

Recent Advances in Orthotic Therapy for **Plantar Fasciitis**

An Evidence Based Approach

Lawrence Z. Huppin, D.P.M.

Assistant Clinical Professor, Western University of Health Sciences,
College of Podiatric Medicine

Disclosures

I disclose the following financial relationships with commercial entities that produce health care related products and services relevant to the content of this lecture:

- **Employee (Medical Director) of ProLab Orthotics, manufacturer of foot orthoses**

Our Goals

- Review Three Studies that Help Optimize Clinical Outcome of Custom Foot Orthoses Used to Treat Plantar Fasciitis
 - Cause of Plantar Fascial Tension
 - Forefoot Wedging Effect on Plantar Fascial Tension
 - Arch Contour Effect on Plantar Fascial Tension
- Develop a “pathology specific” orthosis prescription to most effectively treat plantar fasciitis

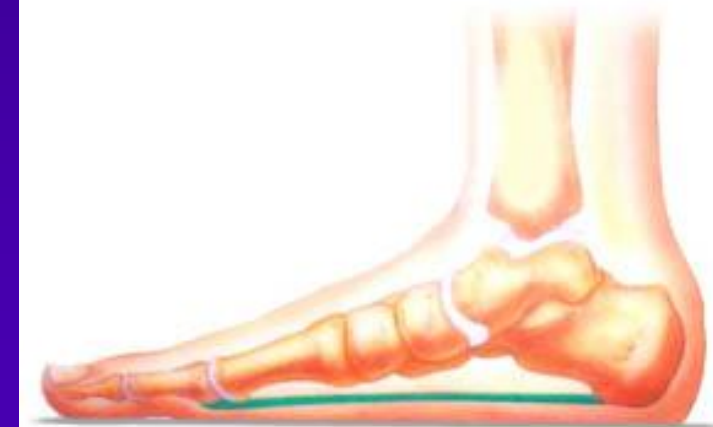
- Offloading Excessive Fascia Tension is Goal of Orthotic Therapy
- What Causes Tension?

Tissue Stress Theory

McPoil, Hunt. **Evaluation and Management of Foot and Ankle Disorders: Present Problems and Future Directions.** Journal of Orthopaedic & Sports Physical Therapy, 1995



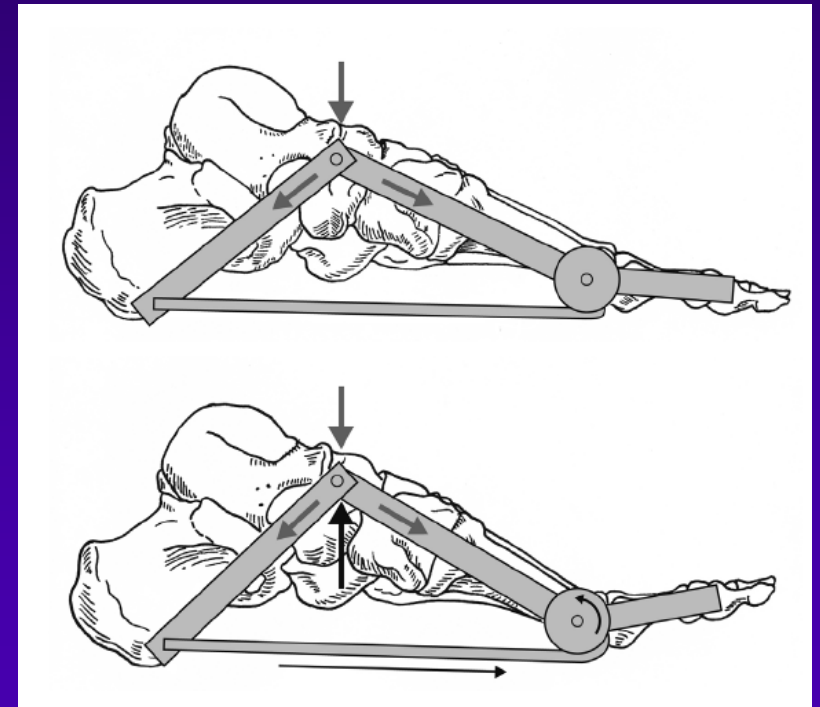
Normal Arch



Flat Arch

Effect of STJ Pronation on PF Strain

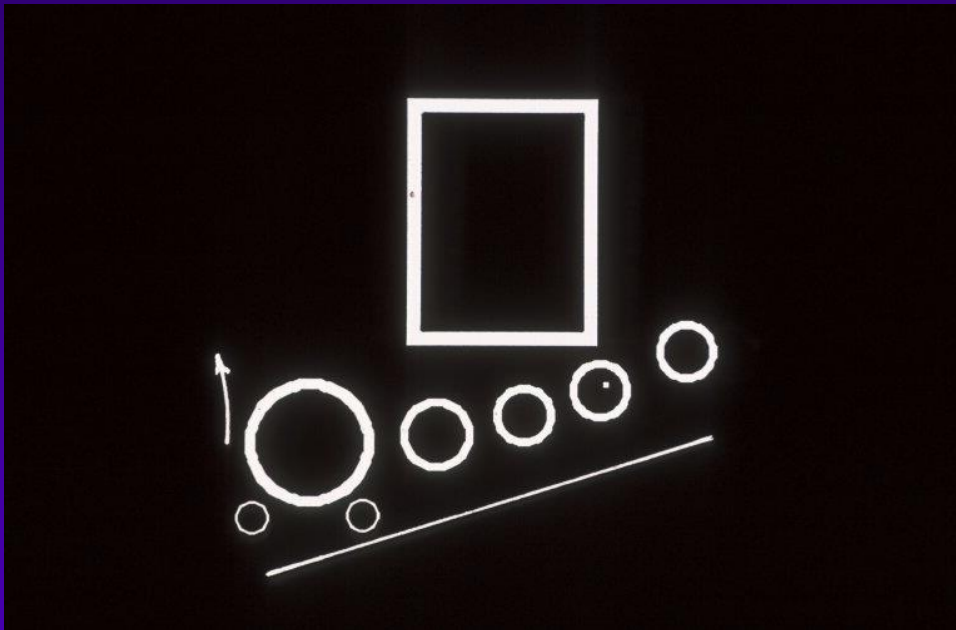
- Cannot by itself cause strain of plantar fascia
- Can only increase plantar fascia strain via the MTJ
 - (inversion of the forefoot on the rearfoot)



