New Thoughts and Orthotic Strategies in the Treatment of Plantar Heel Pain Syndrome

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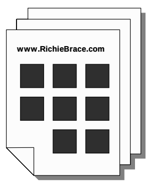
Lecture Handout Courtesy Of:

Allied OSI Orthotic Lab

For lecture notes:



www.richiebrace.com/handouts.htm

Demographics

Author	Male	Female	Mean Age
Wolgin (1994)	42	58	48
Tisdel (1996)	10	22	43
Pfeffer (1999)	76	160	48
Martin (1998)	94	62	45
Davis (1994)	31	74	48
Mizel (1996)	20	37	54
Gill (1996)	165	246	47
TOTAL	438	659	333
	40%	60%	(47.5 YRS)

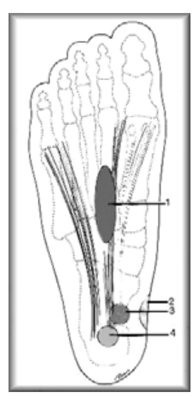
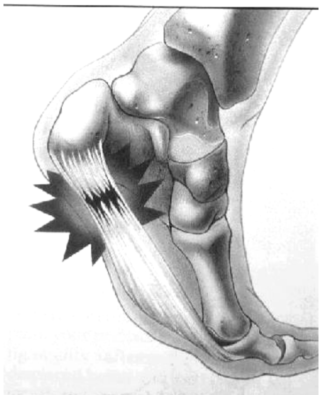


Fig. 7. Conditions capable of producing chronic plantar pain can be differentiated by the area of maximal tenderness: (1) plantar fasciitis, (2) entrapment of the first branch of the lateral plantar nerve, (3) heel pain syndrome, and (4) fat pad disorders.



SUBCALCANEAL PAIN

Nerve Entrapment ?

- **Medial calcaneal nerve**
  Savastano, 1985
- **Nerve to abd. dig. quint. brev.**
  Baxter, 1984

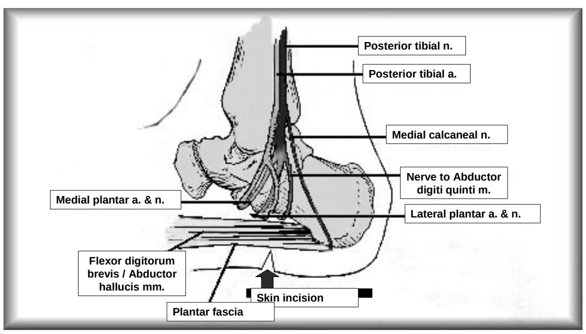
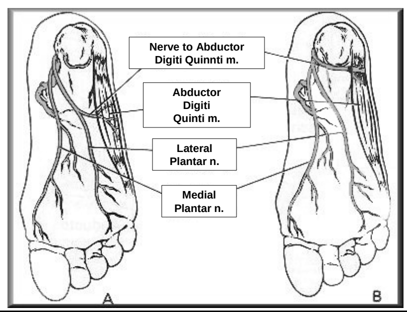


Fig. 2. Neurovascular anatomy of the subcalcaneal region. (From Ward WG, Clippinger FW: Proximal medial longitudinal arch incision for plantar fascia release. Foot Ankle 8:155, American Orthopaedic Foot & Ankle society 1987; with permission.)



Figs. 4A and 4B. (A) Anatomic depiction described in *Gray's Anatomy* of the location of the nerve to the abductor digiti minimi. (B) *Baxter's* anatomic specimen dissections found that this branch actually comes off more proximally, implicating it in the painful heel syndrome.

Causative Factors Of Heel Pain:

Obesity – O'Brien, Shikoff, Tanz

Pes Planus – Bordelon, 1993

Pes Cavus – Culter, 1986

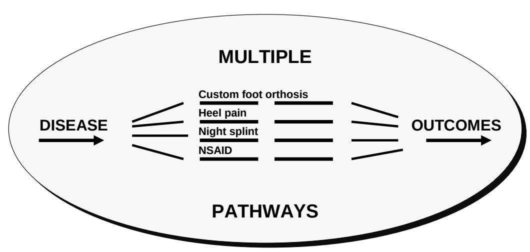
Tight Heel Cord – Kibler, 1991

Pronation of STS – Baxter, 1984 Gould, 1959
Hicks, 1954 Davis, 1990

Shock – McKenzie, 1985

Windlass Dysfunction – Ellis, 1988

Heel Pain Treatments



Pathogenesis

"It is reasonably certain that a condition which has so many different theories of etiology and treatment does not have valid proof of any one cause."

Snook and Chrisman Clin Orthop 82:163, 1972

Points of Confusion

echanics of Plantar scia overload:

- **ot Pronation**
- **TJ Pronation**
- **TJ Pronation**
  - ***Longitudinal axis***
  - ***Oblique axis***
- **Ray movement**
- **rch Flattening**

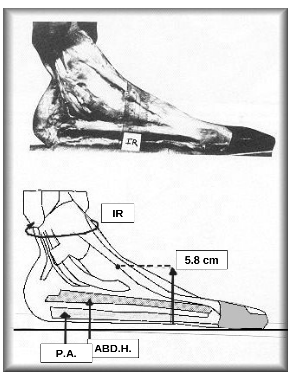


Fig. 15. Anatomic preparation of the foot with the plantar structures in view. Internal rotation is applied to the tibiotalar column and the foot is maintained in the plantigrade position. The height of the medial longitudinal arch measures 5.8 cm. It is lower as compared with a high arch situation measuring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

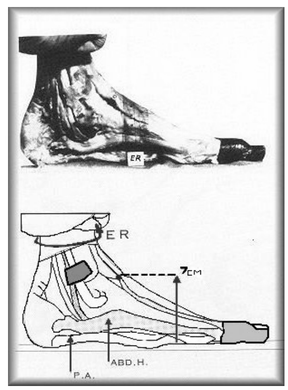


Fig. 12. Anatomic preparation of the foot with the plantar structures in view. External rotation is applied to the tibiotalar column and the foot is maintained in a plantigrade position. The height of the medial longitudinal arch measures 7 cm. It has increased as compared with a low arch situation measuring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

PLANTAR FASCIITIS

Pronation of Subtalar Joint :

- **Cannot by itself cause strain of PF**
- **Can only influence PF thru MTJ**

Scherer PR, The Biomechanics Graduate Research Group for 1988: Heel Spur Syndrome. Pathomechanics and non surgical treatment. Journal American Med Assoc 81:68, 1991.

- **73 Patients, 118 painful heels**
- **Treatments: NSAIDS, Steroid injection, Tape strapping, Foot Orthoses**
- **81% in group with tape strapping and orthoses achieved good results**
- **80% of all patients had foot deformity compensated by supination of longitudinal axis of midtarsal joint**

Scherer PR, The Biomechanics Graduate Research Group for 1988: Heel Spur Syndrome. Pathomechanics and non surgical treatment. Journal American Med Assoc 81:68, 1991.

- **80% of all patients had foot deformity compensated by supination of longitudinal axis of midtarsal joint**
- **Out of 133 painful heels:**
  63 had forefoot valgus
  33 had everted rearfoot
  20 had plantarflexed first ray

SUPP. OF MTJ LA

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

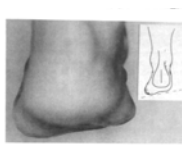


Figure 2. Type B, forefoot valgus.

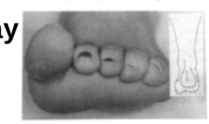
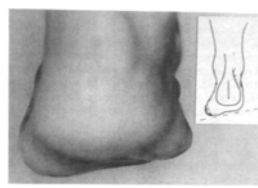


Figure 3. Type C, plantarflexed first ray.



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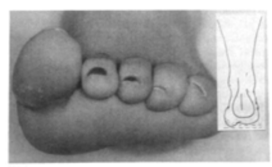


Figure 3. Type C, plantarflexed first ray.

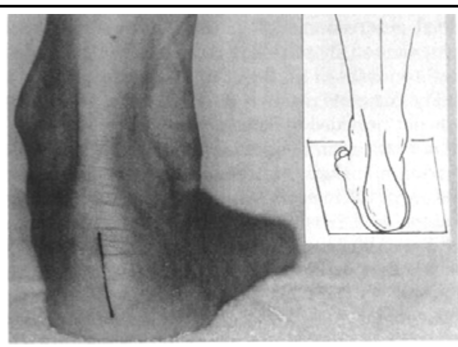
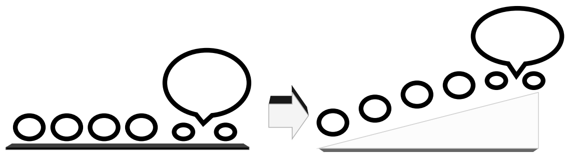


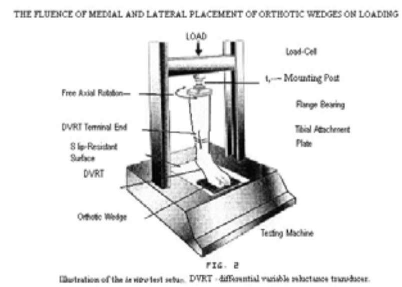
Figure 1. Type A, everted heel.

