Plantar Fasciitis: Evidence Based Evaluation and Treatment of Plantar Heel Pain

Jaime L. Caillet, PT, DPT, OCS, Cert. DN

- Relevant Anatomy and Biomechanics Review
- Plantar Fascia: Morphology
- Epidemiology and Etiology
- Examination and Evaluation
- Plantar Heel Pain Treatment:
  - Exercise
  - Modalities
  - Dry Needling
  - Clinical Practice Guideline Recommendations
Plantar Fasciitis
Epidemiology/Etiology

• Occurs in ~2 million Americans each year; ~10% of population over course of lifetime

• Projected cost between US$192 and US$376 million to 3rd party payers

• Evidence supporting noninflammatory aspect of condition emphasizing degenerative changes to plantar fascia
  – Referred to as plantar heel pain or plantar fasciopathy

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Epidemiology/Etiology

• Risk factors include:
  – Decreased ankle DF ROM
  – Spending majority of workday on feet
  – BMI >30 kg/m²
  – Running excessively/sudden incr run mileage
  – Pes planus
  – High arch foot type

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Anatomy

• Consists of 3 bands: lat, med, central
• **Central band** originates from med tubercle on plantar surface of calcaneus and travels toward toes as a solid band of tissue dividing just prior to MT heads into 5 slips
• When toes are ext, PF shortened as Hicks described as Windlass Effect

Windlass Mechanism

• Originally described by Hicks: passive DF of the hallux causes MLA to rise, rearfoot to supinate, leg to ER and tension to plantar aponeurosis
• As MTP joints are DF in push-off, a windlass effect tightens the plantar fascia

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Windlass Mechanism

- With increasing loads PF becomes progressively stiffer and more able to resist deformation
- Promotes inversion of the calcaneus and supination of the STJ and helps establish a rigid lever for push-off$^5$
Anatomy

- Anatomical continuity exists between fibers of Achilles tendon and plantar fascia in cadavers with aging ↓ number of fibers connecting Achilles tendon and PF
- Most common site of abnormality is near origin or enthesis of central band of the plantar aponeurosis at med calcaneal tubercle
- Less common is sx in mid portion of central band just prior to it splitting into the 5 slips

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Morphology

• Chen et al studied association between PF vascularity and fascia thickness in chronic plantar fasciitis pts. and its relation to pain and dysfunction
• Incr vascularization at prox PF is assoc. with greater pain intensity and both greater fascia thickness and vascularization is assoc. with incr foot dysfunction in pts. with 3 mos-2 year hx

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Morphology

• Avg. PF thickness in healthy individuals:
  – 2.2-3.6 mm
• Plantar fasciitis: 4.6-6.1 mm
• Incr thickness may be secondary to repair of microtears, fiber degeneration or edema
• Propose that because PF relatively hypovascular, new nerve ingrowth associated with new vessels may be a potential mediator of pain

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Examining and Evaluating the Foot and Ankle:

- Subjective
- Location and nature of pain
- Mechanism of injury
  - Can aid in special test selection
- Length of condition to establish stage
- Symptom Behavior
  - Morning pain, pain during training, night pain
- Activity limitations
- Injury history

Objective Exam

- Visual inspection
- Foot type
- Palpation
- Gait Assessment
- ROM
- Accessory joint motion
- Subtalar Joint Neutral
- Neurovascular Assessment
- Strength
- Special Tests
- Functional Testing
Diagnosis

• Insidious onset of pain under plantar surface of heel upon WB after period of NWB
• Pain most noticeable in a.m. with first steps and severity can cause antalgic gt.
• Lessens with incr levels of activity like walking or running but incr at end of the day

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Diagnosis

• Peak age between 40-60 y/o
• CPG update (JOSPT 2014) found in 80 pts. with chronic plantar heel pain mean score on FPI-6 was 2.4± 3.3 versus 1.1 ± 2.3 for controls

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Diagnosis

• Recent change in activity level like ↑ run time or ↑ stand time at work
• Pain can be sharp, localized under anteromedial aspect of plantar heel surface
• Diff Dx: Calcaneal stress fx, bone bruise, fat pad atrophy (FPA), Tarsal Tunnel Syndrome, tumors, Paget disease, Sever’s disease, referred pain due to S1 radiculopathy

