

Could this Research Change the Way You Treat Hallux Limitus?

Lawrence Z. Huppin, D.P.M.

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

Disclosure: Medical Director, ProLab Orthotics

Goals

- Review underlying cause of functional hallux limitus (FHL)
- Review three (3) peer-reviewed studies related to mechanical treatment of FHL
- Apply this evidence to the orthotic prescription for FHL

Review

■ Definition*

- Greater than 50° dorsiflexion NWB
- Less than 14° dorsiflexion in stance
- No trauma or arthritis

■ Associated deformities

- Hallux rigidus
- Hallux valgus

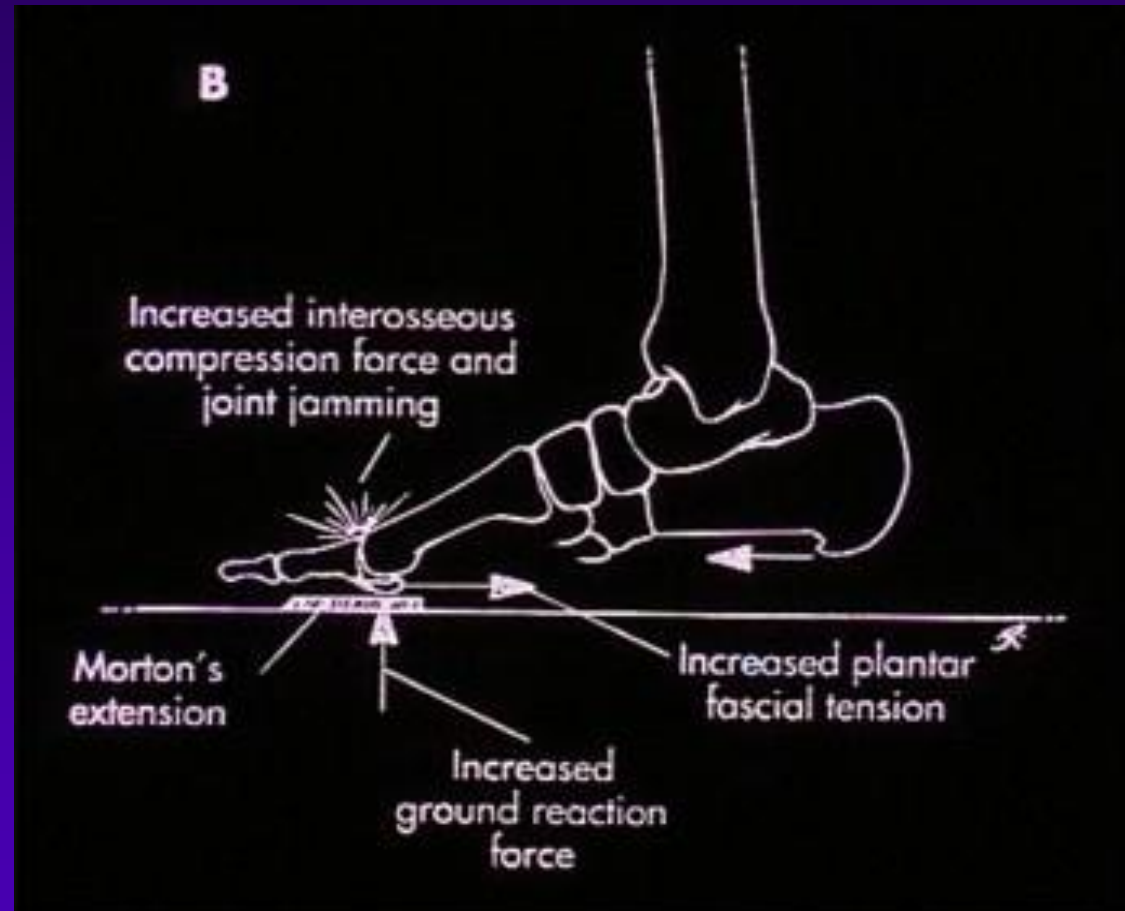


*Scherer PR, et.al. Effect of functional foot orthoses on first MPJ dorsiflexion in stance and gait. JAPMA, 96(6):474-81, 2006

