Background: Over 1 in 3 older people with diabetes fall each year. Postural instability is an independent risk factor for falls for people with diabetic peripheral neuropathy (DPN). People with DPN wear offloading insoles to reduce foot ulcer risk but the impact on balance is unknown.

Aim: Evaluate the effect of a standard offloading insole and its constituent parts on balance in people with DPN.

Method: A random sample of fifty patients with DPN were observed standing for 3× 30 s, and stepping in response to a light, under five conditions presented in a random order; (1) no insole, (2) standard offloading insole and (3) three other insole types with one design component systematically altered. After each condition participants self-rated perceived steadiness. The F-scan pressure measurement system captured the data. Severity of DPN was quantified using a 10 g monofilament and neurothesiometer.

Results: Insole design effected static balance and balance perception, but not stepping reaction time in people with DPN. The standard and resilient shaped insoles significantly increased centre of pressure velocity (14%, $P = 0.006$), (13%, $P = 0.001$), and path length (14%, $P = 0.006$), (13%, $P = 0.001$), when compared to the no insole condition. The textured shaped and flat soft insole had no effect on static balance when compared to the no insole condition ($P > 0.05$).

Conclusion: Insoles with arch fill reduce static balance and balance perception of patients with DPN, but balance is unaffected by soft or resilient insole coverings. Adding a textured cover counters the negative effect of the arch fill. This finding merits future study.

http://dx.doi.org/10.1016/j.fas.2016.05.163

147

FI2016_ProstheticOrthotic_04
Data acquisition through localised sensors for the fabrication of customized foot insoles

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Background: Developing an appropriate foot orthosis to dissipate the high plantar pressure have always been a challenge. The availability and the use of techniques to assess the plantar pressure in any remote settings are very limited due to the costs involved. Transferring the data acquired to fabricate an appropriate orthosis in a single and a unique platform would help in reducing the costs and the time incurred in fabricating an orthosis.

Aims: This study aims to design and develop localised sensors for data acquisition and the fabrication of customized osthosis for patients with anaesthetic feet.

Methods: Flexiforce sensors were identified and fixed on socks that were provided to patients with anaesthetic foot. The sensors were fixed to 10 areas in the socks corresponding to the areas of high pressures of the foot. The patients were followed up while they were involved in their daily living activities. The data from the 10 sensors were acquired using a data acquisition system that were designed and developed.

Results: The identified high pressures in the 10 sensors of the foot helped in developing appropriate modifications so that the pressure were offloaded. The high pressures were offloaded by build ups on specific areas that were identified through the sensors.

Conclusion: The method of fabricating orthosis helped the patients get a more appropriate solutions for their prolonged high plantar pressures. The data acquisition system through the sensors also help the patients get a feedback on the lifestyle leading to the high pressures.

http://dx.doi.org/10.1016/j.fas.2016.05.164

148

FI2016_ProstheticOrthotic_05
Do people who load their feet differently need insoles that have different stiffness?

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Background: Plantar pressure reduction is an important aspect of diabetic foot management. However little information exists about the optimum cushioning properties of materials used in diabetic footwear as insoles/foot-beds. Numerical analyses have indicated that optimizing the material properties of footwear materials can improve their ability to reduce pressure.

Aim: To investigate if the optimal insole stiffness would vary based on patients' body mass (BM) in people with diabetic neuropathy.

Method: Custom PU foams were produced using different ratios of chemical components to achieve a range of different stiffness. Uniform thickness (400 mm × 400 mm × 10 mm) foam sheets were produced with shore-A hardness between 3 and 45 and average(±stdev) increments of 5(±3). Standardized compression tests were performed for all 10 custom materials as well as for 3 commercially available foam materials used in diabetic footwear. Plantar pressure was measured during balanced standing on all custom material sheets for 4 diabetic neuropathic volunteers: 2 with BM of 49 kg ± 1 kg and 2 with BM of 73 kg ± 2 kg.

Results: The maximum compressive force for 50% compression of the commercially available foams was similar to custom foams with 11–28 shore-A hardness. Peak plantar pressure was minimised for materials with shore-A hardness 6 and 11 in subjects with BM of 49 kg ± 1 kg and 73 kg ± 2 kg respectively. In all cases using softer or stiffer material (by 1 shore hardness increment) increased pressure by 24% ± 26% and 32% ± 34% respectively.

Conclusions: Careful selection of insole/foot-bed stiffness can improve the pressure reduction capacity of diabetic footwear. Optimum material stiffness increased with the BM of the volunteers.

http://dx.doi.org/10.1016/j.fas.2016.05.165

149

FI2016_ProstheticOrthotic_06
Do Barefoot Science™ insoles alter foot function?

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Background: Barefoot Science™ insoles (BSI) are marketed as "reforming gait and reducing injuries". The manufacturers claim