TREATING SUBCALCANEAL PAIN: Who gets the best outcomes?

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Points of Confusion
Pathomechanics of Plantar Fascia overload:
Foot Pronation
STJ Pronation
MTJ Pronation
Longitudinal axis
Oblique axis
1st Ray movement
Arch Flattening

Fig. 15. Anatomic preparation of the foot with the plantar structures in view. Internal rotation is applied to the tibiotalar column and the foot is maintained in the plantigrade position. The height of the medial longitudinal arch measures 5.8 cm. It is lower as compared with a high arch situation measuring 7 cm. In the same specimen. The plantar aponeurosis (PA) and the abductor hallucis muscle (ABDH) are seen under tension. They are not undulant.

Fig. 12. Anatomic preparation of the foot with the plantar structures in view. External rotation is applied to the tibiotalar column and the foot is maintained in a plantigrade position. The height of the medial longitudinal arch measures 7 cm. It has increased as compared with a low arch situation measuring 5.8 cm in the same specimen. The plantar aponeurosis (PA) and the abductor hallucis muscle (ABDH) are seen relaxed and undulant.

PLANTAR FASCIITIS

Pronation of Subtalar Joint:
- Cannot by itself cause strain of PF
- Can only influence PF thru MTJ

- 84 Pts. Tx conservative for PF
- 115 of 133 feet had MTJ supination on longitudinal axis (86%)

**SUPP. OF MTJ LA**

- Everted Calc. past perpend.
- Flexible FF valgus
- Plantarflexed 1st Ray

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**COMPENSATION FF VALGUS**

A.)

B.)

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**Elevate Heel?**

- 12 cadaver limbs, static stance
- Strain transducer in central band PF
- 2 load levels: 337 N, 450N
- Heel Heights 2.0, 4.0, 6.0 cm
- Blocks: No significant difference in p.f. strain
- Shank contour platforms: sig. Decrease in p.f. Strain with elevation (p< 0.05)

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Foot types with a “normal” arch do not have any medial tarsal bone contact with the shank profile interface. Therefore, structural repositioning of the foot most likely occurs from lateral skeletal segments that touch the shank profile surface. This suggests that an extended support zone, from just under the calcaneus to the cuboid, decreases the medial truss-like action of the foot by permitting the metatarsals to plantarflex slightly.

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In-Vitro Study

- Nine fresh frozen specimens
- Axial load in static stance 225-900N
- 6 degree wedges: Medial & Lateral, RF & FF
- Strain in plantar fascia measured with reluctance transducer


Plantar Fascia Strain

Wedge under lateral forefoot decreased strain (p<0.05)
Wedge under medial forefoot increased strain (p<0.05)
Rearfoot wedges had no significant effect

Plantar Fascia Strain

Effect of shoe inserts:
3 devices significantly reduced strain:
1.) UCBL
2.) Viscoelastic footbed
3.) Cork & rubber footbed
2 devices did not reduce strain:
1.) Custom rigid functional foot orthosis
2.) Pre-fabricated stock orthosis

“One of the distinguishing features of the orthoses which decreased plantar aponeurosis strain was the surface contours of their medial and central regions and the angles related to their arch shape were more acute.”

Compensation PFFR

A.)

B.)

Compensation FF Valgus

A.)

B.)
Medial view of first ray dissected free of skin and muscle attachments. Method of sagittal plane measurement is demonstrated showing calipers on pin in medial cuneiform and "Devil's Level" on platform on 1st metatarsal.

- First Ray dorsiflexion precedes MTJ supination about longt. axis.
- First Ray dorsiflexes and inverts.

First Ray

Average total ROM = 12.38 mm
Total frontal plane motion = 8.23°
Sagittal/Frontal Ratio = 0.77°

Kelso SF, Richie DH, Cohen IR, Weed JH and Root M: Direction and range of motion of the first ray. JAPMA 72: 600, 1982

8°
Dynamic Gait

In terminal stance:

- Foot inverts
- 1st ray plantar flexes below 2-5

Due to:
- Peroneus longus
- Plantar intrinsics
- Windlass
First Ray Position

1. Same during gait vs. at rest?
2. Accurately depicted in neut susp cast?
3. Cast & orthotic modifications Based on activity?

Static Stance

- No windlass
- No plantar intrinsics
- No peroneus longus

First Ray Position

Static stance

Plantar intrinsics and peroneus longus inactive

Position

1st ray dorsiflexed to at least level of 2nd Met or to end ROM

“Certain forms of treatment for the foot originated from the basis of thinking that only considers the foot as a static structure. Accommodative appliances and arch supports are typical examples of methods of treatment based upon static considerations. Such methods are relatively ineffective in comparison with methods designed to control function of the foot during kinetic stance.”