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Diagnosis

• Key exam tests
  – Pain with palpation of the proximal plantar fascia insertion
  – A/P talocrural joint DF ROM
  – Tarsal Tunnel Syndrome Test
  – Windlass Test
  – Longitudinal Arch Angle

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Plantar Fasciitis vs. Fat Pad Atrophy

• Yi et al retrospective study of 250 pts.
• FPA incidence >40 y/o
  – Atrophy and thinning of fat pad in inferior heel with loss of water, collagen, and elastic tissue reducing shock absorption and protection of calcaneus
• PF most common diagnosis (53.2%)
  – 2nd was FPA (14.8%),
  – 4th was PFFPA (9.2%)

Yi et al

• PF pain characteristics:
  – first step in am (88%)
  – relief of pain after walking (45.9%)
  – unilateral more common than bilateral (76.7%)
  – pain <6 mos (51.5%)
Yi et al

- FPA pain characteristics
  - Aching (78.4%)
  - Tingling (8.1%)
  - Pain after long walk (62.5%)
  - Pain at night (13.5%)
  - Pain at rest (13.5%)
  - B more common than unilateral (78.4%)
  - Duration >6 months (61.1%)

Yi et al

- Logistic regression found:
  - first step pain in the am and tenderness at medial calcaneal tuberosity indicated **PF**
  - worsening of pain at night, B pain, pain with prolonged standing indicated **FPA**
- 43.2% pts. with FPA had pain with first step in am so cannot just look at one symptom
Yi et al

• Relationship between plantar heel pain and bone spur
  – 38.3% with PF has heel spurs
  – 13.5% with FPA (p=.0001)
• Limits: Diagnosis and evaluation after diagnosis not investigated

Treatment

• Activity measures to assess pt.
  change in function over treatment course.
• Pain level with:
  – initial steps after sitting or lying
  – SLS
  – standing for prolonged period of time
  – after walking specified distance

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Treatment

• Cleland et al (N=66) with PF randomized: electrophysical agents (EPAX) and ex vs. manual PT and ex (MTEX) for 6v over 4 wks
  – **EPAX**: US f/b Ionto then stretching and strengthening exercises 3x/day x 4 wks
  – **MTEX**: 5 min aggressive STM to triceps surae and insertion of PF at med calcaneal tubercle and rearfoot ev mobilization; impairments based treatments at hip, knee, ankle, foot

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Cleland et al

• Results: MTEX group better outcomes (LEFS, FAAM, and NPRS) that were statistically and clinically meaningful at 4 wks, 6 month f/u than EPAX group
  – NNT=4
  – Treat 4 patients with MTEX to experience one successful clinical outcome superior to EPAX
  – NNT <5 indicates an effective treatment

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Cleland et al: Limits

- Impairment based approach so no exact package of care; hard to determine what exact man intervention this group needs
- No comparison group looking at orthotics, night splints other EBP approaches

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Cleland at al: Strengths

- Large sample size
- Low drop out rates
- International study so better generalizability of the results

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Rathleff et al

• RCT (N=48) of ultrasonography verified PF pts
• 2 groups:
  – shoe inserts and daily plantar specific stretching
  – shoe inserts and high load strength training every 2nd day x 3 mos

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Results: Rathleff et al

• At primary endpoint of 3 mos strength group had a FFI significantly improved by 29 points (MCID 7 points)
• Effect size of 0.81
• At 12 mos total FFI was 22 points in strength group and 16 points stretch group

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Results: Rathleff et al

• Secondary outcomes: **strength** group reported significantly less foot pain at 3 mos
• **Strength** group at 3 and 12 mos were more satisfied with treatment

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Rathleff et al

- Large tensile forces associated with improvements in degenerative tendon type conditions
- PF hypovascular and made up of type I collagen which may respond to high load through incr collagen synthesis
- Incr collagen synthesis may help normalize structure and improve outcomes

Strengths/Limits: Rathleff et al

- **Strengths**: 3 sites of normal pt. flow, easy to implement with standard equipment
- **Limits**: No data obtained for adherence to exercise, exercise frequency different between groups which may impact compliance
Treatment: Looney et al