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**

Kogler GF, Veer FB, Solomonidis SE, Paul JP: The influence of medial and lateral placement of orthotic wedges on loading of the plantar aponeurosis. Journal Bone Joint Surgery 81-A:1403, 1999





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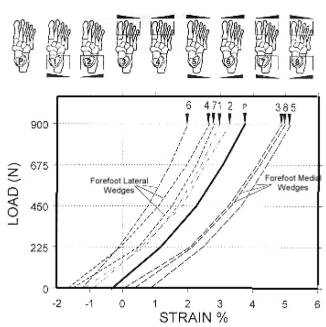


Kogler GF, Veer FB, Solomonidis SE, Paul JP: The influence of medial and lateral placement of orthotic wedges on loading of the plantar aponeurosis. Journal Bone Joint Surgery 81-A:1403, 1999

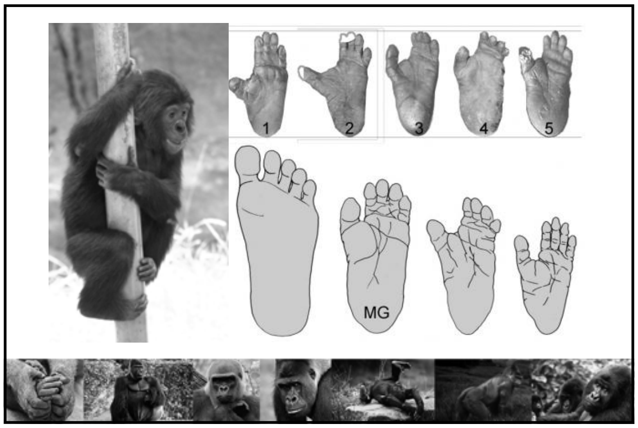
Plantar Fascia Strain

Wedge under lateral forefoot decreased strain ($p<0.05$)

Wedge under medial forefoot increased strain ($p<0.05$)

Rearfoot wedges had no significant effect

Kogler GF, Veer FB, Solomonidis SE, Paul JP: The influence of medial and lateral placement of orthotic wedges on loading of the plantar aponeurosis. Journal Bone Joint Surgery 81-A:1403, 1999



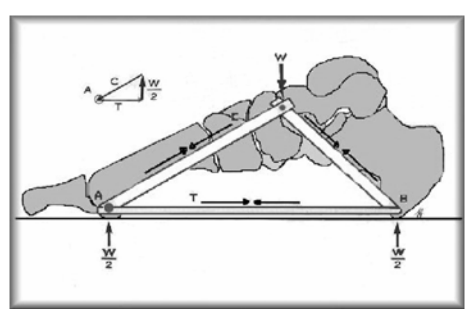
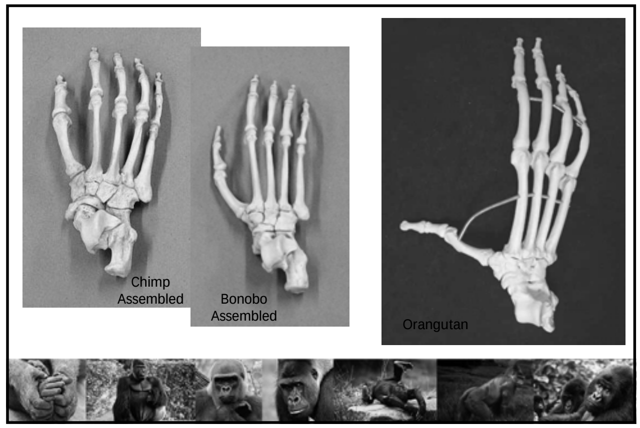
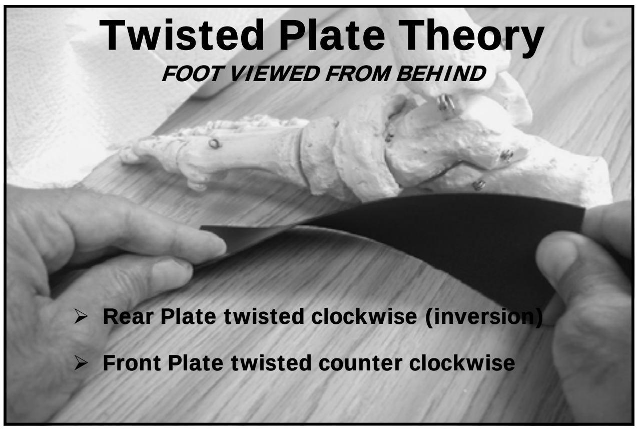


Fig. 7. The truss is a triangular structure. Under the load (W) the struts are under compression (C) and the tie-rod (AB) is under tension (T). Any joint, for example point A, is in vectorial equilibrium as indicated in the insert diagram. C compresses the point A and T tenses the same point.





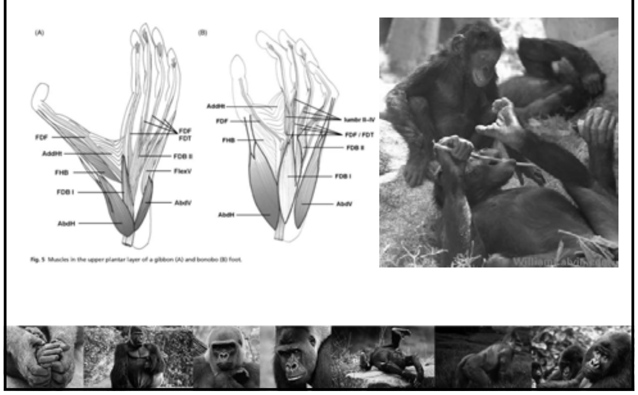
Twisted Plate Theory

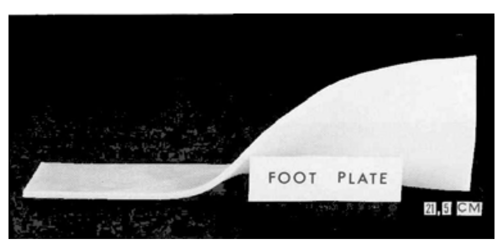
FOOT VIEWED FROM BEHIND

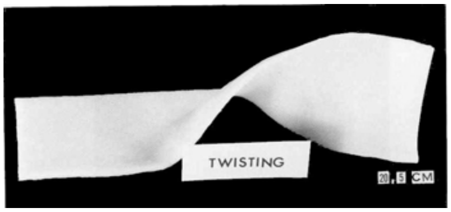
- **Rear Plate twisted clockwise (inversion)**
- **Front Plate twisted counter clockwise**

Twisted Plate Theory

RAISE ARCH:	**Invert Rear Plate** **Evert Front Plate**
LOWER ARCH:	**Evert Rear Plate** **Invert Front Plate**



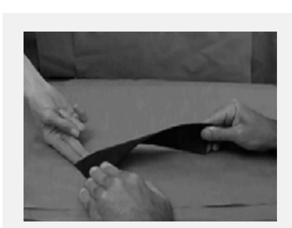


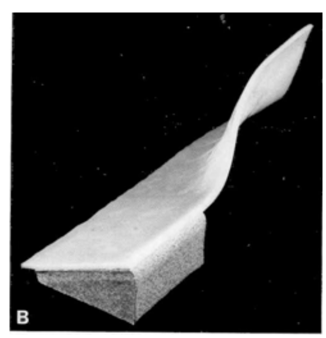


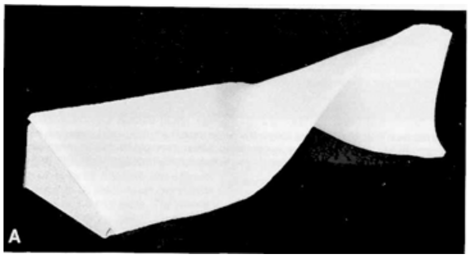
Twisted Plate Theory

RAISE ARCH: Invert Rear Plate
Evert Front Plate

LOWER ARCH: Evert Rear Plate
Invert Front Plate



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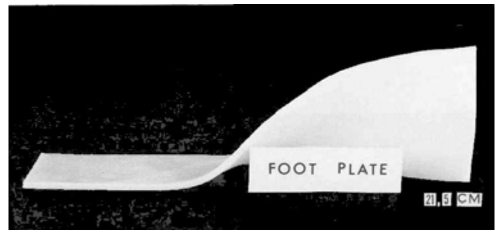
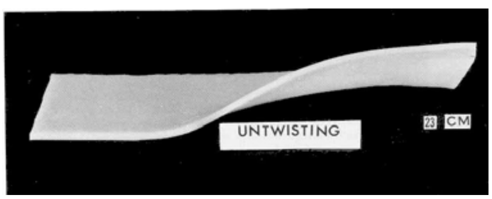
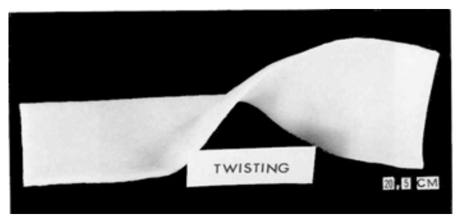
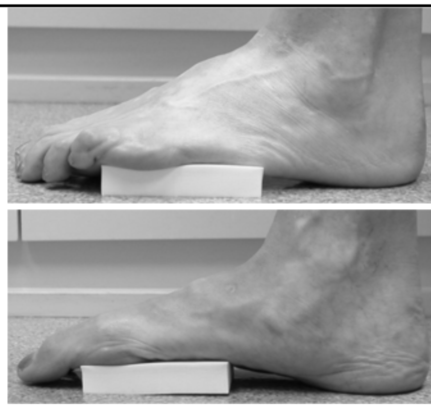