Mechanical Cause of FHL

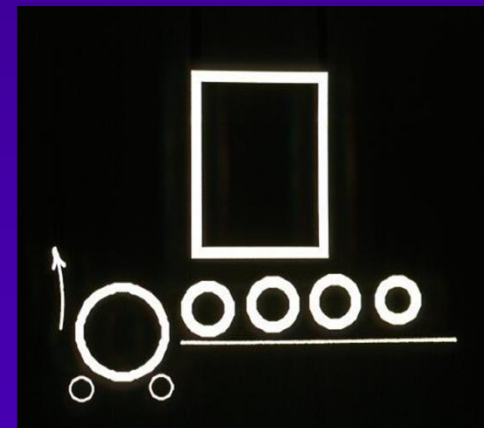
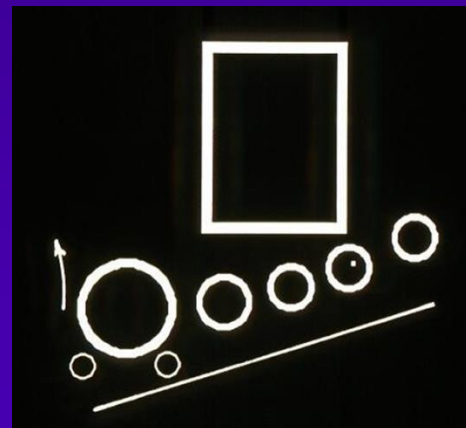
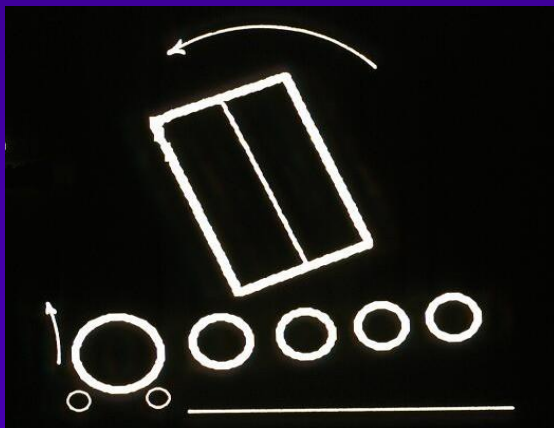
Windlass function blocked by forces driving the 1st ray up

- Prevents 1st ray plantarflexion
- Hallux can not dorsiflex
- 1st MPJ compression increases



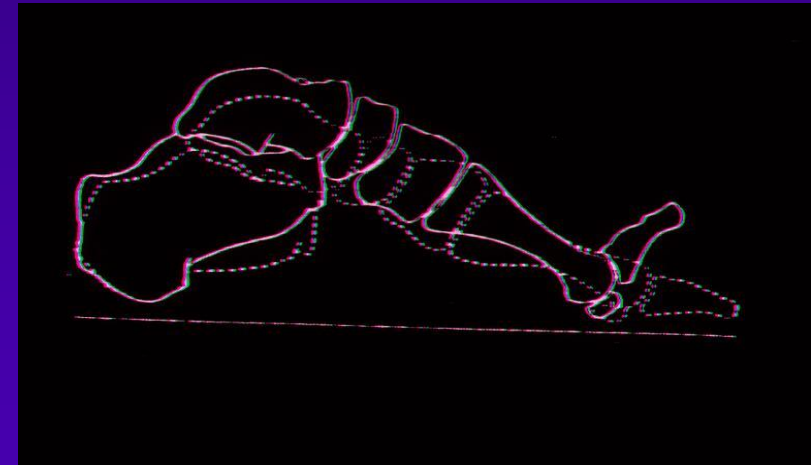
Etiology of FHL

- Three foot types cause increased force under the first metatarsal head
 - Everted calcaneus
 - Everted forefoot resulting from flexible forefoot valgus
 - Everted forefoot resulting from planterflexed first ray



Roukis, et al. JAPMA 1996

- Increased force under 1st metatarsal = decreased hallux dorsiflexion
 - Ground reactive forces against the 1st MPJ prevent 1st ray plantarflexion
 - Lack of 1st ray plantarflexion will limit 1st MPJ dorsiflexion.
 - *100% of subjects, dorsiflexion is decreased*



Roukis, et. al. Position of the first ray and motion of the first MTP. JAPMA 86:11, 1996.

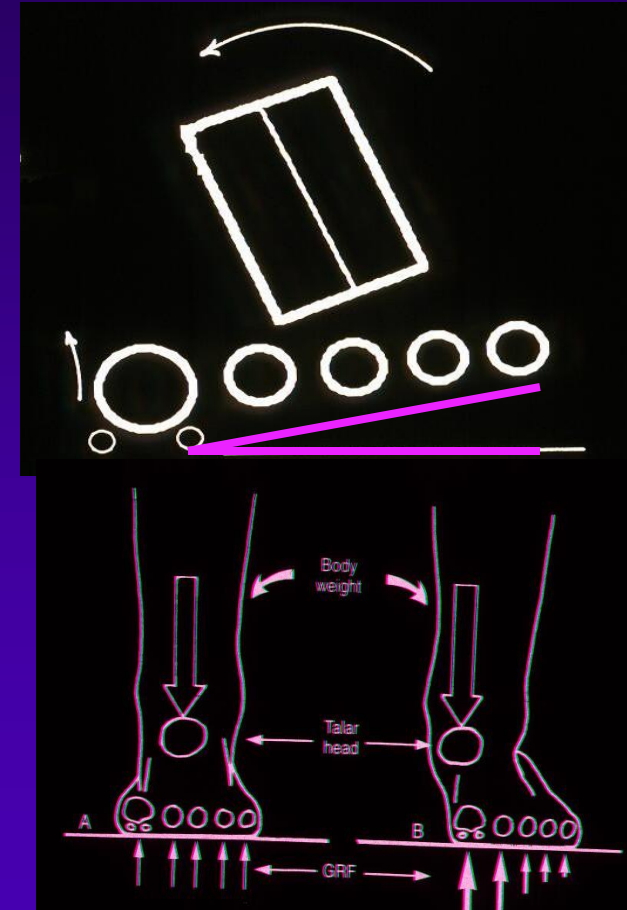




Harradine, JAPMA 2000

- Rearfoot eversion and hallux dorsiflexion
 - “Eversion of the rearfoot will lower the maximal hallux dorsiflexion”
 - ❖ No wedge: 85.91
 - ❖ 3° wedge: 68.23
 - ❖ 5° wedge: 58.80
 - First ray dorsiflexion
 - Hallux dorsiflexion decreased