• IASTM has some effectiveness:
  – Graston to triceps surae, soleus, plantar fascia, and med calcaneal tubercle & stretching HEP max of 8 sessions
  – Successful outcome, reduced NPRS, and improved LEFS all reached statistically significant levels

Limits: Looney et al

• Level 4 evidence/case series, no control group
• Small sample size
• Short term follow up (max 8 wks)
Treatment

• Bolivar et al (N=100) found relationship exists between tightness of gastroc, soleus, hamstring and development of PF
  – Most studies support tight gastroc as etiologic factor
  – Normal values= 10° DF with knee ext, 15° DF with knee flexed.
  – If gastroc contracture (≤ 10° DF with knee ext) 100% Sn, 96% Sp subjects more likely to develop PF

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Treatment

Bolivar et al

• Straight leg elevation test (positive if ≤70°) found High Sp (82%) and Sn (94%) that subjects with contracture of post. Leg more likely to develop PF
  – Cannot draw cause and effect but shows relationship between these factors
• Clinical examination should evaluate flexibility of posterior leg musculature

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Treatment

- Surface EMG activity for strengthening Abd Hallucis due to its role in support of MLA
  - Abd of great toe (64.4 ± 11.1% MVIC) with manual resistance
  - Toe spread exercise (40.5 ± 16.4 %MVIC)
  - Flexion of MTP (40.1 ± 12.9 %MVIC) with manual resistance

Cotchett et al

- Myofascial Trigger Points (MTrPs) may play a role in chronic heel pain;
  - Possible MTrPs: soleus, gastroc, tibialis posterior, popliteus, abductor hallucis, quadratus plantae, peroneus longus, flexor digitorum brevis
- Purpose: Evaluate effective of trigger point DN for treatment of heel pain
- RCT N=84 (Real DN, Sham DN)
  - 1x per week for 30 min x 6 weeks
Figure 6. The intrinsic foot muscles are presented in their anatomic orientation within the four plantar layers and the dorsal intrinsic muscle. The numbers correspond to the muscles as follows: (1) abductor hallucis, (2) flexor digitorum brevis, (3) abductor digitii minimi, (4) quadratus plantae (note its insertion into the flexor digitorum tendons), (5) lumbricals (note their origin from the flexor digitorum longus tendon), (6) flexor digitorum profundus, (7) adductor hallucis oblique (a) and transverse (b) heads, (8) flexor hallucis brevis, (9) plantar interossei, (10) dorsal interossei and (11) extensor digitorum brevis.


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Table 3. Mean Scores and Mean Difference Between Groups for Primary Outcome Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Real Dry Needling Group</th>
<th>Sham Dry Needling Group</th>
<th>Adjusted Mean Difference (95% CI)</th>
<th>P</th>
<th>Cohen d</th>
</tr>
</thead>
<tbody>
<tr>
<td>First-step pain (VAS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>67.7 (20.9)</td>
<td>58.5 (19.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 wk</td>
<td>51.6 (22.6)</td>
<td>57.2 (23.8)</td>
<td>−8.3 (−15.6 to −1.0)</td>
<td>.026*</td>
<td></td>
</tr>
<tr>
<td>4 wk</td>
<td>48.1 (23.6)</td>
<td>42.6 (24.1)</td>
<td>−9.2 (−18.7 to 0.3)</td>
<td>.058</td>
<td></td>
</tr>
<tr>
<td>6 wk</td>
<td>28.6 (19.0)</td>
<td>38.3 (25.0)</td>
<td>−14.4 (−23.5 to −5.2)</td>
<td>.002*</td>
<td>−.49</td>
</tr>
<tr>
<td>12 wk</td>
<td>20.9 (19.4)</td>
<td>29.9 (23.3)</td>
<td>−12.5 (−21.6 to −3.4)</td>
<td>.007</td>
<td></td>
</tr>
<tr>
<td>Pain (FHSQ)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>32.9 (22.1)</td>
<td>40.2 (19.7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 wk</td>
<td>47.7 (21.6)</td>
<td>47.1 (19.2)</td>
<td>5.0 (−0.0 to 12.0)</td>
<td>.158</td>
<td></td>
</tr>
<tr>
<td>4 wk</td>
<td>60.7 (20.6)</td>
<td>52.7 (20.7)</td>
<td>11.6 (3.3 to 19.5)</td>
<td>.004*</td>
<td></td>
</tr>
<tr>
<td>6 wk</td>
<td>63.0 (20.5)</td>
<td>55.7 (23.4)</td>
<td>10.0 (1.0 to 19.1)</td>
<td>.029*</td>
<td>.33</td>
</tr>
<tr>
<td>12 wk</td>
<td>72.2 (18.9)</td>
<td>65.7 (20.5)</td>
<td>6.5 (1.1 to 17.0)</td>
<td>.026*</td>
<td></td>
</tr>
</tbody>
</table>