Effect of Forefoot Inversion on Plantar Fascial Strain

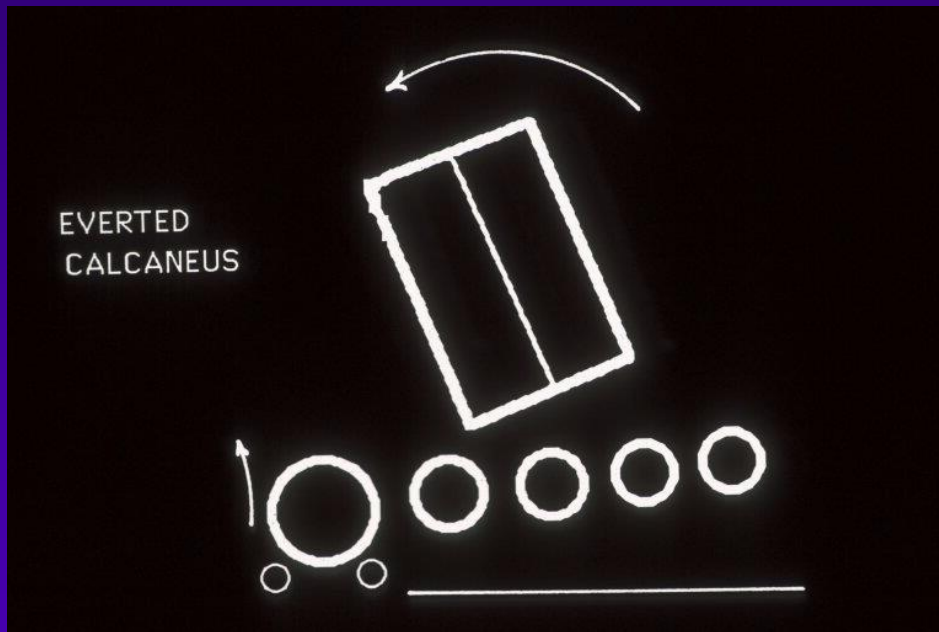
- 73 patients with 118 painful heels
- 91% had foot deformity compensated by supination of long axis of MTJ
- Out of 118 painful heels
 - 63 had forefoot valgus
 - 33 had everted rearfoot
 - 20 had plantarflexed first ray

What foot types supinate the MTJ?



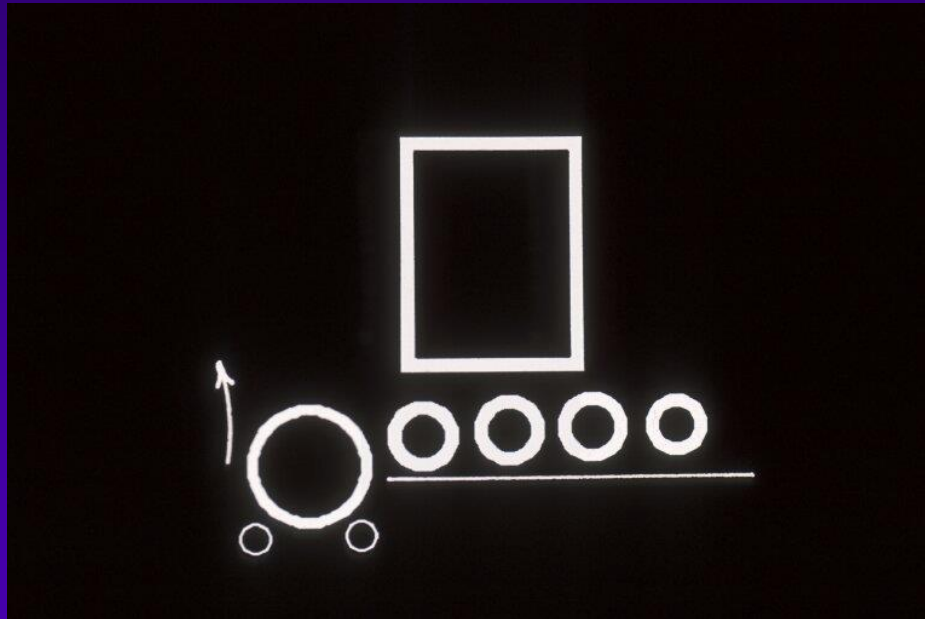
- **47% forefoot valgus**
- 24% everted heel
- 20% plantarflexed first ray

What foot types supinate the MTJ?



- 47% forefoot valgus
- **24% everted heel**
- 20% plantarflexed first ray

What foot types supinate the MTJ?



- 47% forefoot valgus
- 24% everted heel
- **20% plantarflexed first ray**

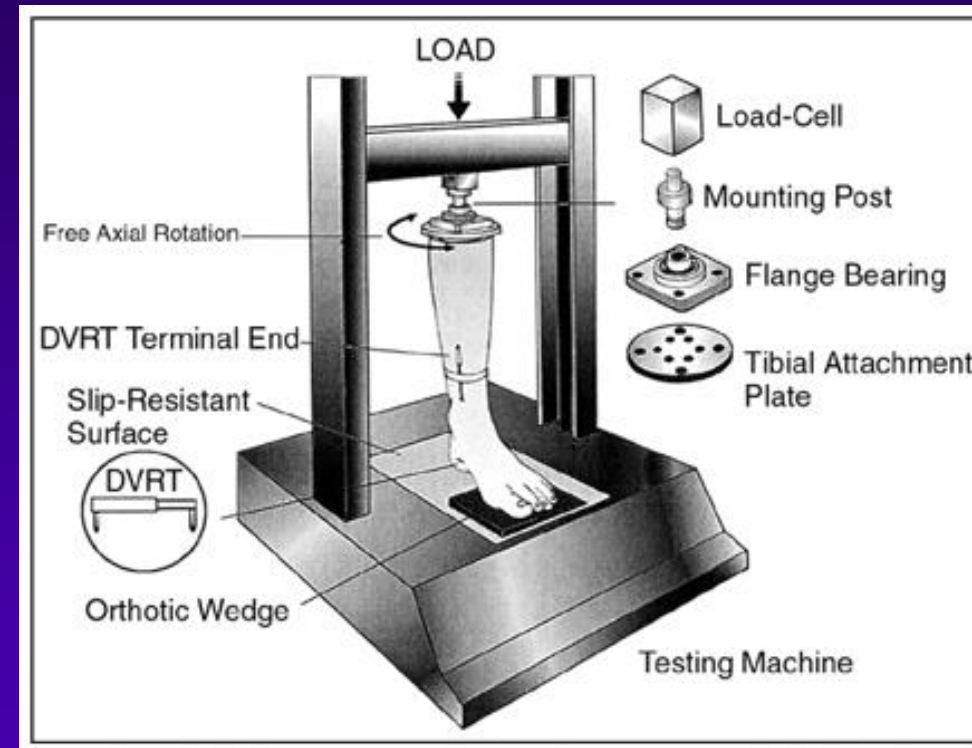
- ① 115 of the 133 heels in this study had one of the deformities, that, upon weightbearing, would force the forefoot into a position of inversion on the rearfoot,
- ① Researchers theorized that supination (inversion) of the midtarsal joint placed increased tension on the plantar fascia

It is not the pronation.....

**But rather inversion of the forefoot
via midtarsal joint supination and
first ray dorsiflexion**

Effect of Forefoot and Rearfoot Wedging on Plantar Fascial Strain

- Fresh frozen cadaver feet
- Axial load in static stance
- 6 degree wedges
 - Medial and Lateral
 - Forefoot and Rearfoot
- Plantar fascial strain measured with transducer



Kogler GF, et.al. "The Influence of Medial and Lateral Placement of Orthotic Wedges on Loading of the Plantar Aponeurosis. In vitro study JBJS, 1999.