Harradine, Bevin: The effect of rearfoot eversion on maximal hallux dorsiflexion. JAPMA 2000.



Scherer, et al. JAPMA 2006

- Evaluated the influence of functional orthoses on the ROM in stance and gait of the first MTP joint
- Defined FHL as $> 50^\circ$ dorsiflexion NWB and $< 14^\circ$ dorsiflexion in stance
- Casted with 1st ray plantarflexed (based on Roukis)
- Custom functional orthoses
 - minimum cast fill (Roukis)
 - 14 mm heel cup (Harradine)
 - 2mm medial heel skive (Harradine)
 - wide width (Harradine)
 - Reverse Morton's extension (Roukis)

Scherer PR, et.al. Effect of functional foot orthoses on first metatarsophalangeal joint dorsiflexion in stance and gait. JAPMA, 96(6):474-81, 2006

Scherer, et al. JAPMA 2006

■ Stance

- Hallux dorsiflexion measured in stance with and without orthosis.

■ Gait

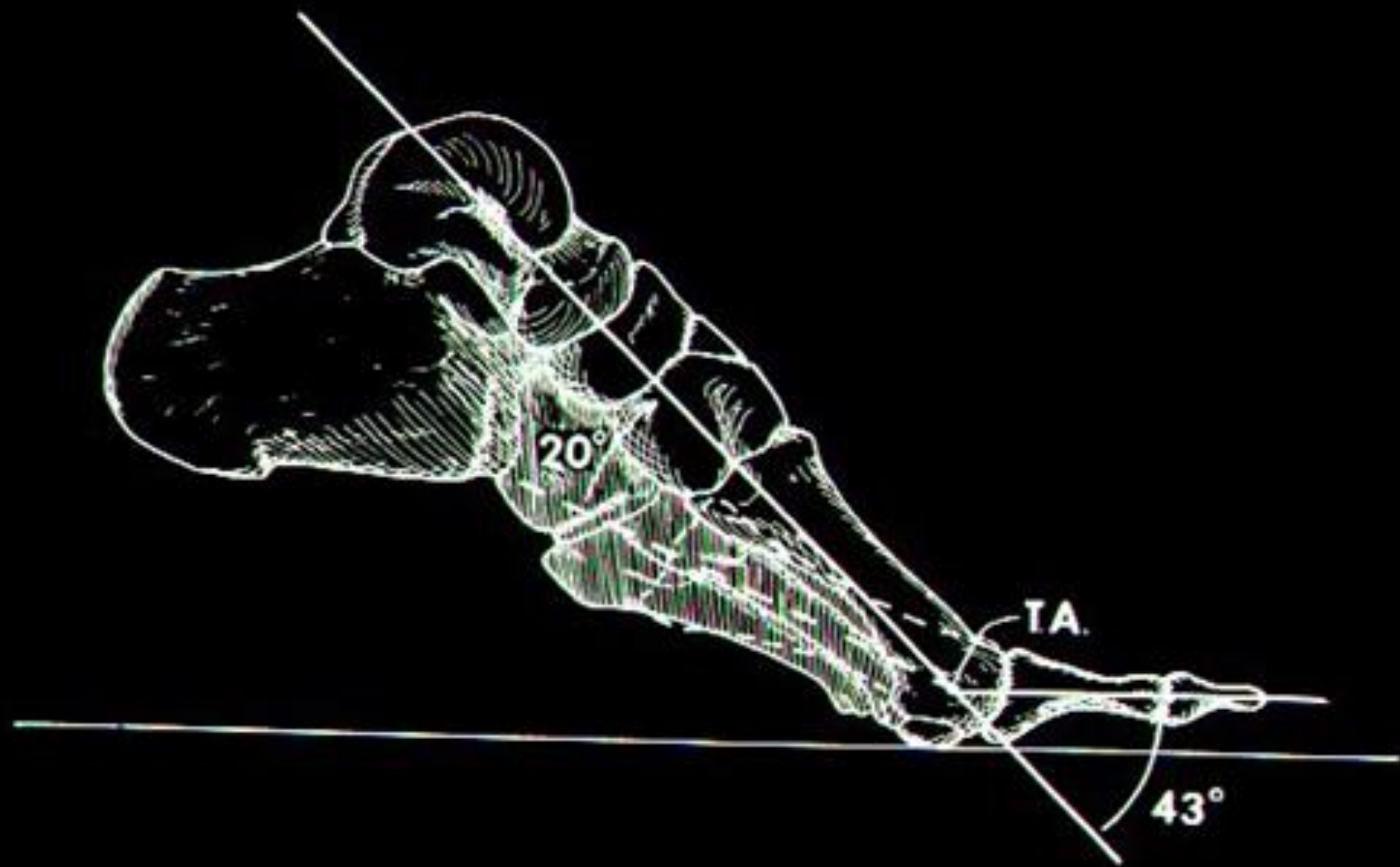
- Decrease in hallux pressure at heel off = increase in 1st MTPJ motion
- Greater 1st MTPJ motion = less pressure under hallux