FOOT PLATE
21,5 CM

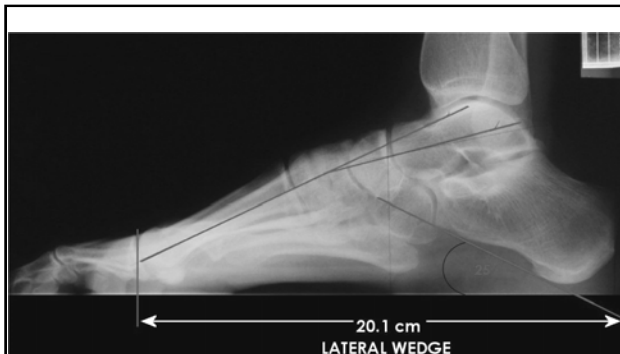

UNTWISTING
23 CM


TWISTING
20,5 CM

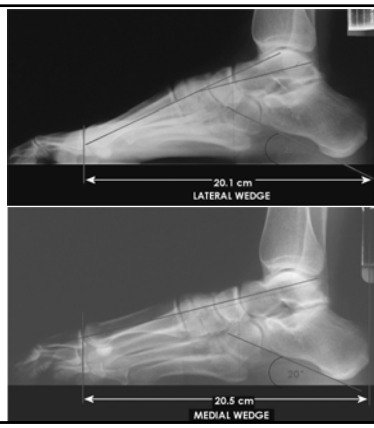


20.4 cm
NO WEDGE

20°
20.5 cm
MEDIAL WEDGE



20.1 cm
LATERAL WEDGE



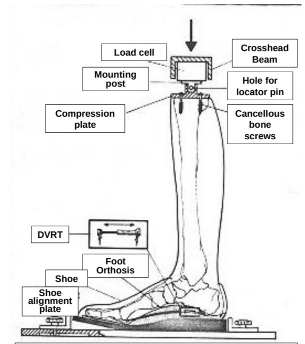


Figure 2. Diagramatic representation of the experimental set-up for testing the longitudinal arch support mechanism of foot orthoses.

Kogler GF, Veer FB, Solomonidis SE, Paul JP: Biomechanics of longitudinal arch support mechanisms in foot orthoses and their effect on plantar aponeurosis strain. Clinical Biomech 11:243, 1996

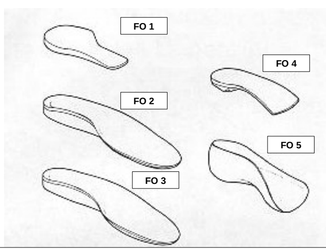


Figure 3. Illustrations of test orthoses for a left foot. FO no. 1, prefabricated stock orthosis; FO no2, custom viscoelastic orthosis; FO no. 3, custom semi-rigid orthosis; FO no. 4, custom rigid functional orthosis; FO no. 5, custom rigid UC-BL shoe insert

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

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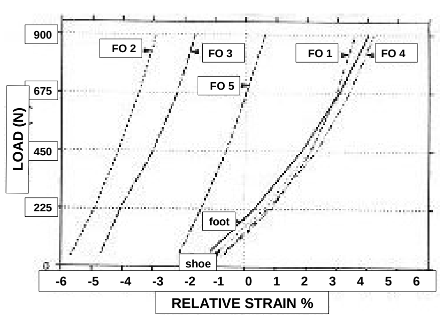

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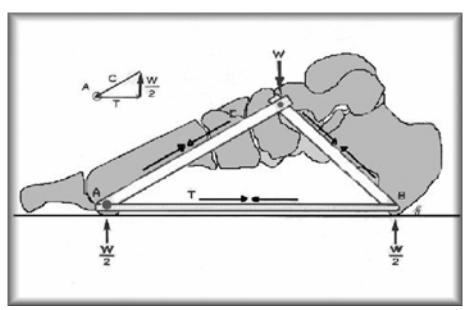

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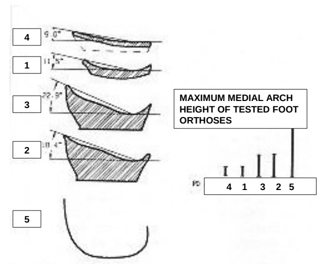
“One of the distinguishing features of the orthoses which decreased plantar aponeurosis strain was the surface contours of their medial and central regions and the angles related to their arch shape were more acute.”

Kogler GF, Veer FB, Solomonidis SE, Paul JP: Biomechanics of longitudinal arch support mechanisms in foot orthoses and their effect on plantar aponeurosis strain. Clinical Biomech 11:243, 1996



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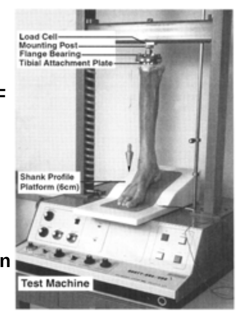
Elevate Heel?

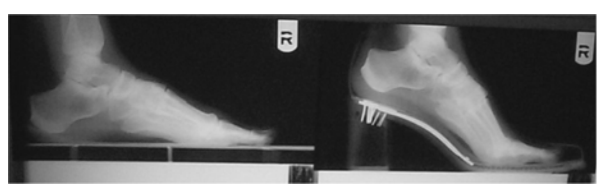
- **12 cadaver limbs, static stance**
- **Strain transducer in central band PF**
- **2 load levels: 337 N, 450N**
- **Heel Heights 2.0, 4.0, 6.0 cm**
- **Blocks: No significant difference in p.f. strain**
- **Shank contour platforms: sig. Decrease in p.f. Strain with elevation (p< 0.05)**



Kogler G.F., Veer F.B., Verhulst S.J., et. al. “The effect of heel elevation on strain within the plantar apneurosis: In Vitro Study.” Foot and Ankle 22:433-439, 2001.

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.

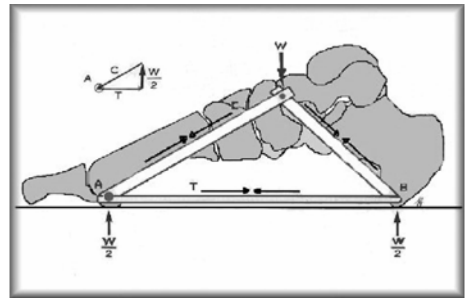
Kogler G.F., Veer F.B., Verhulst S.J., et. al. “The effect of heel elevation on strain within the plantar apneurosis: In Vitro Study.” Foot and Ankle 22:433-439, 2001.



Subcalcaneal Pain

Footwear considerations

1. Heel height
2. Shank stability
3. Home shoe program



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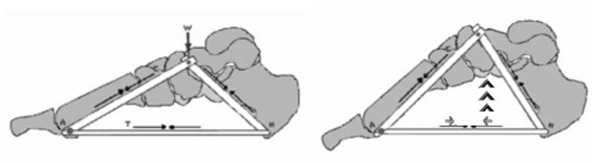
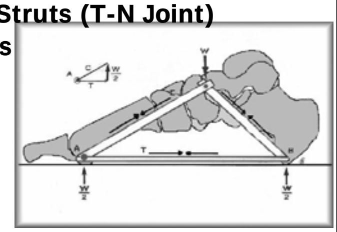


Medial Truss Theory

Reduce Plantar Fascia Strain:

Plantarflex Distal Strut (1st Ray)
Dorsiflex Proximal Strut (Calcaneus)
Elevate Junction of Struts (T-N Joint)
Elevate Lateral Truss



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 CAUSING HEEL TO PRONATE PAST PERPENDICULAR

↓

FIRST RAY DORSIFLEXES AND INVERTS

↓

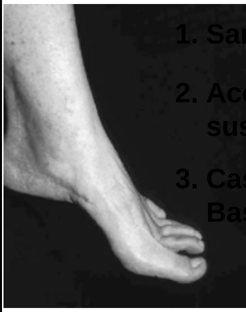
MIDTARSAL JOINT SUPINATES ABOUT LONGITUDINAL AXIS

ECCENTRIC CONTRACTION OF FLEXOR HALLUCIS BREVIS, ABDUCTOR HALLUCIS — MEDIAL COLUMN FLATTENING

↓

OVERLOAD OF PLANTAR FASCIA

First Ray Position



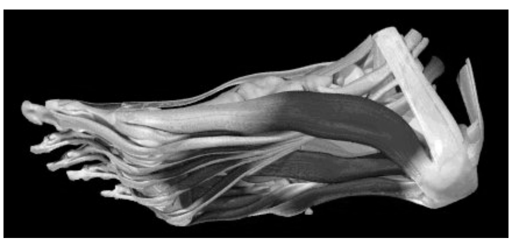
1. Same during gait vs. at rest?
2. Accurately depicted in neut susp cast?
3. Cast & orthotic modifications Based on activity?