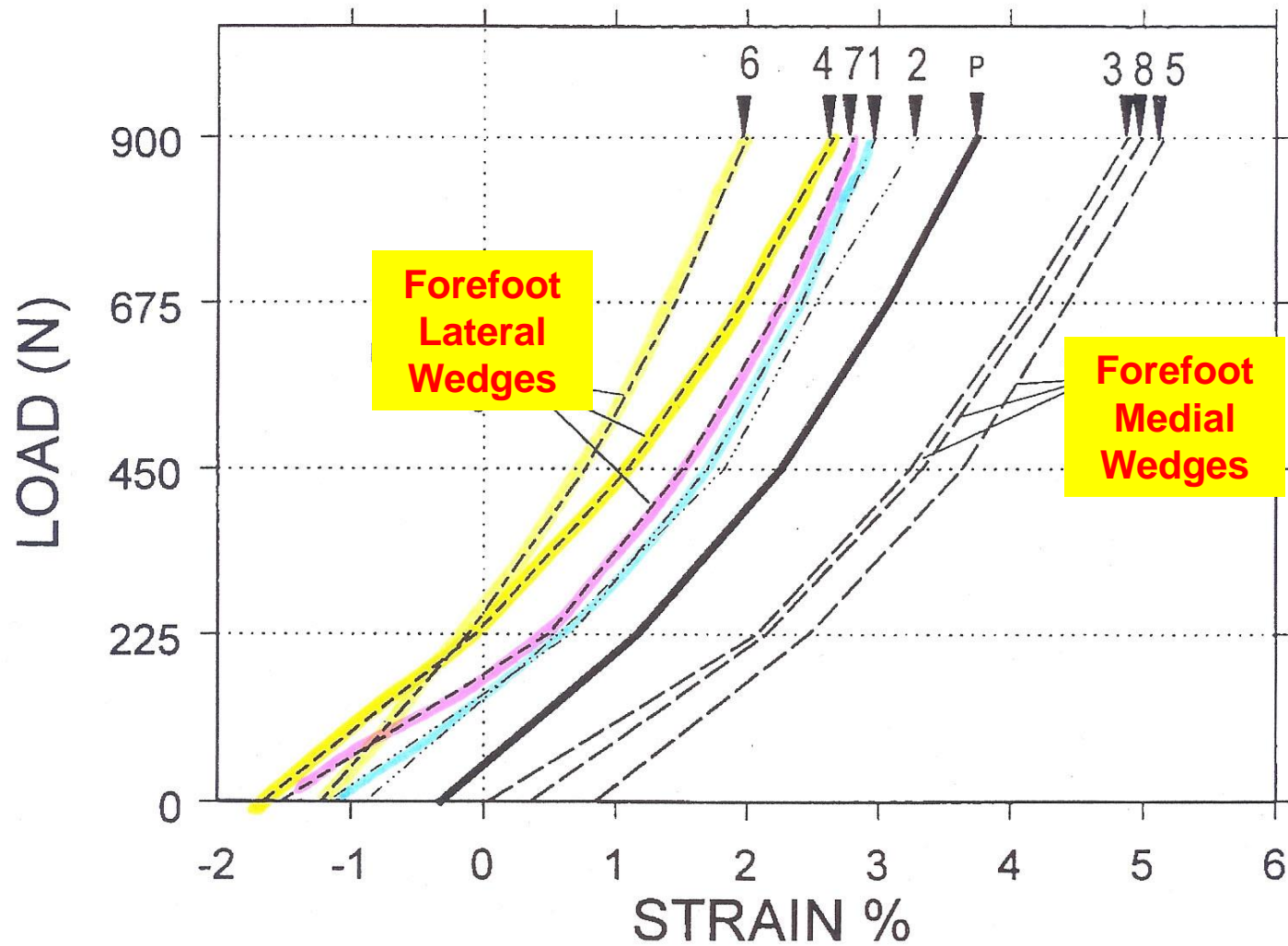
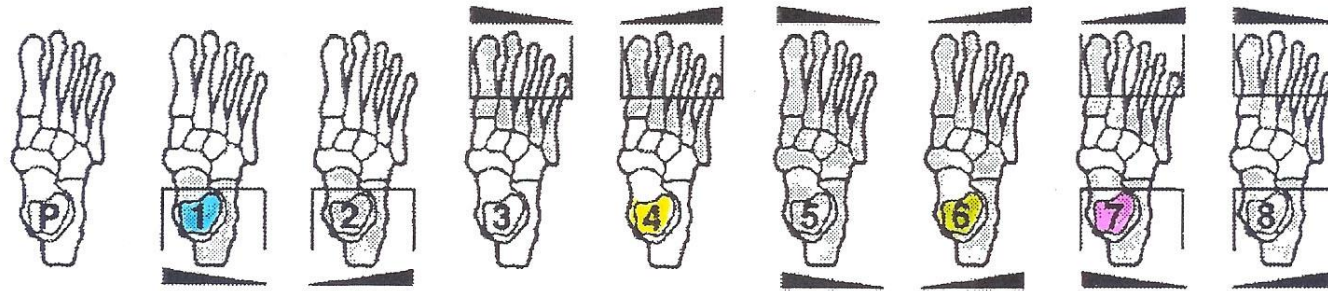


FIG. 4

Plantar Fascial Strain

- Decreased with lateral forefoot wedge
- Increased with medial forefoot wedge
- Rearfoot wedges had no significant effect

The most effective way to decrease strain on the plantar fascia is to evert the forefoot

-Kogler, et al, JBJS, 1999

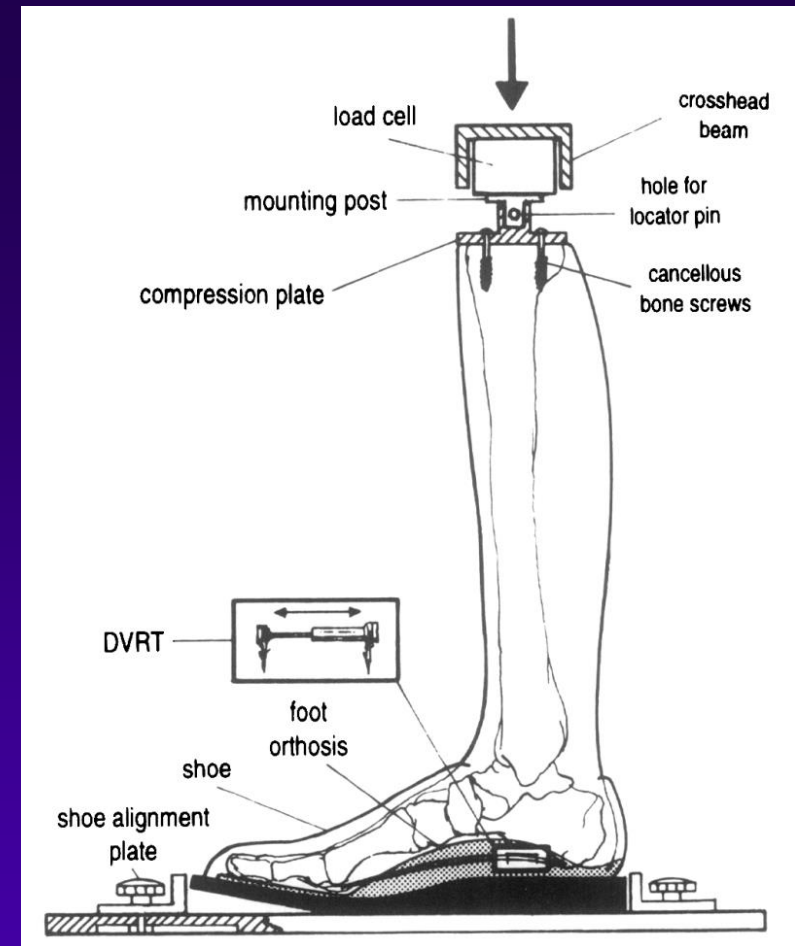
Is Varus Posting an Option for Plantar Fasciitis?