Scherer PR, et.al. Effect of functional foot orthoses on first metatarsophalangeal joint dorsiflexion in stance and gait. JAPMA, 96(6):474-81, 2006

Scherer, et al. JAPMA 2006

- Study #1: Weight Bearing Dorsiflexion
 - When orthotics used in stance, hallux dorsiflexion mean increase 90%
- Study #2: Sub-hallux pressure in gait
 - When orthotics used in gait, sub-hallux pressures mean reduction of 14.8%

Scherer PR, et.al. Effect of functional foot orthoses on first metatarsophalangeal joint dorsiflexion in stance and gait. JAPMA, 96(6):474-81, 2006



Applying the Evidence to the FHL Orthotic Rx

- Plantarflex first ray (*Roukis/Scherer*)
 - Bring first ray down when casting
 - Maintain close contour with medial arch
 - Reverse Morton's extension
- Reduce rearfoot eversion (*Harradine*)
 - Deep heel cup
 - Increased width
 - Medial skive

Casting Technique

- Plantarflex 1st ray or dorsiflex hallux



What Happens If You Don't Plantarflex the First Ray When Casting?

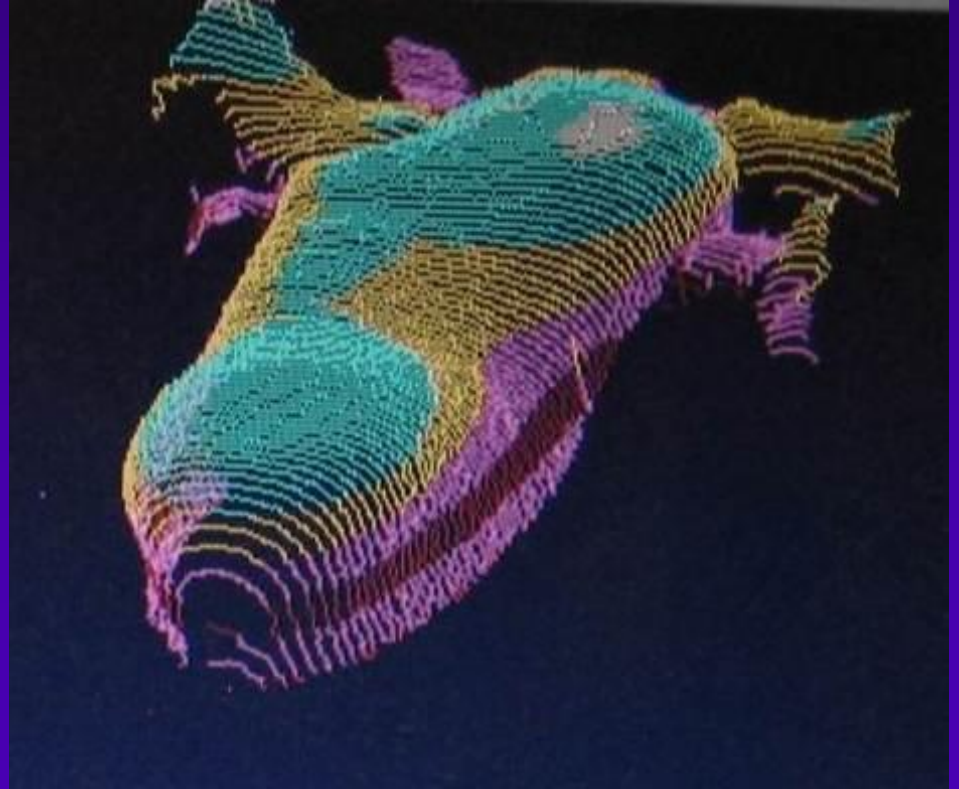
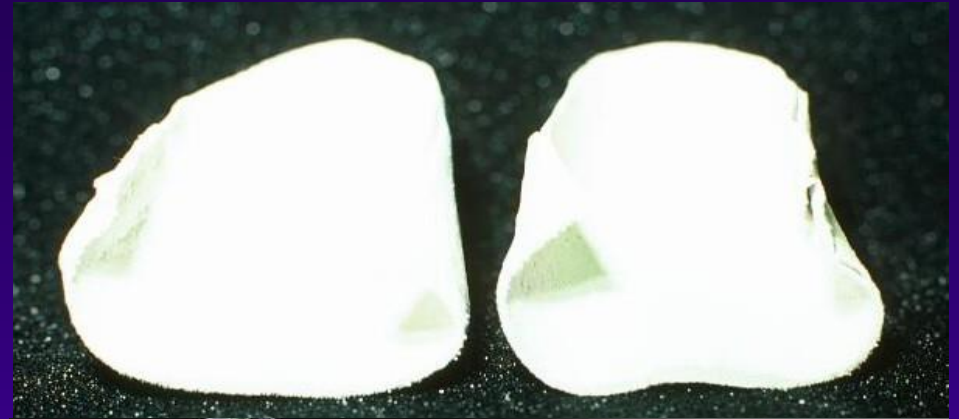
Excess varus captured
In negative cast