Dynamic Gait

In terminal stance:

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

Due to: Peroneus longus
Plantar intrinsics
Windlass



Plantar Intrinsics

- No activity until 40% of gait cycle
- In pronated feet, activity at 10%
- Principal active role in arch stability
- No activity in standing feet

Mann and Inman, JBJS, 1964

RELAXED STANCE

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

Basmajian, 1963
Huang, 1993
Reeser, 1983

First Ray Position

Static stance

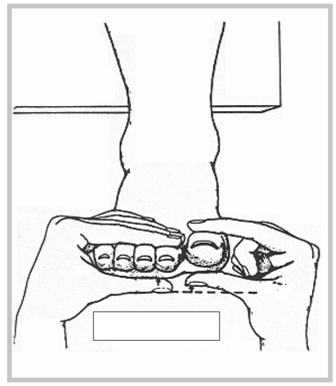
Plantar intrinsics and peroneus longus inactive

Position

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

Static Stance

- No windlass
- No plantar intrinsics
- No peroneus longus



AOFAS Study

Use of custom foot orthotics

	Rate of success
Standing less than 8 hrs. per day	85.7
Standing more than 8 hrs. per day	44.4

Pfeffer G et al: comparison of custom and prefabricated orthoses in the initial treatment of proximal plantar fasciitis. Foot & Ankle 20: 214, 1999

"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."

Root, ML, Orien, WP, Weed, JH: Clinical Biomechanics: Normal and Abnormal Function of the Foot, Vol 2. Los Angeles, Clinical Biomechanics Corp, 1977.

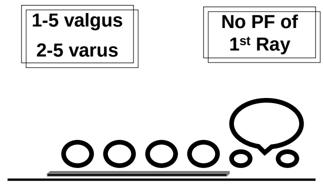
"Static stance stability of the foot is of minor clinical significance. In most feet that function abnormally during kinetic conditions, the static stance periods are probably not very traumatic to the foot. Therefore, static stance can be considered to be clinically insignificant except in feet that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

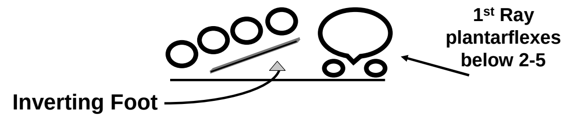
Root, ML, Orien, WP, Weed, JH: Clinical Biomechanics: Normal and Abnormal Function of the Foot, Vol 2. Los Angeles, Clinical Biomechanics Corp, 1977.

First Ray Position

Static stance – with orthosis



Dynamic Gait

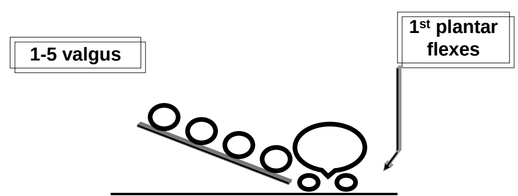


Theory

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.

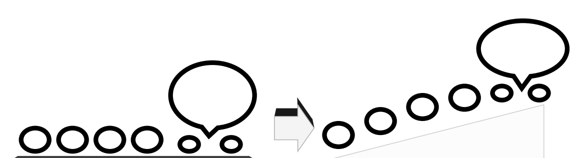
First Ray Position

Dynamic gait – with orthosis



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

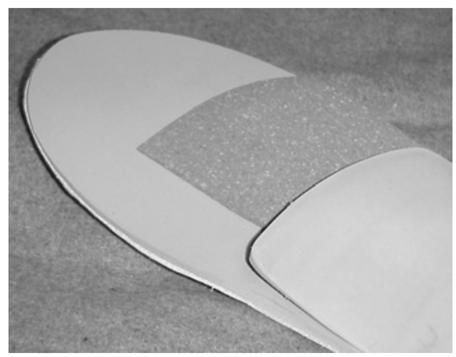
Goal: Prevent dorsiflexion overload of First Ray

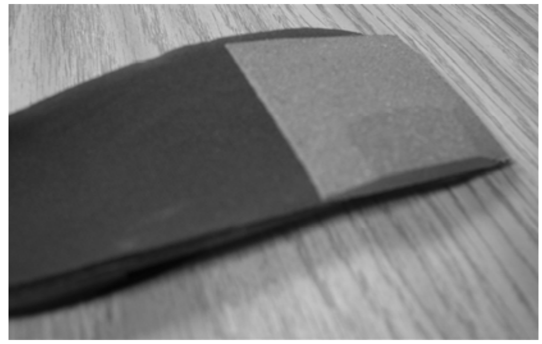
Strategy: Assure that the first metatarsal remains plantar to the plane of the lesser metatarsals during static stance and during gait

Plantarflex First Ray

ORTHOTIC STRATEGIES

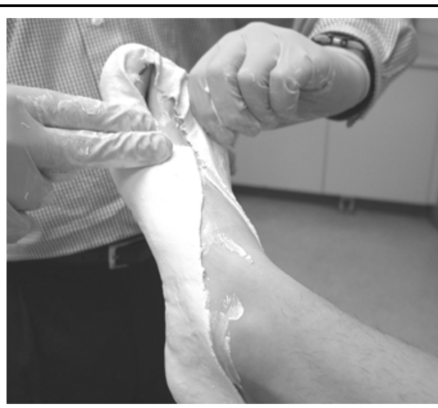
1. **Push down on 1st during Casting**
2. **Reverse Mortons Extension**
   or
   External FF Valgus Wedge
3. **Lite Filler between platforms**
4. **First Ray Cut Out**





Maximal Plantar Flexion Of First Ray

- Push down on First Ray During Casting Procedure



Maximal Plantar Flexion Of First Ray

- Push down on First Ray During Casting Procedure
- Light Filler Between Balancing Platforms

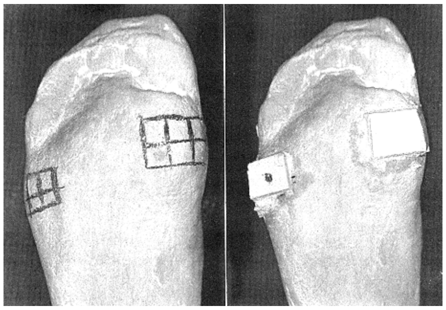
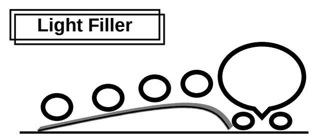


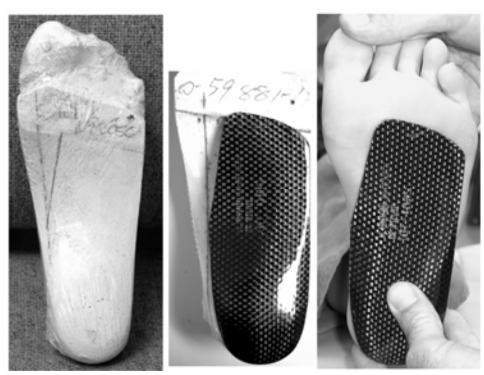
Figure A & B: A, Reference marking for intrinsic forefoot balancing during the positive cast correction technique. B, Reference and corrective platforms for intrinsic balancing of the positive cast.