“Static stance stability of the foot is of minor clinical significance. In most feet that function abnormally during kinetic conditions, the static stance periods are probably not very traumatic to the foot. Therefore, static stance can be considered to be clinically insignificant except in feet that are severely subluxed and pronated.”

“Most symptomatology and trauma to the foot is occasioned by instability of the foot that primarily develops during kinetic function. Therefore, the foot should be clinically evaluated and treatment consideration should be based primarily upon kinetic requirements of the foot. Treatment based upon static considerations has usually failed to provide more than partial relief of symptoms and that relief may be only temporary.”

Figure A & B: A, Reference marking for intrinsic forefoot balancing during the positive cast correction technique. B, Reference and corrective platforms for intrinsic balancing of the positive cast.

First Ray Position
Static stance – with orthosis

1-5 valgus
2-5 varus
No PF of 1st Ray

AOFAS Study
Use of custom foot orthotics

| Standing more than 8 hrs. per day | 44.4 |
| Standing less than 8 hrs. per day | 85.7 |


RELAXED STANCE
1. Extrinsic foot muscles inactive
2. Arch integrity maintained solely by plantar fascia

Basmajian, 1963
Huang, 1993
Reeser, 1983

Theory
1. The alignment of the First Ray is different in a neutral suspension cast position than it is in a weight bearing static stance position.
2. A functional foot orthosis (Root design) affects First Ray position differently in dynamic gait than during static stance.
Dynamic Gait

First Ray Position

Dynamic gait – with orthosis

1st Ray plantarflexes below 2-5

Inverting Foot

First Ray Position

Static stance – with orthosis

1st plantar flexes

First Ray Position

Static stance – with orthosis

1st dorsi flexes

First Ray Position

Dynamic gait – with orthosis

1st plantar flexes

First Ray Position

Static stance – with orthosis

1st dorsi flexes

1-5 valgus

2-5 ↓
First Ray Position

1-5 varus: with orthosis

- No 1st contact

Dynamic | Static

First Ray Overload

- Orthosis too wide
- Supinated cast – “false FF Varus”
- FF Varus post with no true FF Varus
- 2-5 varus with filler

Plantar Heel Pain

Orthotic Treatment Proposal

Goal: Prevent dorsiflexion overload of First Ray

Strategy: Assure that the first metatarsal remains plantar to the plane of the lesser metatarsals during static stance and during gait

Adding a FF varus post when there is no FF varus

- Post will push 1st met above 2 met
- 1st ray overload
- Plantar fascia overload
Step 1

- Neutral suspension cast position
- Subtalar neutral
- Load lateral column

Step 2

- Keep lateral column loaded
- Keep STJ in neutral
- Thumb under plane of 2-5
- Push up 1st metatarsal to end-ROM
I. Loaded Forefoot Valgus

A. 2-5
   1-5 valgus
   Light filler
   Balance 1-5

B. 2-5 valgus
   1-5 valgus
   Light filler
   Balance 1-5

CLASSIFICATION

Push-up
1st
Remains a 1-5 valgus
1st Met end ROM

Push-up
1st
1st Met moves to 2nd
II. Loaded Forefoot Varus

A 2-5 varus
1-5 valgus

Balance 2-5
1st cut out

Push-up

Becomes a 1-5 varus

B 2-5 varus
1-5

Balance 2-5
1st cut out

Push-up

1st

Becomes a 1-5 varus
II. Loaded Forefoot Varus

C 2-5 varus
1-5 varus

Supinatus

Push-up
1st

Solution

Push-down
on 1st

Balance 1-5
Light filler

“The Seal Beach Protocol”
Orthotic Management of Subcalcaneal Pain

Loaded FF Varus ➔
• Balance 2-5
• First Ray Cut Out

Loaded FF Valgus ➔
• Balance 1-5
• Light filler between platform
• No cut out

PROPOSED MECHANISM

1. 1st Ray dorsiflexes & inverts
2. MTJ supp. about long. axis
3. Eccentric cont. of abd. hallucis and FHB
4. Elongation strain of PF
5. Oblique MTJ pronation

MECHANISM OF PLANTAR FASCIAL OVERLOAD

FOREFOOT VALGUS OR PRONATED SUBTALAR JOINT CAUSINGHEEL TO PRONATE PAST PERPENDICULAR

FIRST RAY DORSIFLEXES AND INVERTS

MIDTARSAL JOINT SUPINATES ABOUT LONGITUDINAL AXIS

ECCENTRIC CONTRACTION OF FLEXOR HALLUCIS BREVIS, ABDUCTOR HALLUCIS

MEDIAL COLUMN FLATTENING

OVERLOAD OF PLANTAR FASCIA
Time Heals All Wounds…

Time Wounds All Heels…

Thank You