Excess varus captured
In positive cast

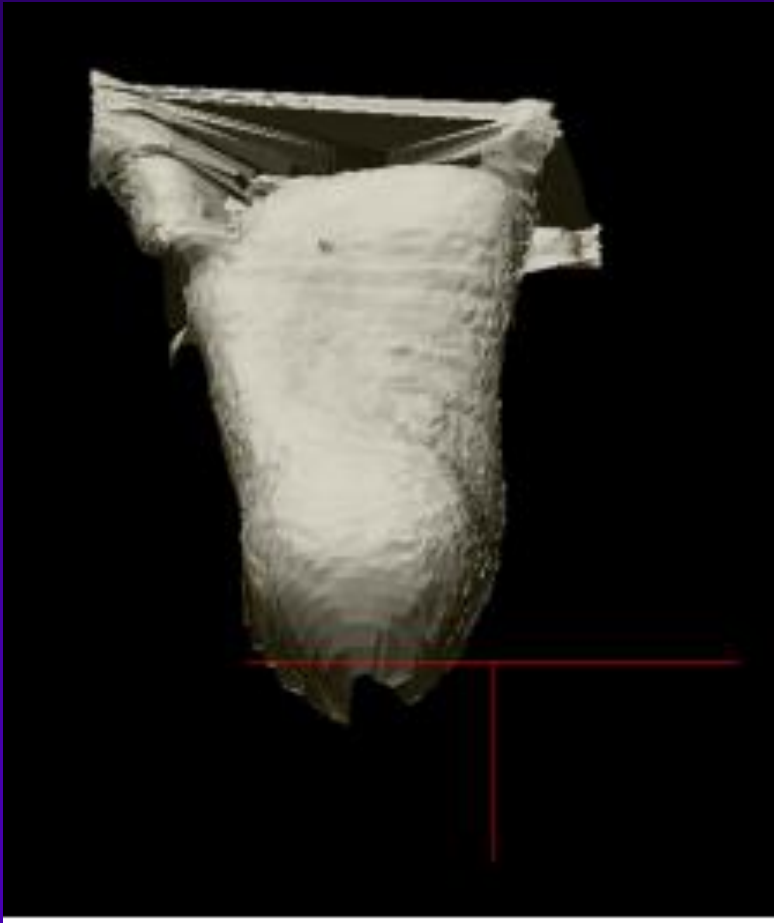


Excess varus captured
In orthosis

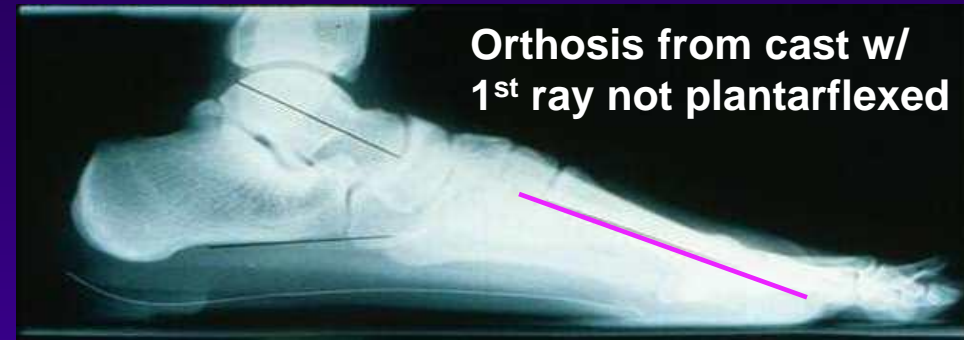
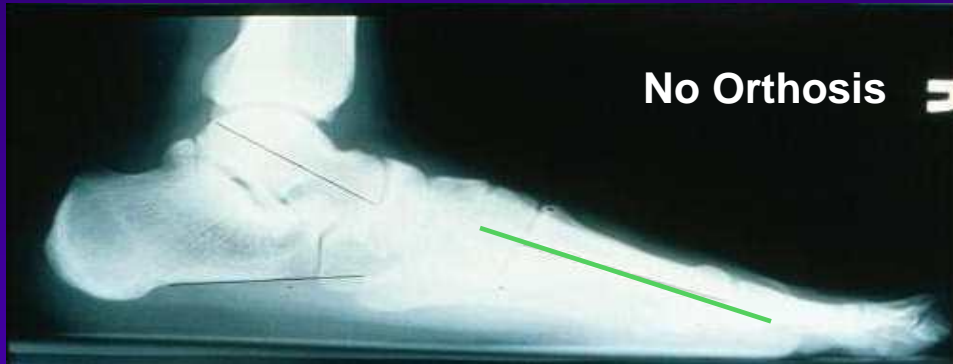