*Values are mean (SD) unless stated otherwise. 95% CI = 95% confidence interval. Primary end-point results, nominated prior to the commencement of the trial, are highlighted in bold type. *Statistically significant at P < .05.
**VAS = visual analog scale (higher values indicate greater levels of heel pain when getting out of bed in the morning).
FHSQ = Foot Health Status Questionnaire (0 = “worst foot health,” 100 = “best foot health”).
Cotchett et al

- NNT=4 for patients who met MID for both primary outcomes
- Cohen d (effect size) were medium
- Peak effect reached at 6 weeks
- Possible effects include:
  - ↑ blood flow and O2 sat in vicinity which may aid in the removal of pain inducing substances
  - Influence on neural mechanisms by changes in brain activity including areas of brain involved in sensory, cognitive, and affective dimension of pain

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Cotchett et al

- **Strengths**: sample size, high adherence, 3 month follow up, blinded participants, DN treatment developed by consensus
- **Limits**: Practitioner not blinded, number and duration of treatments restricted, single podiatrist performed, diagnosing MTrPs challenging in clinical trial

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Kumnerddee and Pattapong

• Prospective RCT looked at N=30 with 6 months hx of PF and failed traditional therapy x 6 wks
• **Control**: analgesics, shoe modification, specific ex and stretching 3x per day
• **Exp**: same Rx +10 Electroacupuncture 2x per wk
  – Needles placed at tender points at anteromed aspect of heel 1 cm in depth

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Kumnerddee and Pattapong

Results at end of treatment
• VAS reduced from **6.00 ± 1.69 to 1.89 ±1.59** in acupuncture group
• 6.27 ± 2.34 to 5.40 ± 2.26 in control group (p<0.05)
• FFI reduced from baseline in acupuncture group only

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Treatment

• **Electroacupuncture** found to be more effective in chronic refractory plantar fasciitis than conventional treatment alone

• Combined with conventional treatment of stretching of calf muscles and shoe modification
  – reduced pain and disability and success rate as high at 80%\(^7\)

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Treatment: Clinical Practice Guidelines

- **Strong** Evidence for use of *Manual Therapy*: joint and soft tissue mobs, procedures to assist with ↑ flexibility
- **Strong** Evidence for 1-3 month program of *night splints*¹⁰
- Evidence on *strengthening intrinsics* limited but some evidence that Short Foot Exercises have impact on ND, arch height morphology and foot intrinsic function⁹

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Treatment

- Many studies support use of **calf stretching** and recent CPG rated evidence **strong** for calf and/or plantar fascia-specific stretching for short term pain relief and improvement.
- Recommended dosing of 2-3x/day either sustained (3 min) or intermittent (20s)\(^{10}\)

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Treatment

- **Strong** evidence for **Antipronation Taping** for immediate reduction in pain and improved function (up to 3 wks). **Elastic taping** to PF and gastroc can provide short term pain relief (1 week).
- **Strong** evidence for use of **prefab or custom foot orthoses** to provide short term (2 wks) to long term (1 yr) relief for reduction in pain and improvements in function\(^{10}\)

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Treatment

CPG Recommendations

- **Conflicting** evidence that Dex (0.4%) or acetic acid (5%) via iontophoresis can provide short-term relief (2-4 wks) for pain relief and improved function
- **Phonophoresis/Ultrasound: Weak** evidence supporting use

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Foot Posture Index

- 6 item clinician rating system
  1. Talar head position
  2. Supralateral and infralateral malleolar curvature
  3. Calcaneal frontal plane position
  4. Prominence of talonavicular joint
  5. Congruence of MLA
  6. ABD/ADD of forefoot on rearfoot
- FPI: moderate to good intra-rater and inter-rater reliability as well as criterion validity

