Navicular stress fracture in a sprinter.

Case study

Anne-Marie O'Connor

Musculoskeletal Podiatrist
Agenda

- Background Tarso-navicular stress fractures
- Case Study
- Interventions and research
- Further Research
Anatomically, wedged between the talus and 3 cuneiforms.

Central portion of the bone is relatively avascular.

In combination with excessive forces are placed on the central portion during heel strike and sprinting, this portion of the bone is highly vulnerable.
Incidence

- Originally described in racing greyhounds (Bateman 1958)
- First described in humans in 1970 (Hulkko et al 1985)
- In 1980’s it was recorded as a rare fracture; incidences 0.7-2.4% recorded
- Recent study indicates 73.1% of t&f stress fractures are navicular (Morgan et al 2005).
Foot Biomechanics

Intrinsic Factors

Pes cavus foot type, limited STJnt motion, limited ankle joint motion, Increased pronation velocity, Met adductus, short 1st met, medial narrowing of the talar-navicular joint

However no study has demonstrated the statistical significance of any of these factors

(Pavlov et al 1983)
How is it diagnosed?

- **Clinically Suspected** c/o pain in mid-foot and arch when hopping, toe hopping, standing on toes
- Palpation of the dorsal-proximal region of bone ‘N’ spot is positive in 81% of cases
- **Radiological Diagnosis** is made with bone scan/ MRI, or CT scan to evaluate the extent of the fracture
- Early stages x-ray negative
**Classification** (Boden et al)

<table>
<thead>
<tr>
<th>High Risk (poor natural history) (tension loading)</th>
<th>Low Risk (compression loading)</th>
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<tbody>
<tr>
<td>Superolateral femoral neck, anterior tibial shaft, tarsal navicular, proximal 5(^{th}) mets talar neck</td>
<td>femoral shaft. Medial tibial lateral malleolus, calcaneus, 2nd/3(^{rd})/4(^{th}) mets</td>
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<tr>
<td>STOP LOADING</td>
<td>MODIFY LOADING</td>
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Treatment

- Conservatively
  6 weeks in non weight bearing cast
  slow return to loading over 6 weeks
- Surgery
  screw fixation and bone graft.
Summary

- If the athlete complains of mid-foot pain
- Increased with axial dynamic loading
- There should be a high index of suspicion
Agenda

- Tarso-navicular stress fractures
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Case Study
Navicular stress fracture

- 22 year old podium Para-Olympian sprinter, with CP running 100/200 metres
- With a history of 3 previous navicular stress fractures of the right foot, 2006/07/08, all treated conservatively.
- Right side mainly effected with the CP.
- All associated with an increase in training load.
- He was still able to train, deep water running
- He also competed all 3 seasons.
- December 2009 he started to C/o pain in right mid-foot, tarsal area
Referral to Podiatry

- Pain was aggravated rising onto toes and by side-stepping (axial oblique force)
- O/e no pain on N-Spot
- MRI scan at the time was clear
- Loading was immediately reduced
Objective of the referral

- Assess his Podiatric Biomechanics
- Analyse and comment on his running style
- Assess his running footwear (spikes)
- Review current orthotics
Podiatric Biomechanics

- Equal leg length
- Right external neutral hip position
- B/ Average flexibility hams/quads
- B/ Average to low range ankle dorsiflexion
- Av STJ / MTJ /1st MPJ range
- FPI score 8
- Static stance heel valgus 9-10 degrees and a 10mm navicular drop bilaterally
Objective of the referral

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Biomechanics of sprinting on a bend
Objective of the referral

- Assess his Podiatric Biomechanics
- Analyse and comment on his running style
- Assess his running footwear (spikes)
- Review current orthotics
Footwear - Spikes

- He was in a very flexible spike, both the sole plate and the upper.
- Thought process; increased flexibility caused more time in axial pressure.
- Flexible upper would lead to more medial rotation in this position.
Objective of the referral

- Assess his Podiatric Biomechanics
- Analyse and comment on his running style
- Assess his running footwear (spikes)
- Review current orthotics
Previous orthotics

- Tried lots of different orthotics but not tolerated any
- They have been, subjectively;
  Too ridged and irritated medial arch
  Too soft, felt like they slowed him down
  Poor fit in spikes, too wide/ heel coming out!
Orthotics' Prescription

*Rear foot*, intrinsically/extrinsically posted
Poron arch pad
*Top cover*, none slip with shock attenuation
*Material*, flexible polypropylene plastic
*Cut*, low on heel and narrow to fit in spikes
What makes the difference; orthotics/ spikes

- Research done by Sports Technology Institute Loughborough University by Dr Toon and Dr Forrester Feb 2010.
- Using force platform/ high speed video and vicon, ground reaction force data was collected.
- Three trials (1)spikes (2) spikes and orthotics (3) spikes, orthotics and taping, (4) spikes and taping.
Research concluded.

- ‘the unaltered sprint spike condition provides the least mediolateral control’
- ‘the spikes and orthotics, the spikes and taping and the spikes with orthotics and taping, offer at least twice as much mediolateral control’
- ‘the most mediolateral control is seen when taping and orthotic interventions are combined’
Research Concluded…

- ‘With a prolonged period in contact with the ground and the large negative impulse, the unaltered sprint spike is the least efficient of the tested conditions.’

- ‘The combined use of orthotic and taping seems to generate the most efficient ground contact, minimising braking forces whilst allowing for the generation of a resultant propulsive component.’
Hypothesise

- Any forces which decrease axial rotation forces and therefore increase shear on the bone would be advantageous to resolution of the condition.
Update

- Review apt with sprinter in August 2010, he is back to full training and has had no occurrence of his navicular stress reaction.
Further Research

- What were the alteration in forces between the flexible and stiff spikes
- Difference in straight and left bend
Thank you for Listening