Foot Scanners That Allow NWB

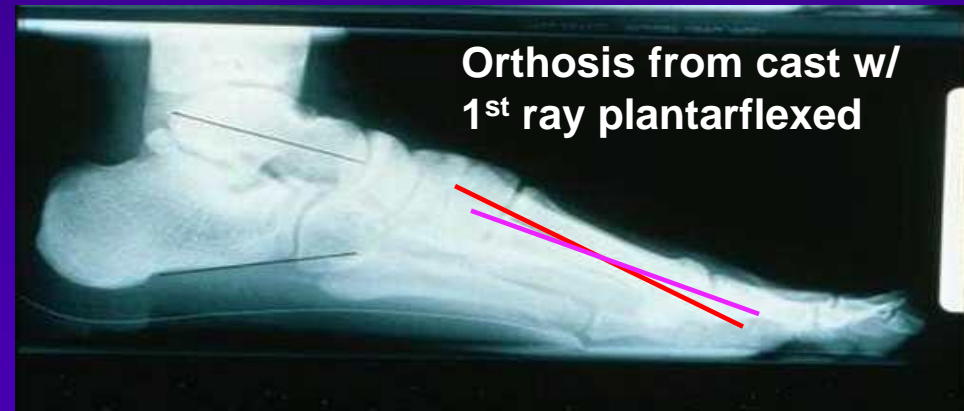
- Meets EBM



What Happens If You Don't Plantarflex First Ray When Casting?