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Foot Posture Index

• Normal score is +4 = slightly pronated foot posture at rest
• Older adults (mean=80y) more pron foot posture
• Younger children have tendency for more flattened pron foot posture as MLA develops
• No significant gender differences found\textsuperscript{103}

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FPI Scatterplot\textsuperscript{103}
Talar Head Palpation

- Palpate head of talus on med and lat side of the anterior ankle
- Not STN but in relaxed stance

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>Talar head palpable on lat side but not on med</td>
</tr>
<tr>
<td>-1</td>
<td>Talar head palpable on lat side / slightly on med side</td>
</tr>
<tr>
<td>0</td>
<td>Talar head equally palpable on med / lat side</td>
</tr>
<tr>
<td>1</td>
<td>Talar head slightly palpable lat side / palpable on med side</td>
</tr>
<tr>
<td>2</td>
<td>Talar head not palpable on lat side / palpable on med</td>
</tr>
</tbody>
</table>

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Supra and infra lat malleolar curvature

- Curves above/below lat malleolus should be ~equal
- PRON=curve below malleolus more acute than curve above
- SUP=curve below malleolus is straight or convex
# Supra and Infra lateral malleolar curvature

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Curve below malleolus either straight or convex</td>
<td>Curve below malleolus concave, but flatter/more shallow than the curve above the malleolus</td>
<td>Both infra and supra malleolar curves roughly equal</td>
<td>Curve below malleolus more concave than curve above the malleolus</td>
<td>Curve below malleolus markedly more concave than curve above malleolus</td>
</tr>
</tbody>
</table>

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Calcaneal Frontal Plane Position

- INV/EV of calcaneus
- In relaxed stance, post. Aspect of calcaneus is visualized

<table>
<thead>
<tr>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than an est. 5° inverted (varus)</td>
<td>Between vertical and an est. 5° inverted (varus)</td>
<td>Vertical</td>
<td>Between vertical and est. 5° everted (valgus)</td>
<td>More than an estimated 5° everted (valgus)</td>
</tr>
</tbody>
</table>
Bulging in the region of the Talonavicular Joint

- Observe area of the skin immediately superficial to the TNJ
- TNJ becomes more prominent with RF pronation
- Sup foot may have area indented
### Bulging in region of TNJ

<table>
<thead>
<tr>
<th></th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area of TNJ markedly concave</td>
<td>Area of TNJ slightly, but definitely concave</td>
<td>Area of TNJ flat</td>
<td>Area of TNJ bulging slightly</td>
<td>Area of TNJ bulging markedly</td>
</tr>
</tbody>
</table>

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Height and Congruence of MLA

- NEU = relatively uniform
- SUP = more acute at posterior end of arch
- PRON = MLA becomes flattened

<table>
<thead>
<tr>
<th>Height and Congruence MLA</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arch high and acutely angled towards posterior end of med arch</td>
<td>Arch mod high and slightly acute posteriorly</td>
<td>Arch height N and concentrically curved</td>
<td>Arch lowered with some flattening in central portion</td>
<td>Arch very low with severe flattening in central portion-arch making ground contact</td>
<td></td>
</tr>
</tbody>
</table>

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Abduction/Adduction of the Forefoot on the Rearfoot

- NEU = should see foot equally from rear view
- PRON = more FF visible on the lateral side due to abd FF
- SUP = more FF visible on the med side due to add FF
## Abd/Add of forefoot on rearfoot

<table>
<thead>
<tr>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No lateral toes visible. Medial toes clearly visible</td>
<td>Medial toes clearly more visible than lateral</td>
<td>Medial and lateral toes equally visible</td>
<td>Lateral toes clearly more visible then medial</td>
<td>No medial toes visible. Lateral toes clearly visible</td>
</tr>
</tbody>
</table>

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Pressure Relieving Inserts
Bonanno et al

- 4-17% older people with non specific plantar heel pain
- Some studies find link between size of calcaneal spur and heel pain in >65 y/o
  - 5x more likely to have current or hx of heel pain
- Purpose: difference in pressure relieving properties of various inserts older pts with heel pain