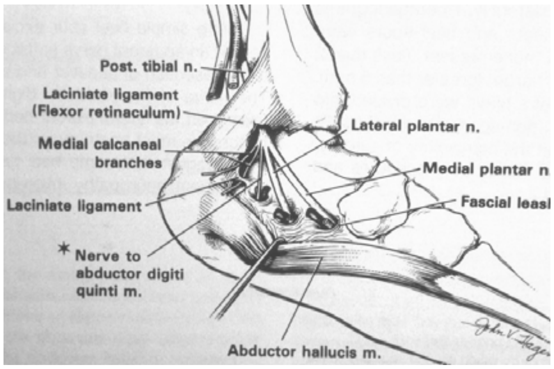


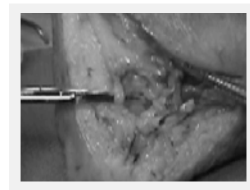
First Ray Cutout

Vs

First Met Accomodation







ABD ANAT

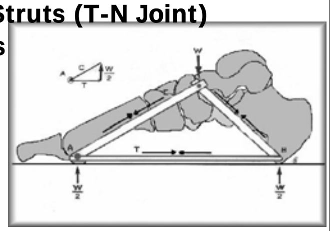
ABD TENSION

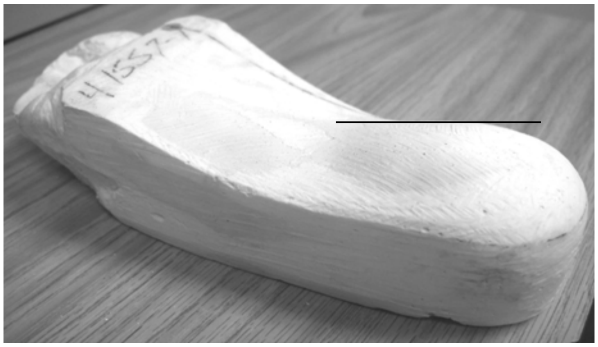
ABD TENSION

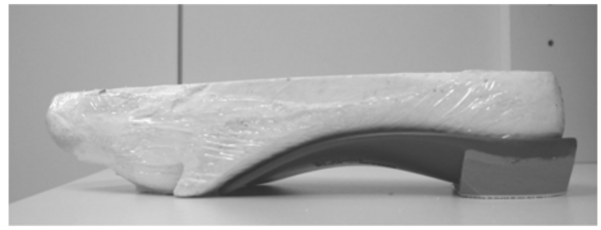
Medial Truss Theory

Reduce Plantar Fascia Strain:

Plantarflex Distal Strut (1st Ray)
Dorsiflex Proximal Strut (Calcaneus)
Elevate Junction of Struts (T-N Joint)
Elevate Lateral Truss







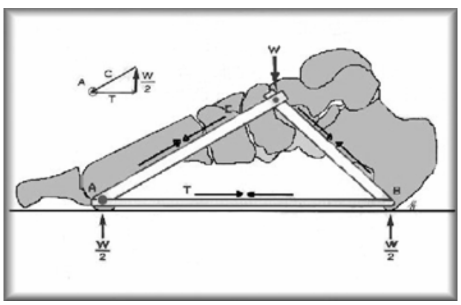


Fig. 7. The truss is a triangular structure. Under the load (W) the struts are under compression (C) and the tie-rod (AB) is under tension (T). Any joint, for example point A, is in vectorial equilibrium as indicated in the insert diagram. C compresses the point A and T tenses the same point.

Dorsiflex Calcaneus

(Increase Calcaneal Pitch)

1. **Decrease Load on Achilles**
   - ✓ **Stretching**
   - ✓ **Night Splint**
   - ✓ **Heel Lift**
2. **Contoured heel seat of FO**

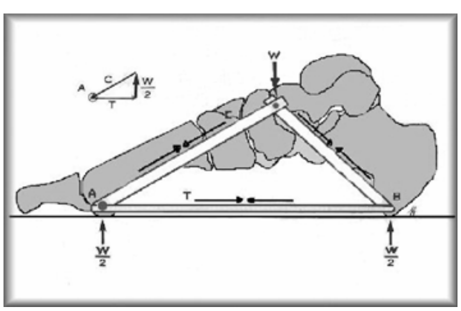


Fig. 7. The truss is a triangular structure. Under the load (W) the struts are under compression (C) and the tie-rod (AB) is under tension (T). Any joint, for example point A, is in vectorial equilibrium as indicated in the insert diagram. C compresses the point A and T tenses the same point.

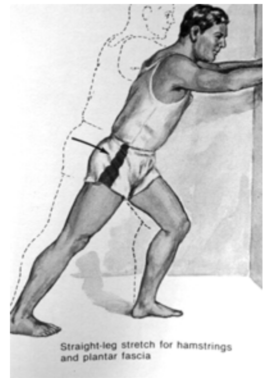
Heel Cord Tension

Subcalcaneal Pain

Treatment recommendations

3. Decrease passive loading of heel cord:

- **Heel elevation (footwear)**
- **Static stretching**
- **Night splint**

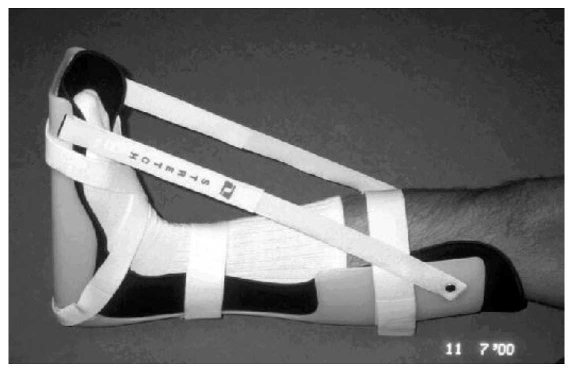


CONSERVATIVE TREATMENT

Which treatment worked best ?

TREATMENT	RATING
Stretching	29
Rest	25
NSAIDS	25
Cushion Inserts	22

Wolgin et al. "Conservative Treatment of Plantar Heel Pain" : "Long Term F/U" Foot & Ankle 15.1.5:97, 1994



Powell M, Post WR, Keener J, Wearden S: Effective treatment of chronic plantar fasciitis with dorsiflexion night splints: A crossover prospective randomized outcome study. Foot and Ankle 19:10, 1998

Pt Total: 37
Sx Present: 6 mo. or more
Tx: PF Night Splint 30 days
Assessment: Physician exam/interview
- Mayo Clinic Scoring System
- AOFAS Ankle Hindfoot Rating

Results:

Satisfied 59%

Satisfied with reservations 13%

Dissatisfied 10%

Could not wear splint 18%

CONCLUSION: **"We believe dorsiflexion splints provide relief from the symptoms of recalcitrant plantar fasciitis in the majority of patients."**

Batt ME, Tanji JL, Skattum N: Plantar fasciitis: A prospective randomized clinical trial of the tension night splint. Clin Journal Sport Med 6:158, 1996.

Patient total: 32
Sx present: 12.7 months
Tx: 2 Groups
1. NSAID, viscoelastic heel stretch (control)
2. Tension plantar fascia night splint (custom fabricated)

Assessment: Physician exam

Results:

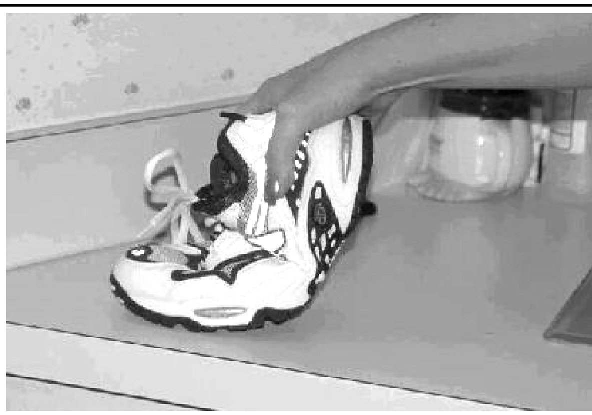
Group	Healed	Time to Healing
Control	6/17	8.8 weeks
TNS	16/16	12.5 weeks
Cross over	8/17	13 weeks

Conclusion: "…the TNS is an effective treatment for plantar fasciitis."

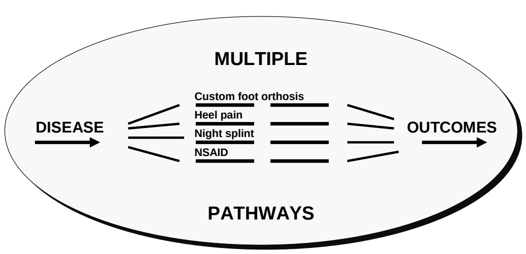
Subcalcaneal Pain

Footwear considerations

1. Heel height
2. Shank stability
3. Home shoe program



Heel Pain Treatments



Success with Orthotics

Rated most successful of all treatment:

Martin, 1998
Wolgin, 1994
O'Brien, 1985
Blake, 1985
Gross, 1991
Lynch, 1998
Ferguson, 1991

Scherer PR, The Biomechanics Graduate Research Group for 1988: Heel Spur Syndrome. Pathomechanics and non surgical treatment. Journal American Med Assoc 81:68, 1991.

Patient total: 73, 118 painful heels
Sx present: not reported
Tx: Tape Strapping, NSAID, Steroid Inj. Rigid foot orthosis
Assessment: Patient evaluation of % of pain relief

Results: Subgroup of strapping & orthosis only.
Good 81%
Fair 15% in 6 weeks
Poor 4%

- 63 of 133 painful heels had forefoot valgus
- 20 had plantarflexed first

- 33 had everted heel

(Thus, 80% had supp. long axis of MPJ)

Scherer PR, The Biomechanics Graduate Research Group for 1988: Heel Spur Syndrome. Pathomechanics and non surgical treatment. Journal American Med Assoc 81:68, 1991.

