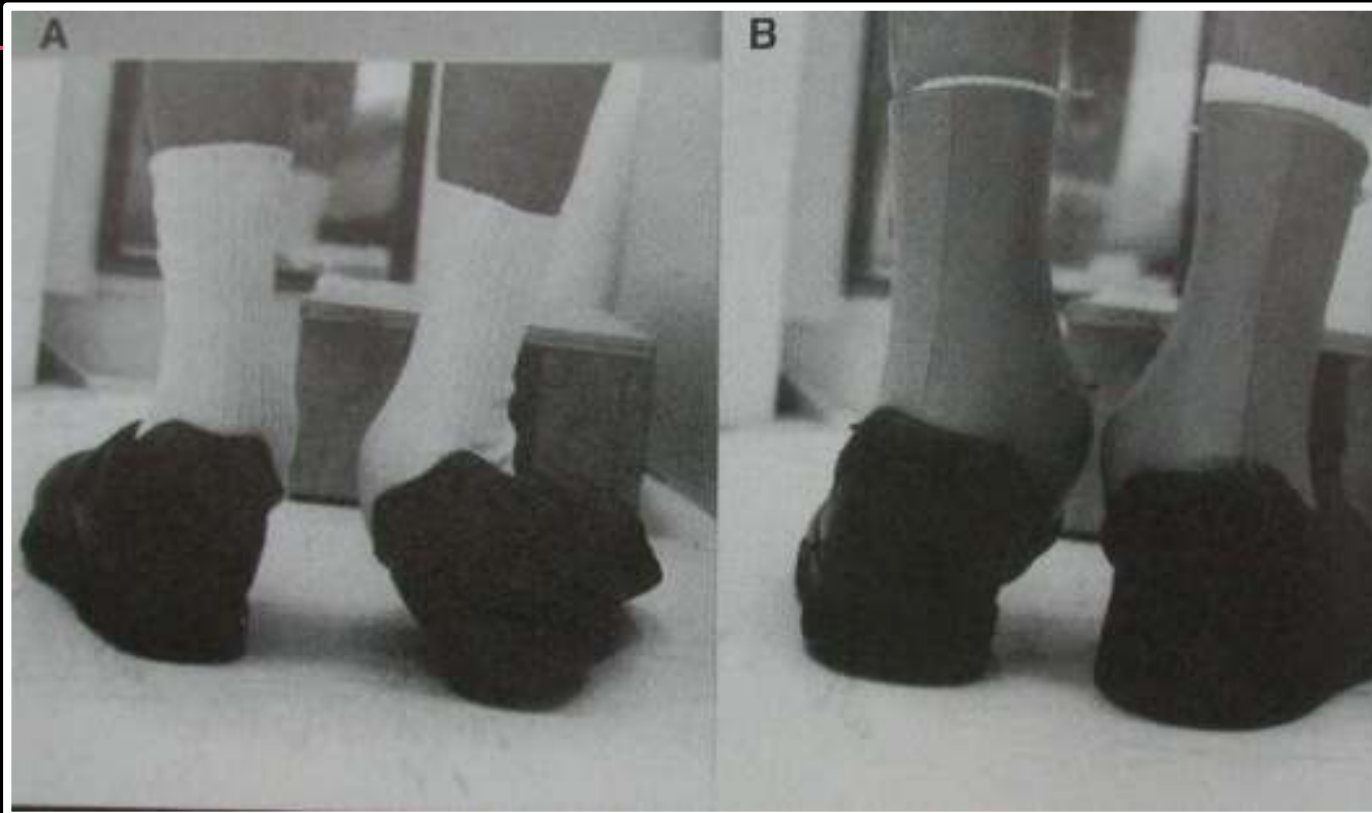
Mean follow up 12 months (3 to 19)



# Arizona AFO — Augustin et al.

Foot ankle Clinics of North America Vol 8 (2003)

- AOFAS hindfoot score increased from 38 to 76 ( $p < 0.001$ )
- Foot Function Index significantly improved in all categories
- SF-36 Improved significantly in 8 out of 9 areas



# Stage II - Surgery

- Indicated for failed conservative management

- Unless:

- Unfit for surgery,
- Elderly, low demand
- Don't want surgery

- Tendon transfer plus Medial slide calcaneal osteotomy

- Consider:

- Calcaneal lengthening
- TA lengthening

# Stage III

- Associated with a more advanced course of tendon rupture and deformity
- Characterized by rigid hindfoot valgus.
- Rigid forefoot abduction or instability at the first TMT joint.