- Varus Forefoot Posting Contraindicated in the presence of plantar fasciitis
- Rearfoot varus appears to play no role

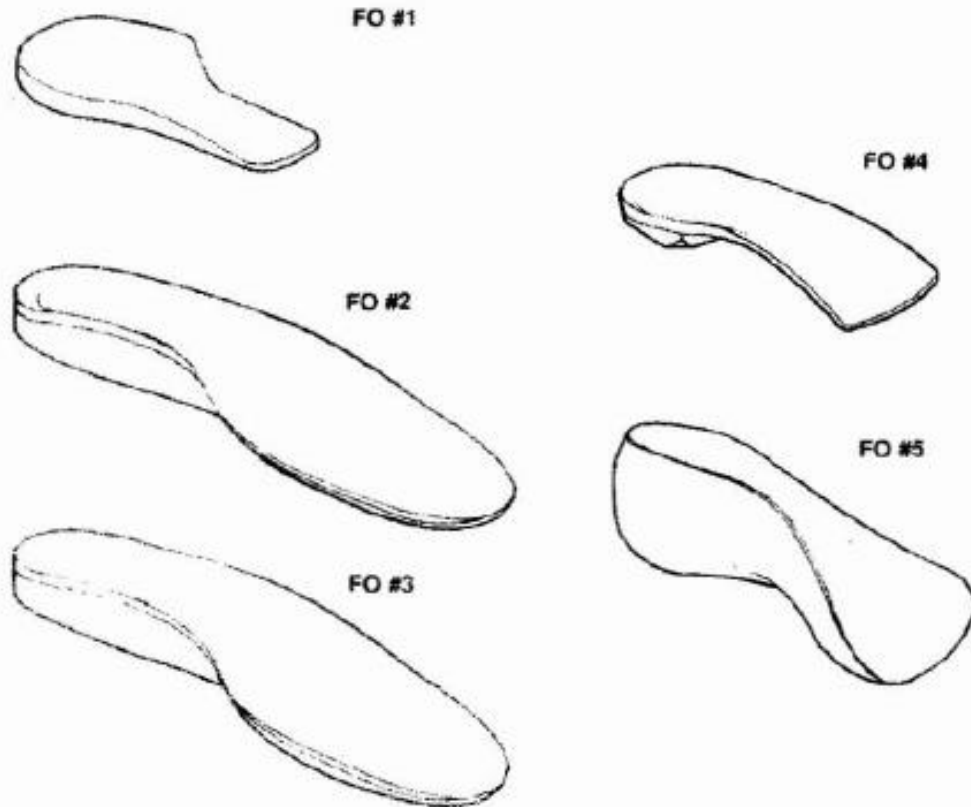


Orthotic Arch Contour and Plantar Fascial Strain

- Measured tension in plantar aponeurosis via strain gauge
- Compared 5 orthoses and shoe alone



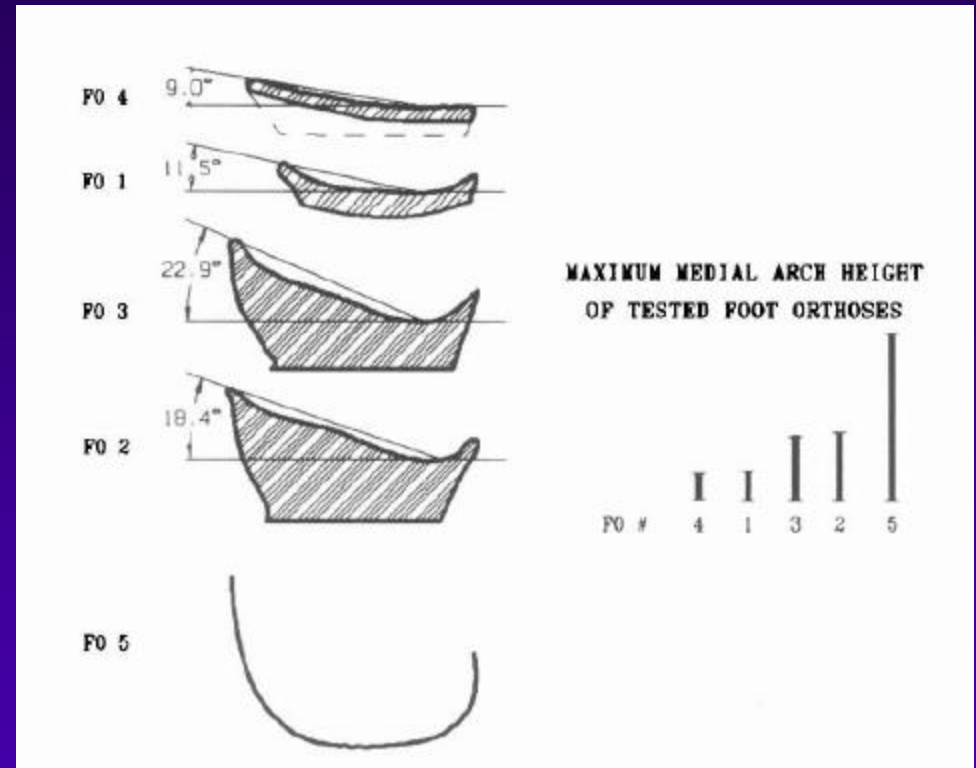
Kogler GF. **Biomechanics of longitudinal arch support mechanisms in foot orthoses and their effect on plantar aponeurosis strain.** Clinical Biomechanics . 1996



- **3 devices decreased strain**
 - UCBL (FO 5)
 - Viscoelastic Footbed (FO 3)
 - Cork and Rubber Footbed (FO 2)
- **2 Devices did not reduce strain**
 - Prefabricated Stock Orthosis (FO 1)
 - Custom rigid functional foot orthoses (FO 4)

Orthotic Arch Height

- Arches that conformed tightly to arch of foot decreased tension
- Orthoses that gapped from arch no difference or increase tension



“,,the orthoses which decreased plantar aponeurosis strain [had closer] surface contours of their medial and central regions and the angles related to the their arch shape were more acute”



Orthoses Proposal for Plantar Fasciitis

- **Goal: Reduce tension on plantar fascia**
 - Prevent First Ray Dorsiflexion
 - Incorporate Valgus Correction
 - Maintain Close Contour with arch
 - If present, reduce rearfoot eversion that leads to first ray dorsiflexion

Casting

“...to control the longitudinal arch the medial arch of the orthosis must stabilize the apical bony structures of the arch.”