Conclusion: "This study demonstrates that with or without initial short term anti-inflammatory medication, mechanical control of the midtarsal joint is an effective treatment for heel spur syndrome."

Lynch D, Goforth WP, Martin JE, Odom RD, Preece CK, Kotler MW: Conservative treatment of plantar fasciitis – A prospective study. Journal American Pod Med Assoc. 88: 375, 1998

Patient total: 85
Sx present: 46 weeks
Tx: 3 Categories
1. NSAID & Steroid Inj.
2. Viscoelastic heel cup
3. Low dye strapping / arch pad functional foot orthosis

Assessment: Patient self-completed questionnaire, Physician evaluation, visualizing pain scale: 2,4,6 & 12 weeks

Lynch D, Goforth WP, Martin JE, Odom RD, Preece CK, Kotler MW: Conservative treatment of plantar fasciitis – A prospective study. Journal American Pod Med Assoc. 88: 375, 1998

Results:
Starting visual analog pain = 6.4
Finish (all 3 groups) 12 weeks = 2.0
68% improvement

Treatment failure:
(no improvement or adverse reaction)
2.3% in Group 1
42% in Group 2
4% in Group 3

Final Pain/activity assessment:

Group	G	F	P
1	20	13	67
2	10	20	70
3	40	30	30

Conclusion: "A significant difference was noted between groups with taping and orthosis proving to be more effective than either anti-inflammatory or accommodative modalities."

Mechanical vs. Accomodative

	Failure at 6 weeks	Good-Excellent Results at 12 weeks
Anti-inflammatory	23%	33%
Accommodative	42%	30%
Mechanical	4%	70%

Lynch D.M., Goforth W.P., Martin J.E. et al: Conservative Treatment of Plantar Fasciitis. A Prospective Study. JAPMA 88 : 375, 1998

Author	Duration of Treatment (mos)	Outcome (%) G	F	P
Wolgin	5.7	82	15	3
Tisdel	12	28	61	14
Martin	12	51	33	14
Davis	5.1	58	31	11
Mizel	16	59	18	22
Scherer	1.2	82	28	8
Lynch	3	12	7	8

Ideal Subcalcaneal Pain Treatment Outcome

	Yes	No
Absence of morning pain	✔	
Absence of day/night pain	✔	
Full work capacity	✔	
Return to previous recreation	✔	
Return to previous fitness	✔	
No unacceptable footwear restrictions	✔	
Restoration of strength – flexibility	✔	
Return to pre-injury mobility	✔	

Plantar Fasciitis: Custom vs. Pre-fab Foot Orthoses

RCT involving 135 participants

Random assignment into three groups:

- Sham orthosis (soft foam)
- Prefabricated orthosis (firm foam)
- Custom orthosis (semi-rigid plastic)

Duration of follow-up for each patient: 12 months

Landorf KB, Keenan AM, Herbert RD: Effectiveness of foot orthoses to treat plantar fasciitis. Arch Intern Med/ Vol 166, June 26th, 2006 pp. 1305-1310.

Plantar Fasciitis: Custom vs. Pre-fab Foot Orthoses

Results:

Compared with sham orthoses:

- Mean pain score with pre-fab orthoses was 8.7 points better (P=.05)
- Mean pain score with custom orthoses was 7.4 points better (P=.10)
- Mean pain score with custom orthoses was 7.4 points better (P=.10)
- Mean function score was 7.5 points better for custom orthoses (P=.04)

There were no differences between groups at the 12 month review.

Landorf KB, Keenan AM, Herbert RD: Effectiveness of foot orthoses to treat plantar fasciitis. Arch Intern Med/ Vol 166, June 26th, 2006 pp. 1305-1310.

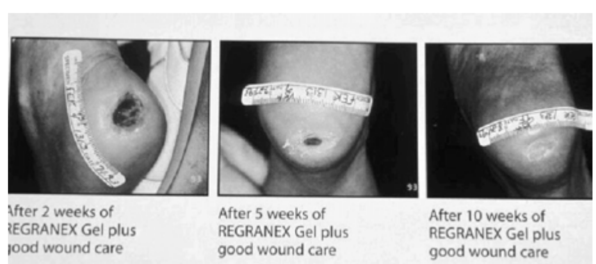
Is a Formthotic a "Prefabricated Orthosis"???

Why was the pain score not significantly different between the 3 groups?

Summary Of Heel Pain Treatment Studies

1. Patients have low expectation of achieving total permanent relief.
2. Acceptable time frame to achieve successful tx outcome?
3. Definition of success: Pain, patient satisfaction
4. Treatments deemed successful, yet:
   Significant # of pts still in pain
   Significant # of pts fail to comply & improve
   Significant length of time to achieve success
5. Multiple tx's yet "Which worked best?"
6. Physician assessment of success
7. Retrospective reviews

Time Heals All Wounds…



Time Wounds All Heels…

Martin RL, Irrgang JJ, and Conti SF: Outcome Study of Subjects with Insertional Plantar Fasciitis. Foot & Ankle Int. 19:803, 1998.

Duration of Sx:

30% > 12 mos.

54% > 6 mos.

Less likely to have good outcome if symptoms present for > 12 mo. before treatment.

P < .05

Martin RL, Irrgang JJ, Conti SF: Outcome study of subjects with insertional plantar fasciitis. Foot and Ankle 19:803, 1998.

CONCLUSION:

2. "This may add support to the observation that subjects with more chronic symptoms have a poorer outcome and that initiation of early, aggressive, non surgical therapy is appropriate and warranted."

Subcalcaneal Pain

Subjects with symptoms less than 12 months have the best outcome with non surgical treatment

Furrey, 1975	Arnis, 1988
O'Brien, 1985	Wolgin, 1994
Shikoff, 1986	Mizel, 1996
	Martin, 1998

Heel Pain = What is a quality outcome? / What is the overall cost?

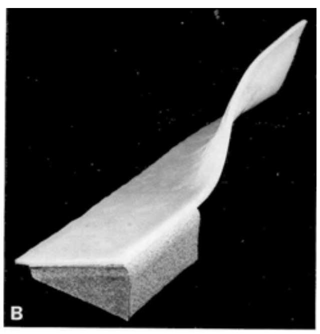
Ideal Subcalcaneal Pain Treatment Outcome

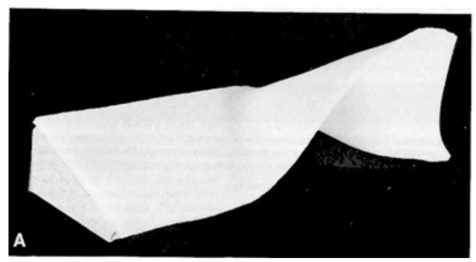
	Yes	No
Absence of morning pain	✔	
Absence of day/night pain	✔	
Full work capacity	✔	
Return to previous recreation	✔	
Return to previous fitness	✔	
No unacceptable footwear restrictions	✔	
Restoration of strength – flexibility	✔	
Return to pre-injury mobility	✔	

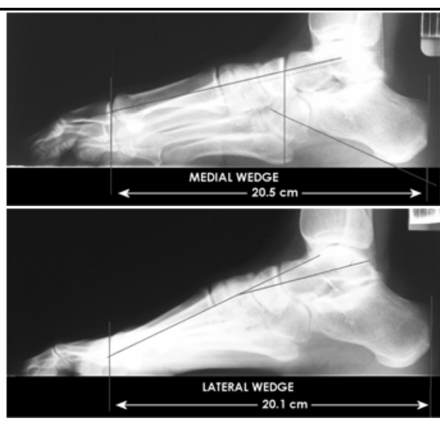
American Academy of Podiatric Sports Medicine

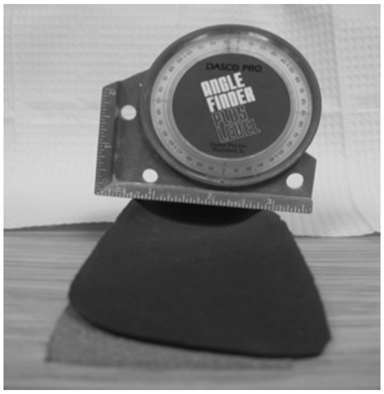
Raise Medial Arch at T-N Joint

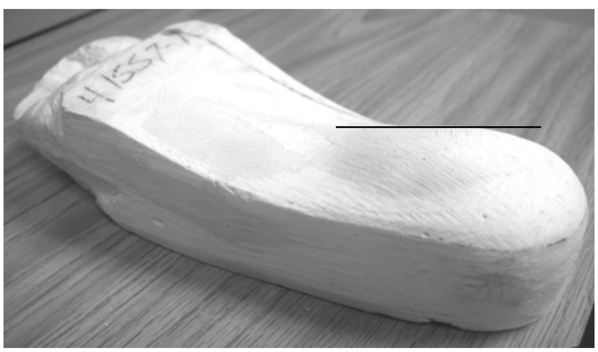
1. Twist the plate – Evert FF
   Lateral FF wedge
2. Plaster expansion at T-N – not a filler
3. Wider footplate at T-N narrower at 1st Ray

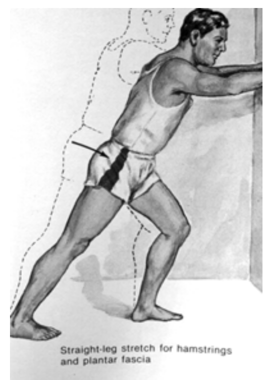












CONSERVATIVE TREATMENT

Which treatment worked best ?