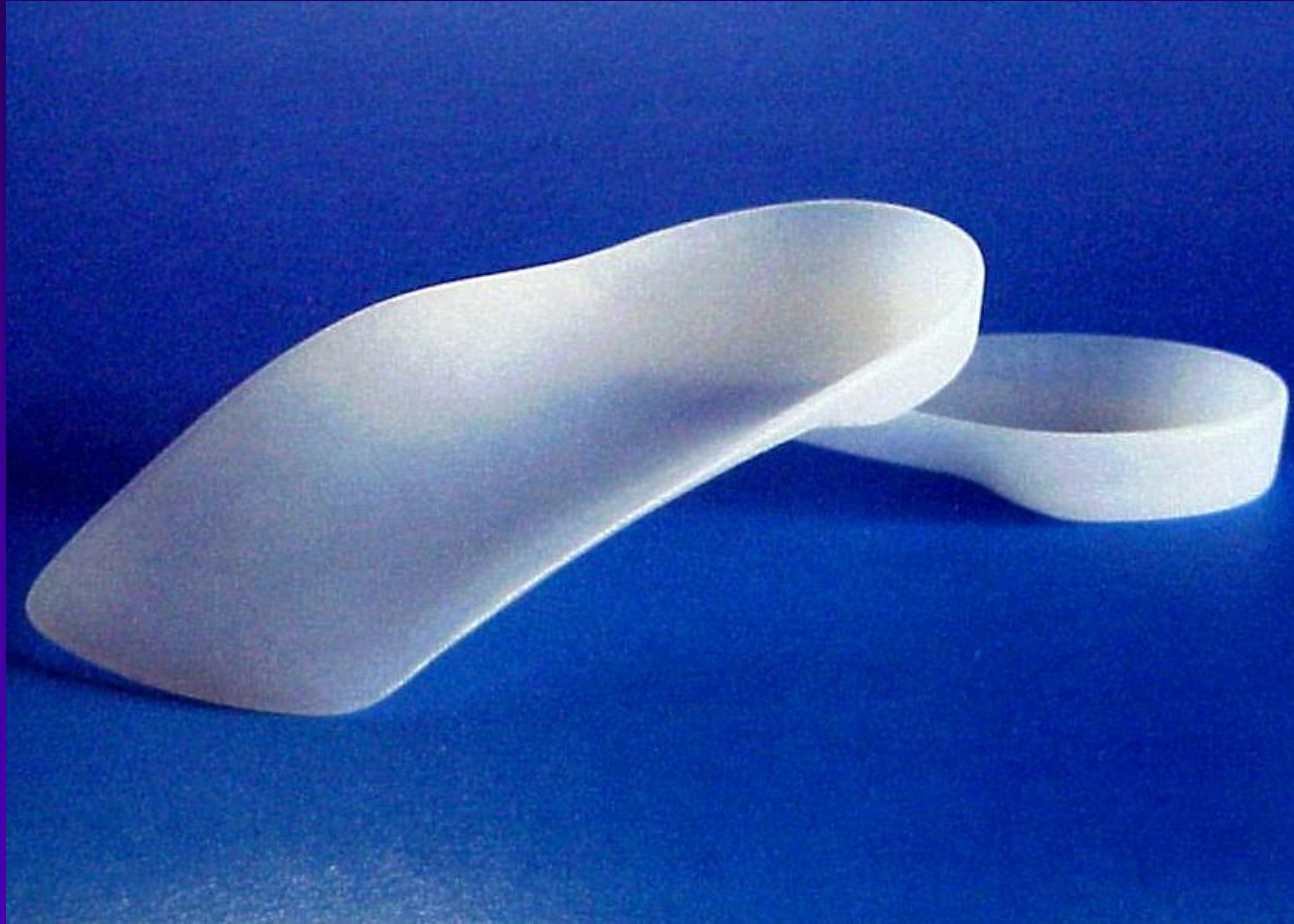
First ray dorsiflexed



First ray plantarflexed

Material Choice

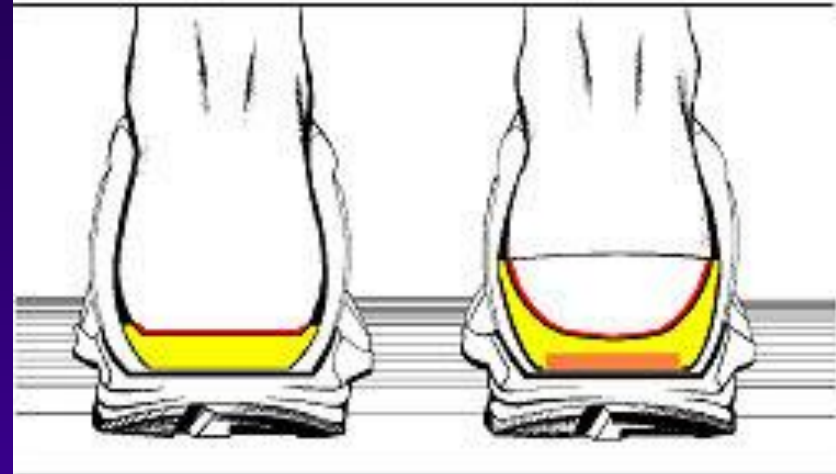
- Material: Semi-rigid



Castwork

HEEL CUP DEPTH

- ☐ Shallow (10mm)
- ☐ **Normal (14mm)**
- ☒ Deep (18mm)
- ☐ _____ mm



ORTHOTIC WIDTH

- ☐ Narrow
- ☐ **Normal**
- ☒ Wide
- ☐ Extra Wide Arch
- ☐ Medial Flange



Castwork

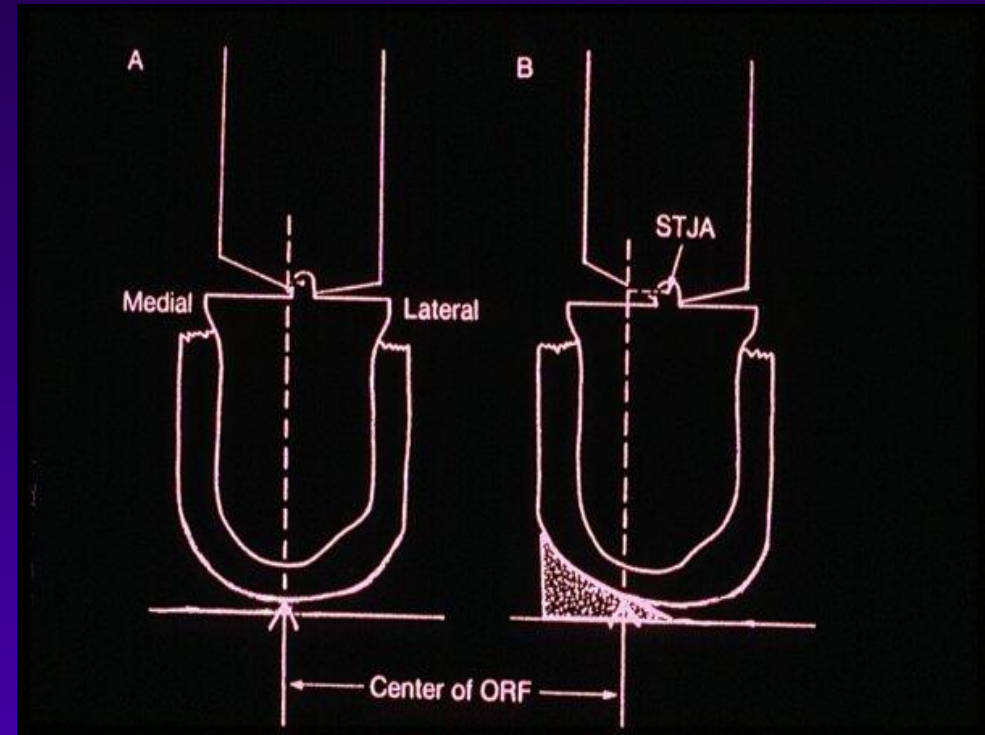
MEDIAL HEEL SKIVE

(minimum heel cup depth)

2mm R L (10mm)