“...advantageous to position the foot so that its medial arch is elevated during negative impression procedures to maximize orthotic control.”

Kogler GF, 1996



Casting Technique

- NWB
- Plantarflex the First Ray and / or Dorsiflex Hallux



The Orthotic Prescription

- Shell Material
- Size – Width and Heel Cup Height
- Positive Cast Arch Fill
- Cast Correction and Intrinsic Accommodations
- Posts
- Top Covers
- Forefoot Extensions

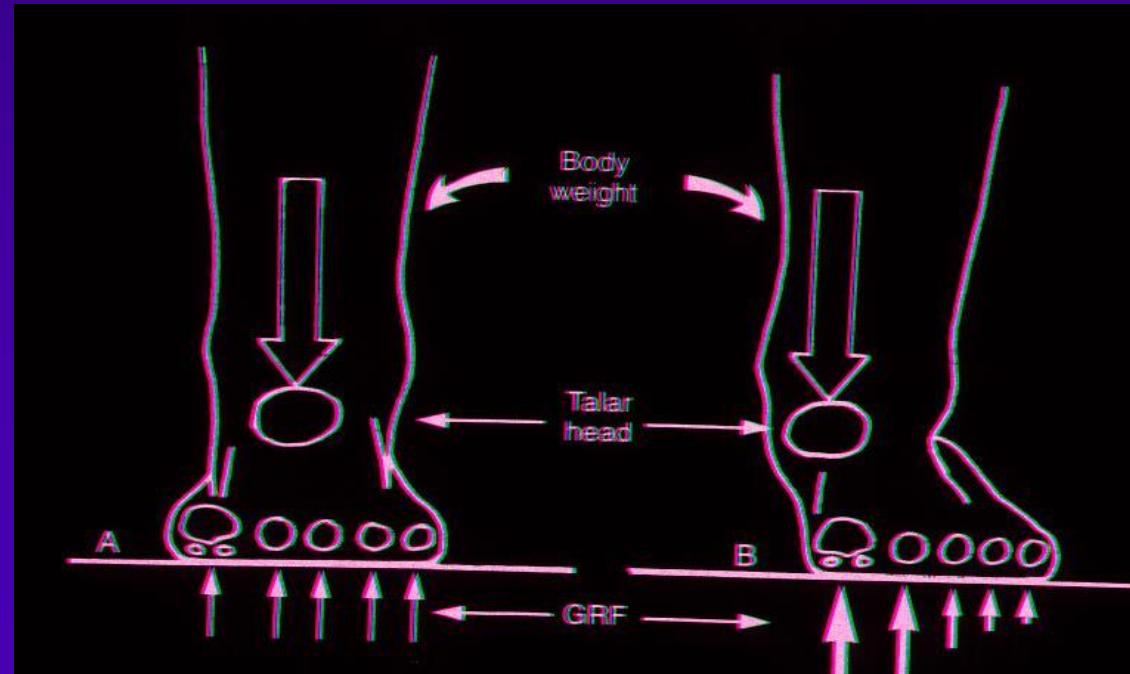
Shell Material

Enough Rigidity to Resist Deformation

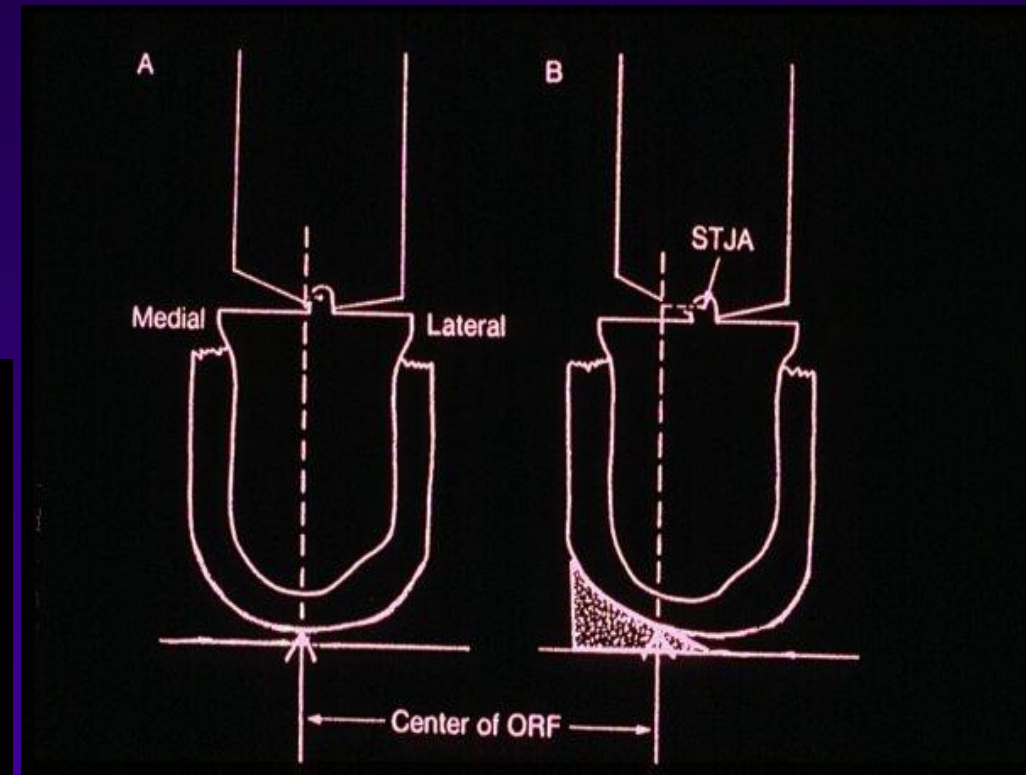
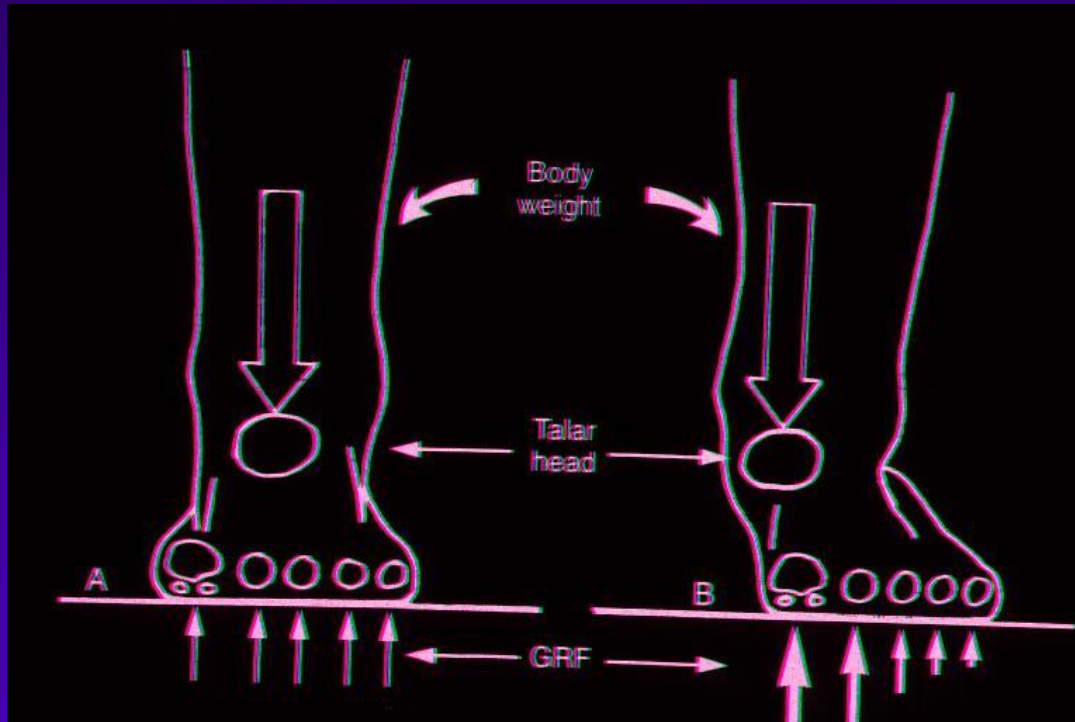
- Polypropylene
- Carbon Fiber
- Subortholon with Fill