TREATMENT	RATING
Stretching	**29**
Rest	**25**
NSAIDS	**25**
Cushion Inserts	**22**

Wolgin et al. "Conservative Treatment of Plantar Heel Pain" : "Long Term F/U" Foot & Ankle 15.1.5:97, 1994

Subcalcaneal Pain

Treatment recommendations

4. Footwear program:

- **Elevated heel**
- **Shank stability**
- **Home shoe use**

Lecture Handout Courtesy Of:

Allied OSI Orthotic Lab

PATHOMECHANICS

- LEG LENGTH INEQUALITY
- PRONATION OF STJ
- RESTRICTED DORSIFLEX
- HIGH ARCH FOOT
- LOW ARCH FOOT
- HEEL STRIKE SHOCK

Arch Elongation

Varus FF Wedge

Valgus FF Wedge

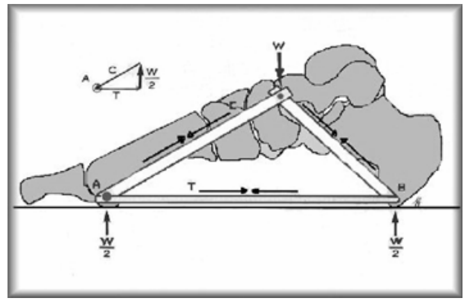
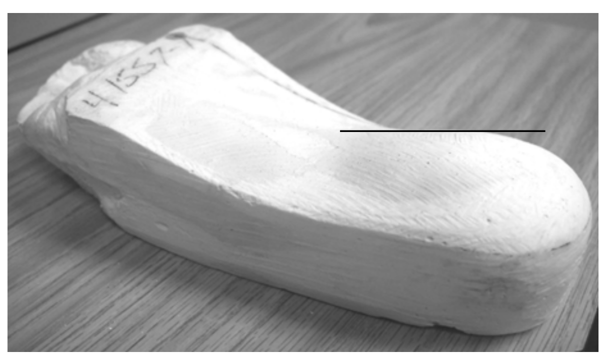
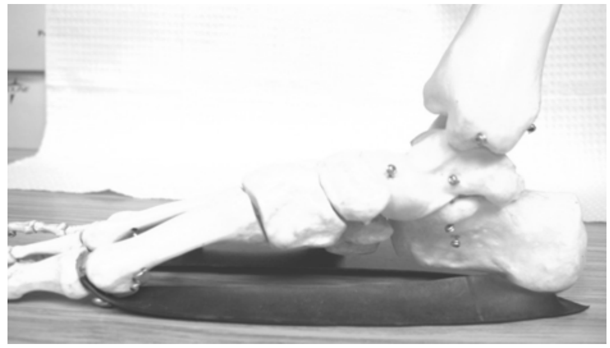


Fig. 7. The truss is a triangular structure. Under the load (W) the struts are under compression (C) and the tie-rod (AB) is under tension (T). Any joint, for example point A, is in vectorial equilibrium as indicated in the insert diagram. C compresses the point A and T tenses the same point.

Raise Lateral Truss

1. FF Valgus Post
2. Minimal Plaster Fill at CC joint
3. Contoured Shank Footwear





Subcalcaneal Pain

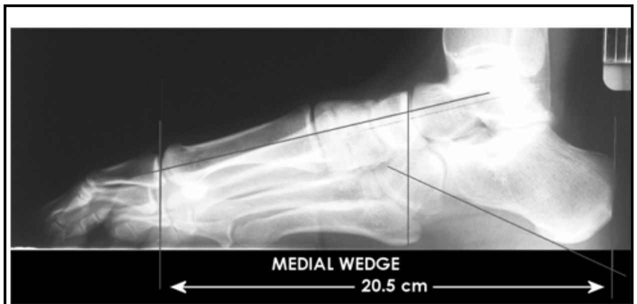
Treatment recommendations

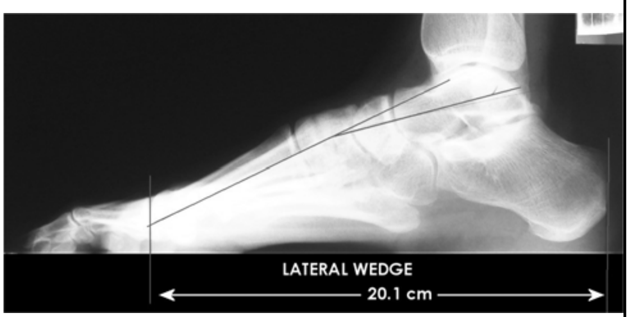
1. Prevent overload (dorsiflexion) of first ray:
   - Light filler between platforms
   - Balance 2-5, 1st ray cut out
   - Avoid wide orthotic plate
   - Don't capture a false FF varus

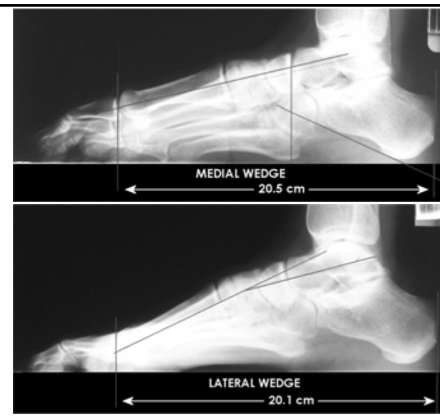
Subcalcaneal Pain

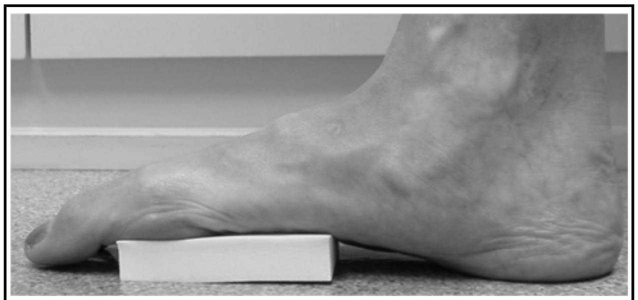
Treatment recommendations

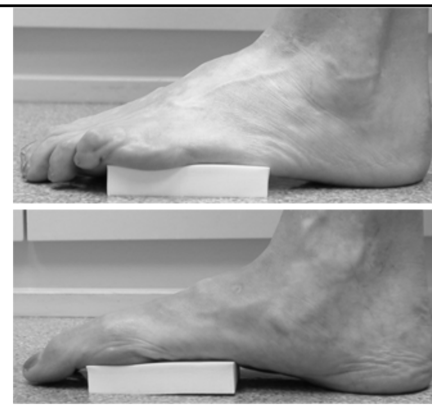
2. Minimize supination of longitudinal Axis of MTJ:
   - Prevent rearfoot eversion
   - If present, capture FF valgus


MEDIAL WEDGE
20.5 cm


LATERAL WEDGE
20.1 cm


MEDIAL WEDGE
20.5 cm
LATERAL WEDGE
20.1 cm





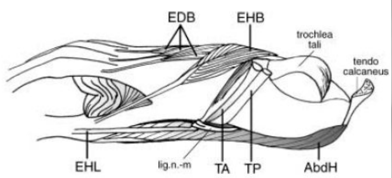


Fig. 3 Medial view of a bonobo foot. Lig. n-m = naviculo-metatarsal ligament.

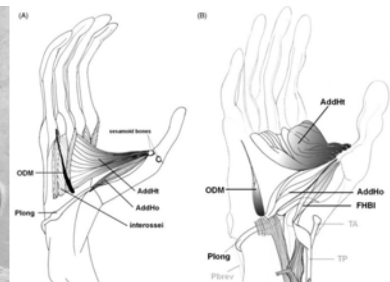


Fig. 6 Hallucal muscles in the upper plantar layer of a gibbon (A) and bonobo (B) foot.

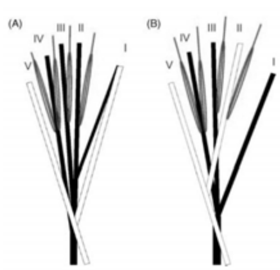


Fig. 4 Schematic distribution of the m. flexor fibularis (FF, in black) and m. flexor tibialis (FT, in white) tendons and the mm. lumbricales (red) in the gibbon (A) and bonobo (B) foot.