# Stage III - Conservative

- Unfit for surgery
- Low demand
- Not too much pain
- Unrealistic expectations of surgery
- Options:
  - Arizona AFO
  - Caliper
  - Extended UCBL





## Stage III - Operative

May consider tendon transfer and slide

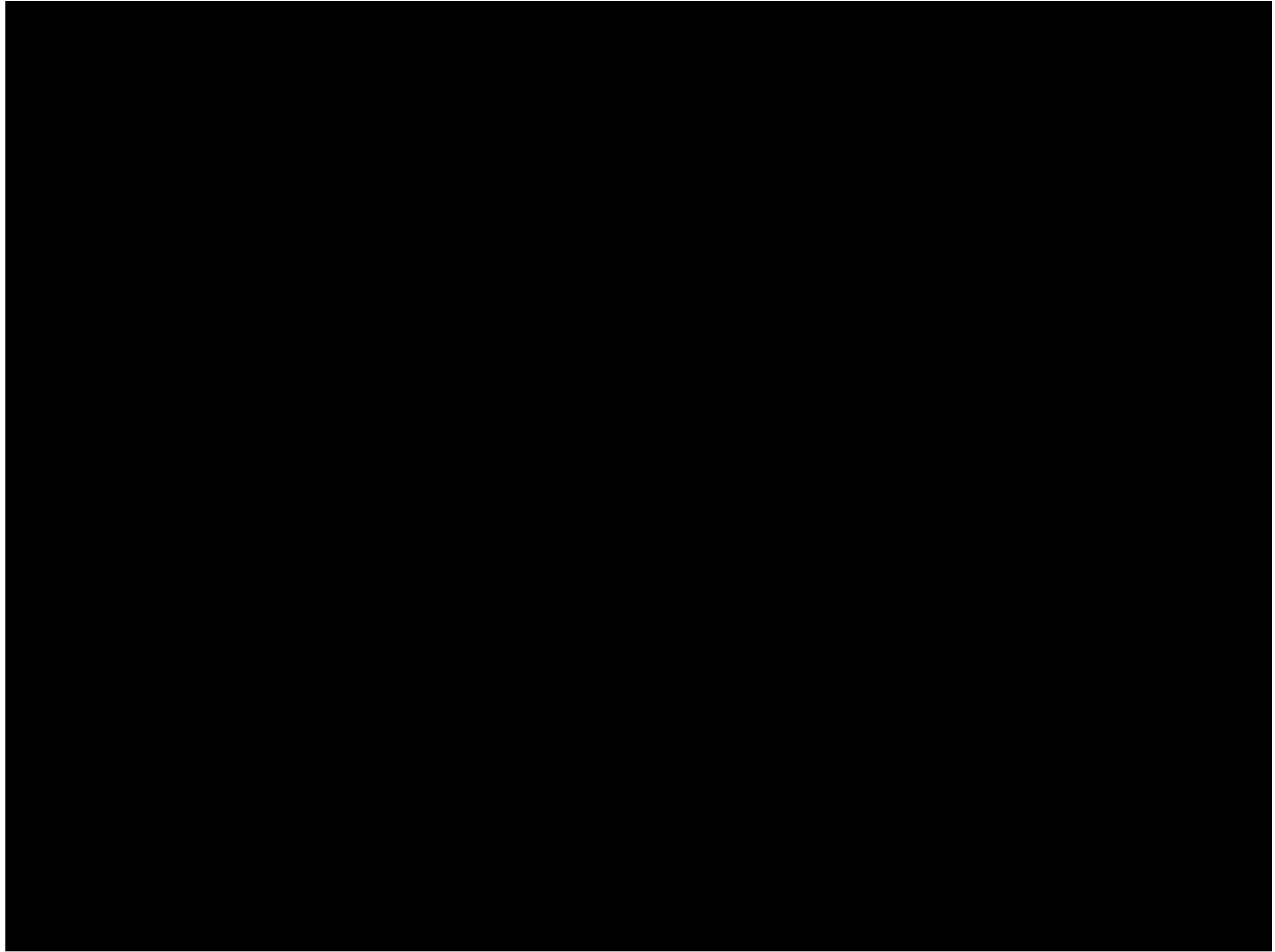
Or

Triple fusion



# Triple fusion





# Conclusions



- Complex problem
- Management guided by Stage and patient factors
- Individualised treatment plan
- Good results with conservative management
- Reconstruction before fusion, especially in young patients



“Following the operation on my foot in January, I would like to thank Mr Gower and his team for the immense improvement to the quality of my life brought about by the operation.

I have always been a very keen walker, but the problem with my tibial posterior tendon gradually reduced my mobility such that by the start of 2006 I could hardly walk at all and was in constant pain. I also had great difficulty cooking, showering, shopping and anything else that requires standing. Now, just a few months after the operation, I can walk several miles without pain and my ability continues to improve.”

# Plantar fascia

- Static and Dynamic functions
- Dependent on:
  - Flexibility of MTP joints
  - Length of skeleton of the foot
- Hicks
  - Tie-bar