Orthosis Size

- If Heel Everted
 - Deep Heel Cup
 - Wide Width

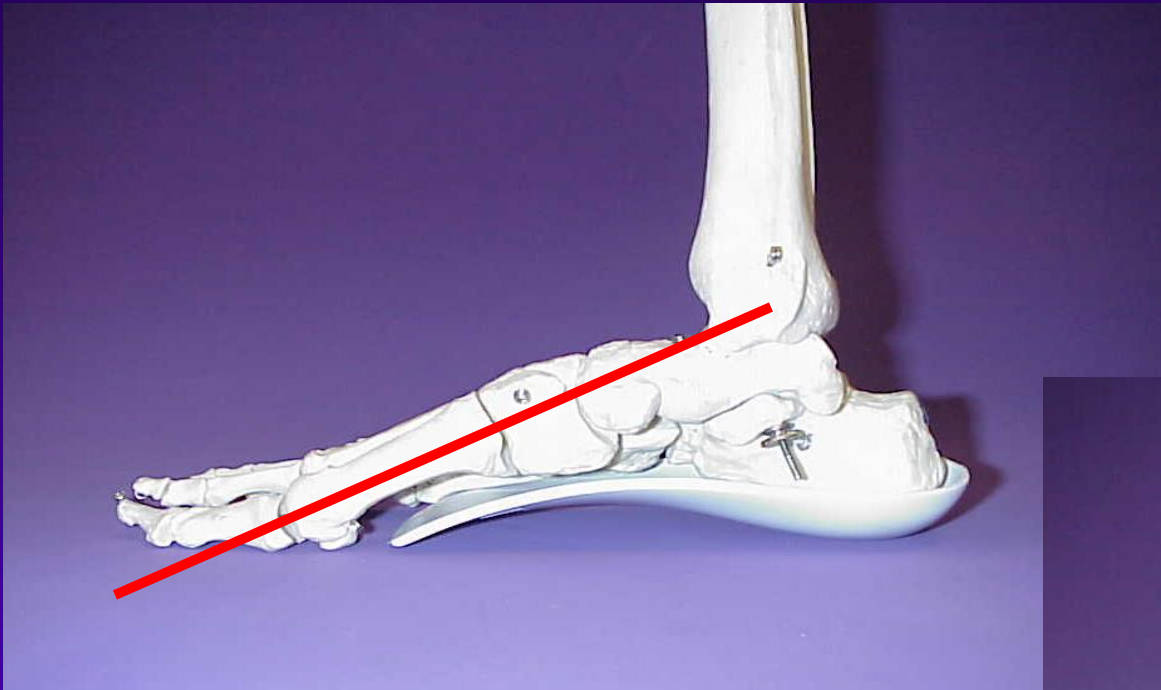


Positive Cast Modifications

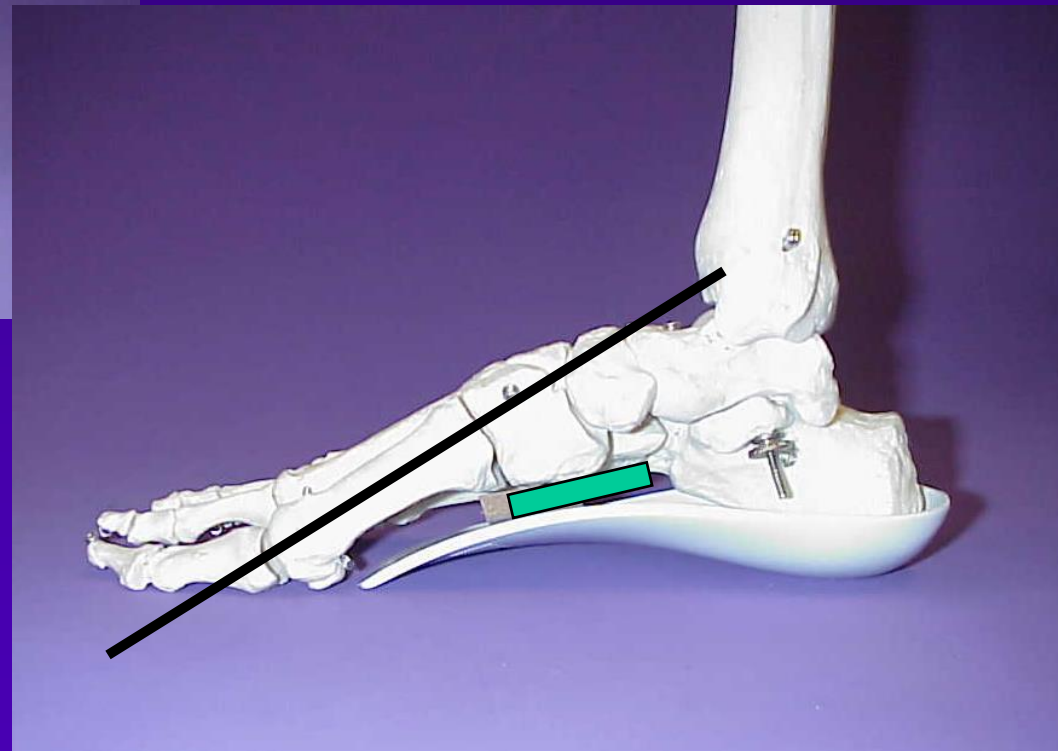


Kirby, 1987. Rotational Equilibrium Around the STJ Axis. JAPMA

How Tight Should Orthosis Conform to Arch of Foot?



