Using Electromagnetic Sensors to Measure Range of Motion Beneath Immobilization Devices on the Foot

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Introduction

- Immobilization is necessary for management of many conditions of the hallux metatarsophalangeal joint
- Physician applied splints have been traditionally used for immobilization purposes
- Braces are becoming less expensive and may be more convenient and comfortable for patients
- It is unknown how much motion is restricted by generic immobilization devices
Question

• Does a physician applied splint provide more immobilization than a hard soled post-operative shoe or a CAM boot at the hallux MTP joint?
Hypothesis

• The physician applied splint will limit motion than the hard-soled post-operative shoe or the high-performance boot
Methods

- 10 healthy volunteers were instrumented with electromagnetic sensors on the right foot.
- Range of motion of ankle and hallux were documented during 4 tasks.
- Each of three immobilization devices was fitted to each subject and the exercises were repeated in randomized order.
- Position and rotation data were collected and analyzed to determine reduction of motion.
Results

• Non weight-bearing
  • All devices significantly restricted ROM at MTP compared to no device (p<0.05)
  • No significant difference between devices on reduction in ROM
• Standing
  • CAM boot and plaster splint decreased ankle range of motion compared to baseline or between devices
• Gait
  • All devices significantly reduced ROM at MTP and ankle during stance phase of gait (p<0.05)
  • No significant difference between devices on reduction of ROM
Discussion

• All devices proved effective at immobilizing the hallux MTP compared to no immobilization device.
• The walking boot showed a trend to less movement than the other devices.
• Results support the use of generic devices in non-operative and post-operative treatment of hallux conditions that require immobilization.
• Use of generic devices may be less expensive when taking into account use of operating room costs used to apply custom splints.
Conclusions

• Generic immobilization devices are effective at immobilizing the hallux and have benefits of being convenient and comfortable

• Electromagnetic tracking is a previously unreported and safe way to study motion under immobilization devices
References


- Pollo, FE. Walking boot design. Orthopedics 1999