Bonanno et al

- 36 subjects: 24 males, 12 females >65 y/o with mean duration of sx 8 mos.
- Primary outcomes: peak pressure, maximum force and contact area beneath the heel
  - Secondary outcomes: peak pressure, maximum force and contact area beneath the mid and forefoot
From left to right:
Dunlop Volley
Silicon heel cup
Soft foam heel pad
Heel lift
Prefabricated foot orthosis

<table>
<thead>
<tr>
<th>Insert</th>
<th>Peak pressure at heel (kPa)</th>
<th>Contact Area (cm$^2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>% change</td>
</tr>
<tr>
<td>Shoe only</td>
<td>251.5 (45.9)</td>
<td>n/a</td>
</tr>
<tr>
<td>Silicon heel cup</td>
<td>236.5 (38.6)</td>
<td>-6%</td>
</tr>
<tr>
<td>Soft foam heel pad</td>
<td>236.7 (37.6)</td>
<td>-6%</td>
</tr>
<tr>
<td>Heel lift</td>
<td>260.4 (35.6)</td>
<td>+4%</td>
</tr>
<tr>
<td>Prefab orthosis</td>
<td>178.0 (27.9)</td>
<td>-29%</td>
</tr>
</tbody>
</table>

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Bonanno et al

- Attenuation provided by prefab orthosis was 5-fold to the next closest insert
- Contoured shape of prefab orthosis may attribute to success with attenuation of forces
- Prefab orthosis was only insert to incr contact area in all 3 regions of foot
  - Greater reduction in heel and forefoot plantar pressure

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Bonanno et al

- Heel insert slightly elevate the heel
- Associated with systematic incr in forefoot loading
- Also reduced contact area under heel, mid and forefoot
- Limits inserts ability to distribute forces
- Have caution when prescribing heel inserts due to incr forefoot pressure may clinically cause incr forefoot symptoms

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Study Limits: Bonanno et al

- Limited time to acclimate to conditions tested
- Lab setting may influence external validity
- Pressure mapping via in shoe Pedar® system may effect plantar pressures
- Long term changes may differ due to degradation of materials
- Association between vertical heel pressure and plantar heel pain not fully understood

What about my heel spur? Menz et al

- 2 pervading theories:
  - Longitudinal traction: repetitive traction of the insertion of the plantar fascia at the calcaneus causes inflammation and reactive ossification at the origin of the PF
  - Vertical Compression: spurs develop in response to repetitive compression vs traction
    - Spurs are fibrocartilagenous outgrowths which form in response to calcaneal stress fx
Menz et al

- 216 subjects (mean age 75.9)
- Bilateral WB lat radiographs in standing
- Static radiographic foot posture measurements: navicular height, calcaneal inclination angle, calcaneal-first metatarsal angle

Results: Menz et al

- 119 (55%) had at least one plantar calcaneal heel spur
- Prevalence did not differ according to sex
- Subjects with heel spurs were significantly more likely:
  - Obese (OR=7.9, 95% CI 3.6-17.0)
  - Report OA in at least one body region (OR = 2.6, 95% CI 1.6-4.8)
  - Have current or previous heel pain (OR= 4.6,, 95% CI 2.3-9.4)
Menz et al

- 55% sample had at least 1 spur which is higher than previously reported in young-middle aged population (11-16%)
- Obesity consistent with both theories
  - Higher vertical heel pressures during gt associated with bodyweight
  - Also can result in flattening of the MLA which can cause traction to plantar fascia

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Menz et al

- Correlation with OA consistent with vertical compression theory
- Degenerative changes in enthesis fibrocartilage and possible subchondral sclerosis which have been connected to spur formation

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Menz

• 61% with heel spurs were ASYM
• Why do some people hurt?
  – Other factors than may contribute include: size of the spur, presence of concurrent fat pad abnormalities, neurogenic origins of foot pain due to the spur and nerve entrapment, fx of the spur itself
  – Consider extrinsic factors: shoewear, occupational environment, level of physical activity

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Limits: Menz et al

• Not a randomly selected sample
• Self reported medical history
• Heel pain only designated as present or absent with no explanation or attempt to determine underlying cause

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