Orthoses that raise the TNJ and prevent dorsiflexion of the distal strut (first ray) most effective at reducing strain on the central band of the PF
Kogler, JBJS, 1999



So, how do you raise the TNJ? (Raise the arch)

- Cast Fill
- Inversion



Ensure Lab Does Not Overfill Medial Arch



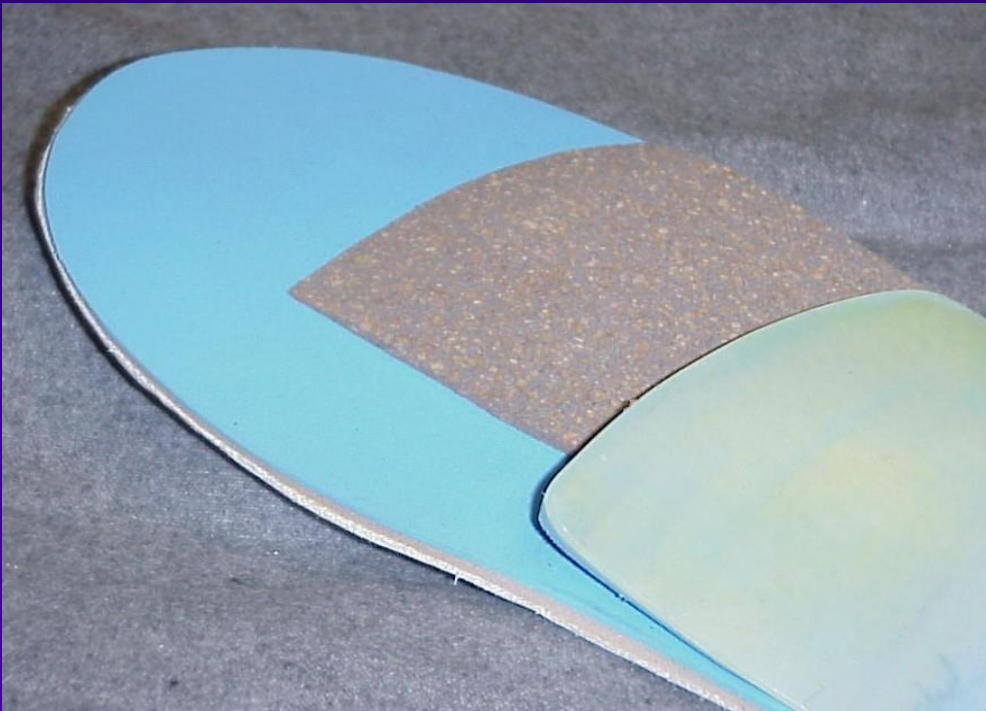
orthotic labs may add plaster “expansion” to the positive cast in this area to reduce the chance of arch irritation

Evaluate Orthosis



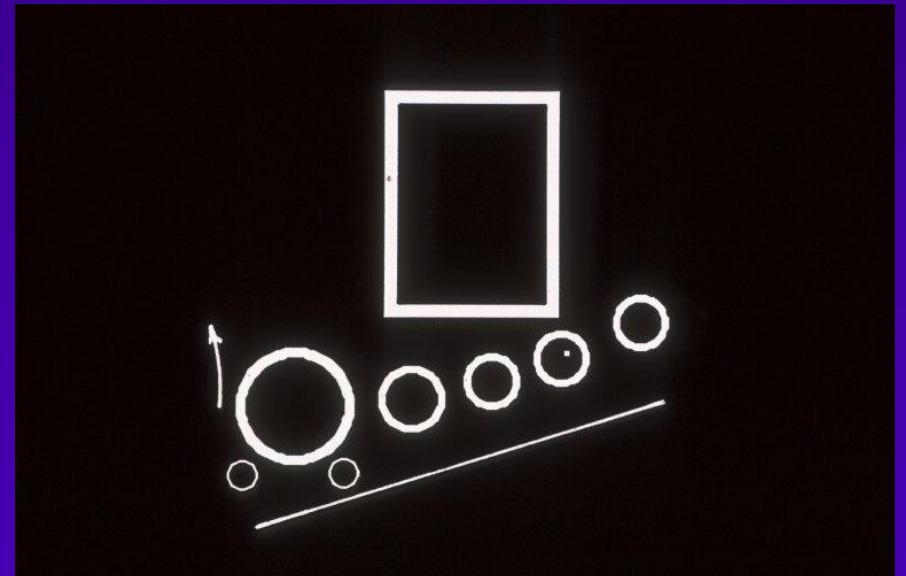
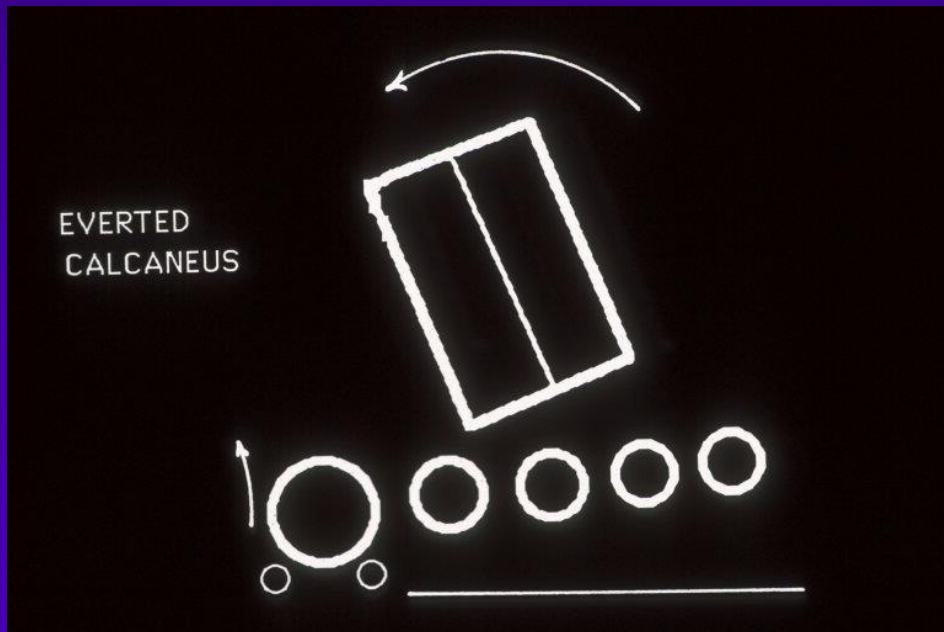
Forefoot Extensions

- Forefoot Valgus Extension
- Reverse Morton's Extension



Orthotic Recommendations:

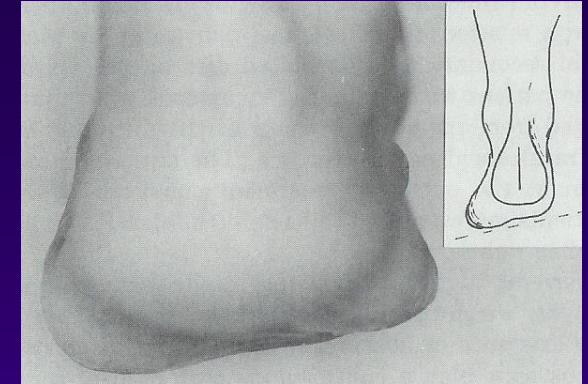
- Two scenarios produce a supinated midtarsal joint and tension on the plantar fascia
 - Everted Forefoot (FF valgus / PF 1st Ray)
 - Everted Heel (may also include everted forefoot)



