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Title

3D printing: The future of foot orthotic provision? An evidence based approach to evaluating 3D printed designs

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Summary

This project compared nine 3-D printed foot orthotic (FO) designs to handcrafted FOs. Measurement were peak forces at heel strike and toe off and user evaluation questionnaires. The results show 3D printing in the orthotic provision process is feasible and has some benefits over handcrafted FOs.

Introduction

Current custom orthoses have complex design elements that are produced by hand in a time consuming manner that is neither quantifiable nor replicable. Prefabricated devices are inexpensive and convenient but lack the design features that custom crafted orthoses can provide. The principal problem that needs to be investigated is “Can 3D printing be used to combine the convenience of prefabricated devices with the benefits of customization to support rationalized orthotic prescription criteria that support orthotic design optimization?”

Methods

The project had two phases. The first phase developed the design for the two foot orthotic design elements that had been identified in literature (wedge and hyperbolic paraboloid) and ended with the successful printing of the conceptualized orthosis designs. Phase 2 compared the resulting designs to a traditionally handcrafted orthosis. Force plate data was collected for each of the designs and for the handcrafted orthosis and peak forces were compared at the 0% and 60% points of the gait cycle for each design. In addition, a modified version the the PEQ-m feedback questionnaire was completed by the user for each of the designs.

Results

This study has shown that: 1) it is possible to vary foot orthotic design criteria in a way that is consistent with current orthotic prescription practices 2) That these designs can be produced effectively using 3D printing technology and 3) That users cannot distinguish between the handcrafted and 3D printed designs.

Conclusion

It is anticipated that 3D printing will significantly impact the manner in which foot orthoses will be produced in the future. 3D printing will have the added benefit of being able to measure changes in foot orthosis designs allowing objective, evidence based practice models for the prescription and evaluation of foot orthosis designs to be developed. The use of 3D printing has already become wide spread in a wide range of industries and can provide benefits to orthotists as well, providing orthotists learn understand and embrace the technology.

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