Risk Factors for Jones Fracture in Elite Athletes: Analysis of Plantar Loading During Sports

Yannick Goeb, BS
Nate Wilcox-Fogel, MS
Michelle Vryhof, ATC
Kenneth Hunt, MD

Stanford University Human Performance Lab
Stanford University Department of Orthopaedic Surgery
Risk Factors for Jones Fracture in Elite Athletes: Analysis of Plantar Loading During Sports

Our disclosures are in the Final AOFAS Mobile App.
I have no potential conflicts with this presentation.
Introduction

- An internal review of 2 years of data in our institution’s injury database indicates that 27% of all injuries suffered by athletes are to the foot and/or ankle.
- Fractures of the proximal metaphysis of the fifth metatarsal (i.e., Jones fractures) are a relatively common injury in athletes. These injuries generally require surgical fixation and missed time from sports participation to optimize healing rates and return to sport.
- Corrective Orthotic devices are often used during rehabilitation for these injuries, although the effectiveness of orthotics in offloading the lateral forefoot has not been previously described.
Study Aims

- Characterize the dynamic loads at the 5th metatarsal in elite athletes with a history of successfully treated Jones fracture
- Compare 5th metatarsal loads of athletes with a history of Jones fracture with those of uninjured control athletes
- Evaluate the effect of corrective orthoses on 5th metatarsal loads in Jones fracture athletes
Study Design + Experimental Methods

- Recruitment of athletes: 9 elite athletes with history of Jones fracture
  - 7 football, 1 soccer, 1 golf
- Gender, Age (+/- 2 years), sport, position (if applicable) matched control athletes
- Test subjects complete course of standard athletic activities
  - 1.34 m/s treadmill walk
  - 2.91 m/s treadmill run
  - 2-footed jumping with required 2-footed landing
  - 10m shuttle run to simulate quick reversals of direction
  - 15m zig-zag course to simulate cutting at 45 degrees at speed
Novel Pedar Wireless Insole System

- Validated for assessment of dynamic plantar loads
- Sampling rate 99Hz
- 99 sensors/insole
- Athletes instructed to wear personal training shoes. No cleats used.
Study Design + Experimental Methods

- Data from successfully completed trials exported using Novel Software
- Custom mask used to isolate loads at 5\textsuperscript{th} met base
- 5\textsuperscript{th} met loads compared between Jones fx athletes and controlled
- Independent analysis done for each Jones fracture athlete with/without corrective orthotics
- Pair-wise comparisons done using Wilcoxon Sign Rank
Results
Results
Conclusions

- Jones fx athletes showed increased 5th met loads during walking, running, and cutting relative to uninjured controls.
- The highest pressures and forces were seen at fifth MT base during cutting where Jones fx athletes showed significantly increased maximum force and impulse.
- Increased loads may contribute to the development of Jones fractures in athletes at all levels.
- Use of standard corrective orthoses did not significantly reduce peak or mean pressure, maximum force, or impulse at the 5th metatarsal base during sports activities.
Future Directions

- Use of topological data analysis to characterize loading patterns of elite athletes with varying injury histories (fig)
- Examination of effectiveness of novel bracing and orthoses
- We are broadening our injury database, allowing prospective analyses of the impact of preventive and therapeutic measures on injury and return to play.
References