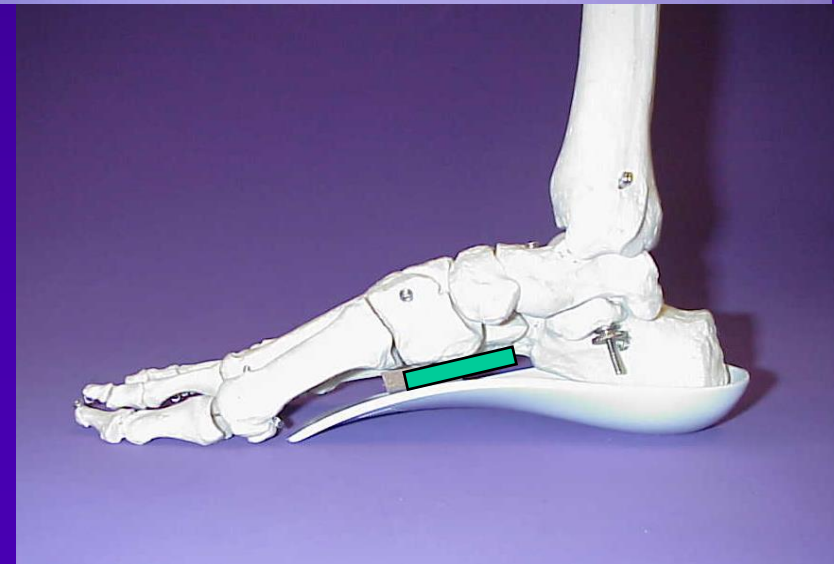
4mm R L (14mm)

6mm R L (18mm)



How Tight Should the Orthoses Conform to the Arch of the Foot?

Tighter orthotic supports base of first ray to allow first ray to plantarflex



Cast Fill / Inversion

■ Cast Fill

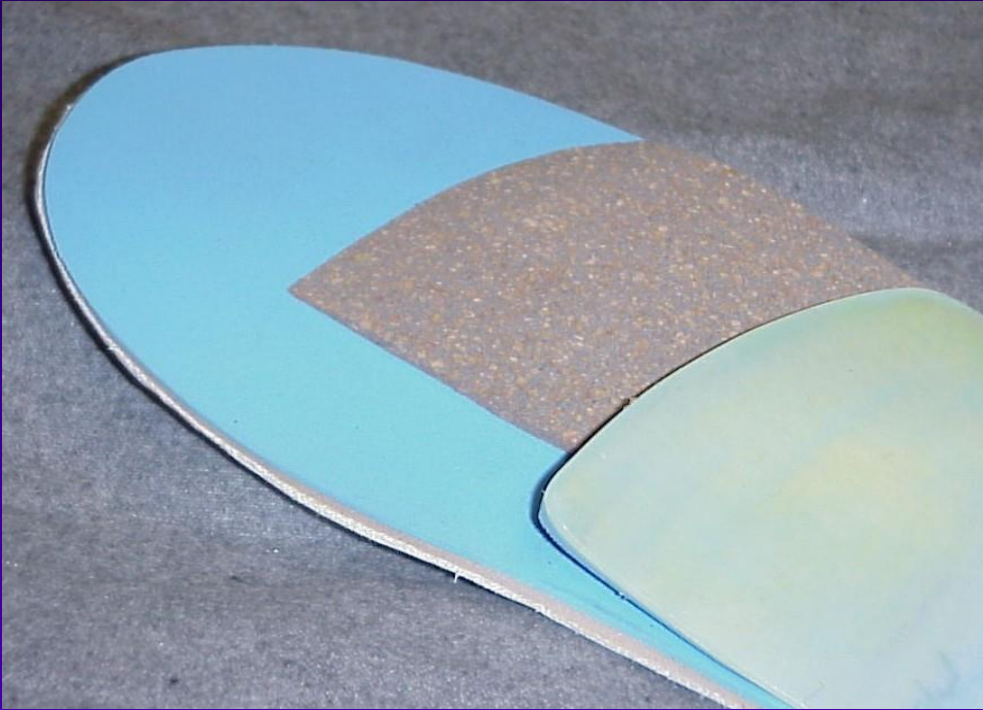
- Prescribe minimum fill
- Ensure that the lab does not overfill the medial arch
- Excess plaster expansion in the arch reduces the chance of arch irritation, but also reduces effectiveness



■ Inversion



■ Reverse Morton's Extension



Hallux Limitus Prescription

Casting	First ray plantarflexed
Material	Semi-rigid polypropylene
Width	Wide
Heel Cup Height	Standard or deep depending on heel eversion
Positive Cast Corrections	4mm medial heel skive if heel everted
	2° inversion
Posting	0/0 EVA rearfoot post
Covers	EVA to toes
Accommodations	Reverse Morton's extension

Take Home

- *Plantarflex the first ray when casting*
- *Positive castwork critical to outcome*
- *Prescribe to prevent rearfoot eversion*
- *Prescribe to decrease force under the first metatarsal head*

Thank You