Orthotic Recommendation: Everted Forefoot

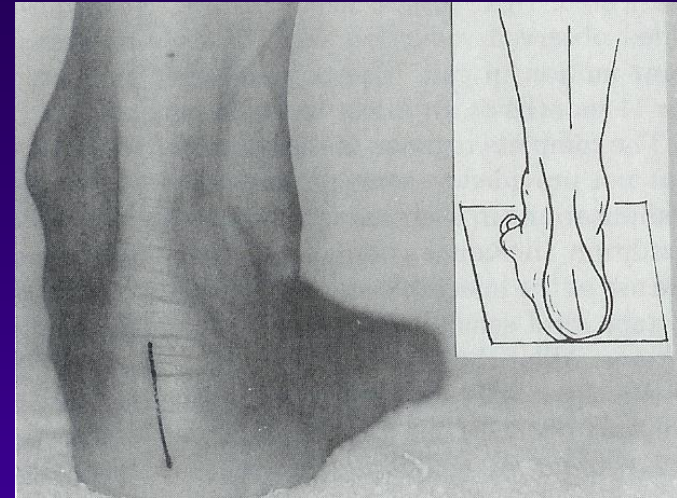
- Neg Cast – 1st Ray Plantarflexed
- Rigid or Semi-rigid
- Cast Fill - Minimal
- Heel Cup - Standard
- Width - Standard
- Cast Work – No Skive
- 2 degrees inversion
- Post – 0/0
- Forefoot Extension- Reverse Morton's or Valgus Wedge*

*Kogler Effect



Orthotic Recommendation: Everted Rearfoot

- Neg Cast – 1st Ray Plantarflexed
- Rigid or Semi-rigid
- Cast Fill - Minimal
- Heel Cup – **Deep**
- Width - **Wide**
- Cast Work – **Medial Skive** – 2-4mm
- 2 degrees inversion
- Post – 0/0

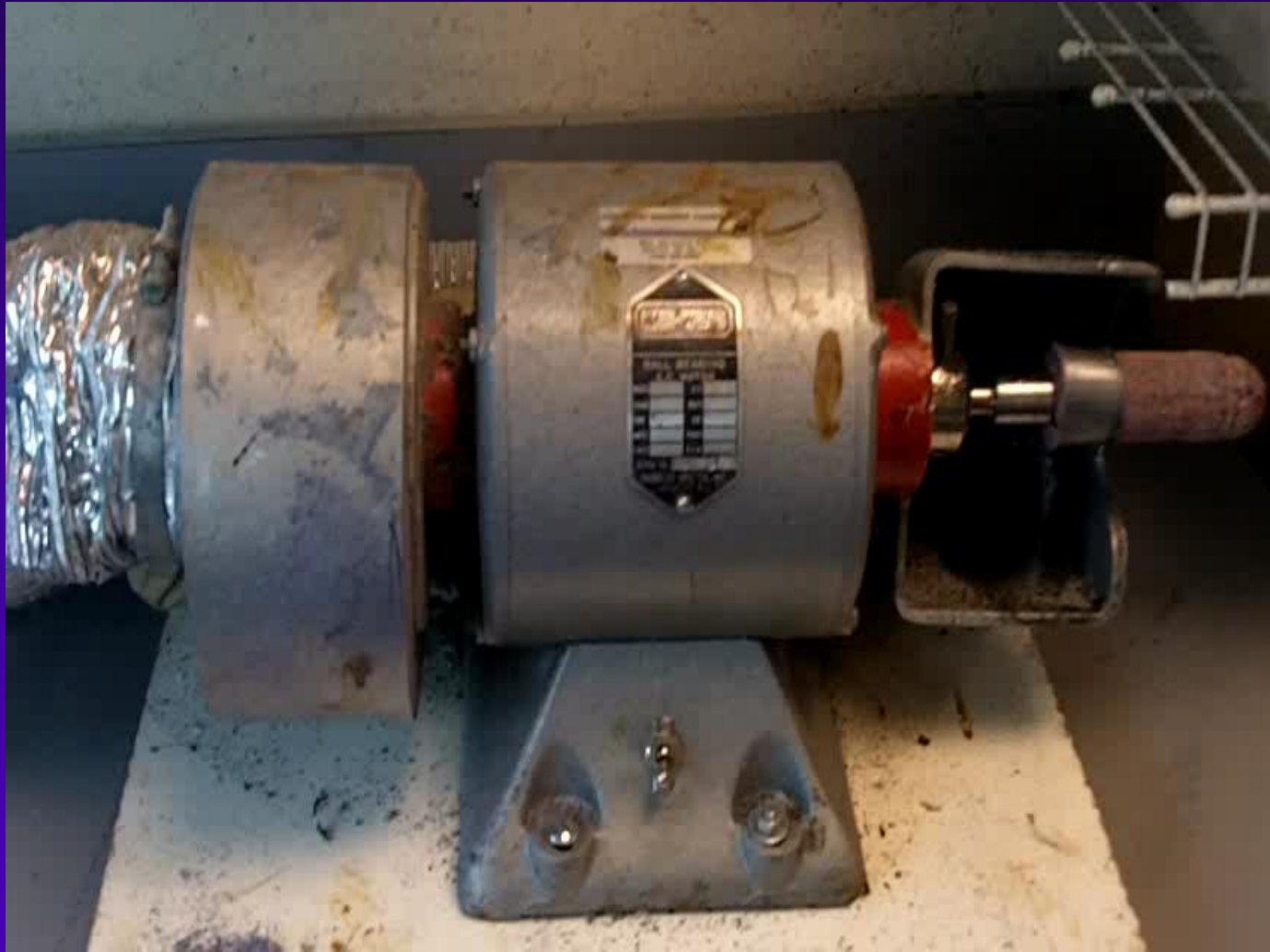


**Differs from previous Rx*

Troubleshooting

- Higher Arched Orthoses will mean occasional medial arch irritation





Summary: Don't

- Don't Invert the Forefoot on the Rearfoot
 - Don't Use Weightbearing Casting
 - Don't Forget to Plantarflex the First Ray
 - Don't Prescribe Varus Posts
 - Don't Prescribe Morton's Extensions
 - Don't Dispense Orthoses that Gap from the Arch of the Foot

Summary: Do

- Allow the First Ray to Plantarflex
 - Plantarflex the first ray while casting
 - Prescribe an orthosis that conforms close to the arch of the foot
 - Ensure lab does not overfill medial arch
- Learn to troubleshoot arch irritation

Thank You!

Recent Advances in Orthotic Therapy

Webinar Series

■ Evidence Based Orthoses

- Achilles Tendonitis
- Adult Acquired Flatfoot
- Calcaneal Apophysitis
- Cavus Foot
- FHL / HAV
- Lateral Ankle Instability
- Knee Pain
- Metatarsalgia
 - ❖ Neuroma, Sesamoiditis
- Pediatric Flexible Flatfoot
- Plantar Fasciitis
- Tarsal Tunnel Syndrome
- Tibial Fasciitis

◎ Other Topics

- > Troubleshooting Foot Orthoses
- > Orthotic Casting Technique
- > Digital Casters / Foot Scanners
- > Patient Communication

◎ Suggestions

- > Lhuppin@gmail.com