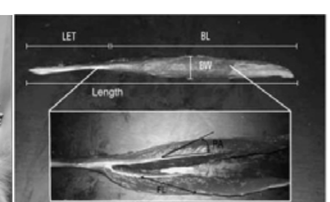
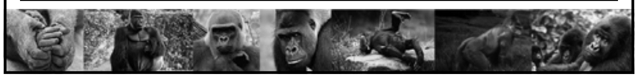


Fig. 1 Illustration of the different measurements taken on the isolated muscles. Muscle fibre length (FL) and pennation angle (PA) are measured on the longitudinally dissected muscle belly (lower inset). Legend: Length = total muscle–tendon length, BL = muscle belly length, BW = belly width, LET = length of the external tendon, FL = muscle fibre length and PA = pennation angle.

Like the hand, the foot has three anatomical regions: (1) The seven bones of the tarsus form the ankle and proximal half of the foot. (2) The middle portion of the foot consists of five metatarsals. (3) Phalanges, the skeletal elements of the toes, have the same number and arrangement as in the fingers.

The primary difference between the human and chimp foot is the contrast between prehensile functions of the ape foot and the anatomy of bipedal striding in the human. The chimpanzee foot has an opposable hallux and long phalanges. The human foot has greatly reduced digits, with all metatarsals parallel and an increase in the lever arm of the tarsus for striding. In the human foot, a longitudinal arch provides a shock absorbing and weight distribution system. The orientation of the ankle joint allows the tibia to take a straighter path over the foot during walking



Dr. Meldrum has been investigating the ways monkeys, apes and human ancestors get around, or locomote, for nearly fifteen years. Some of his research has focused on the way in which the human foot has adapted to the habit of walking on two feet (bipedalism). His research compares and contrasts the anatomy and function of diverse primate feet -- the interaction of the muscles ligaments and bones, as well as the sole pad and skin ridges. He has also taught courses in comparative primate anatomy, the fossil record of primate and human evolution, and currently teaches human anatomy in the Health Professions Programs at Idaho State University.

Representative Publications:

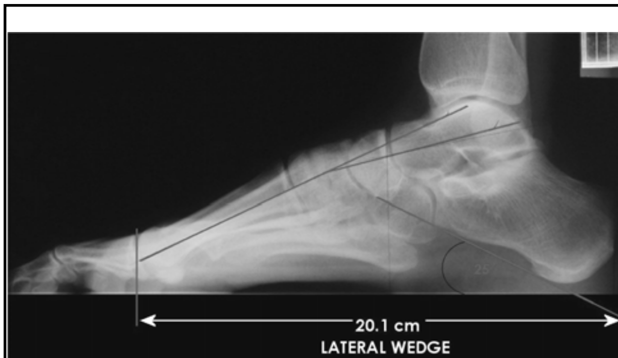
Meldrum, DJ and Wunderlich, RE. (1998) Midtarsel flexibility in ape foot dynamics, early hominid footprints and bipedalism. Am. J. Phys. Anthropol. Suppl 26. (In press)

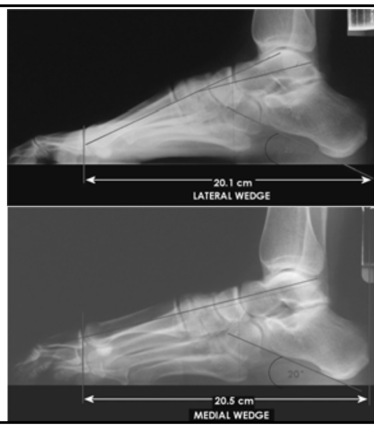
Hamrick, MW, Meldrum, DJ and Simons, EL (1995). Anthropoid phalanges from the Oligocene of Egypt. Journal of Human Evolution. 28:121-145.

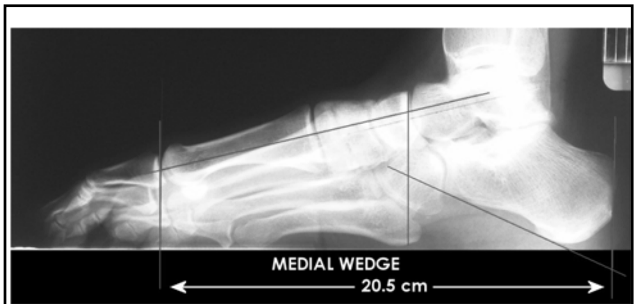
Meldrum, DJ (1993). On plantigrady and quadrupedalism. American Journal of Physical Anthropology 91:379-385.

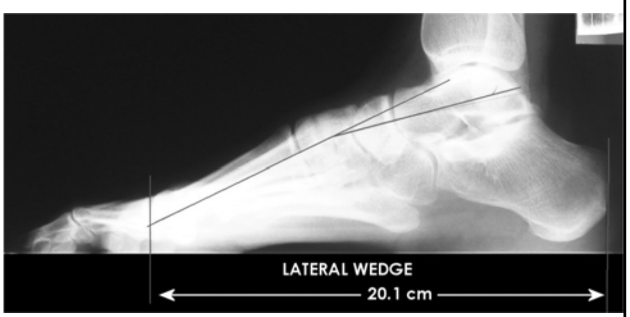
Jungers, WL, Meldrum, DJ and Stern, JT, Jr. (1993) Evolutionary and functional significance of the human peroneus tertius muscle. Journal of Human Evolution 25:377-386.

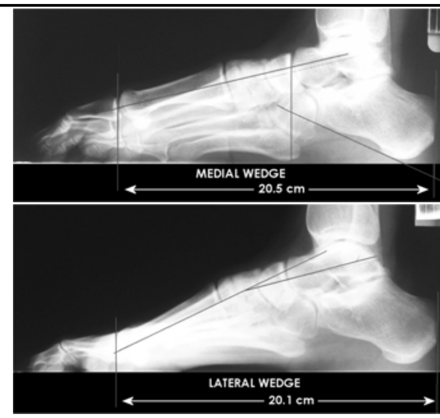
Meldrum, DJ (1991). The kinematics of the cercopithecine foot on arboreal and terrestrial substrates with implications for the interpretation of hominid terrestrial adaptations. American Journal of Physical Anthropology 84:273-289.

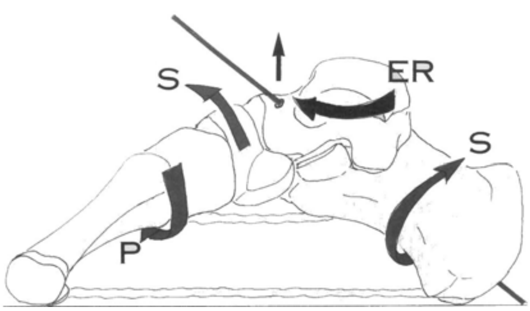



20.1 cm
LATERAL WEDGE
20.5 cm
MEDIAL WEDGE


MEDIAL WEDGE
20.5 cm


LATERAL WEDGE
20.1 cm


MEDIAL WEDGE
20.5 cm
LATERAL WEDGE
20.1 cm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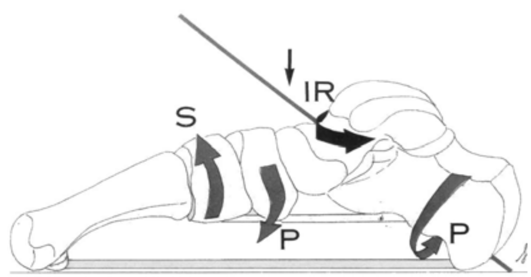
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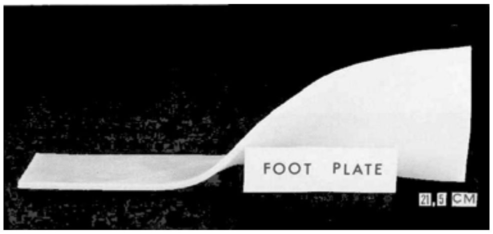
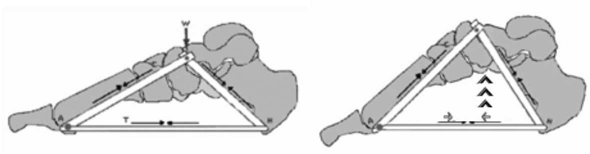


Twisted Plate Theory

RAISE ARCH: **Invert Rear Plate**
Evert Front Plate

LOWER ARCH: **Evert Rear Plate**
Invert Front Plate



Scherer PR, The Biomechanics Graduate Research Group for 1988: Heel Spur Syndrome. Pathomechanics and non surgical treatment. Journal American Med Assoc 81:68, 1991.

Patient total: 73, 118 painful heels
Sx present: not reported
Tx: Tape Strapping, NSAID, Steroid Inj. Rigid foot orthosis
Assessment: Patient evaluation of % of pain relief

Results: Subgroup of strapping & orthosis only.
Good 81%
Fair 15% in 6 weeks
Poor 4%

- 63 of 133 painful heels had forefoot valgus
- 20 had plantarflexed first

- 33 had everted heel

(Thus, 80% had supp. long axis of MPJ)

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

Scherer et al: JAPMA 81:68, 1991