

Design of Polymers 3D-Printed heels for Orthopaedic Footwear: Influence of Behaviour in the Mechanical Properties

ABSTRACT

Footwear design, manufacturing process, and production are entering a new phase when manufacturing cycles become shorter than usual. Although clients expect a shorter lead time, they are also becoming more and more demanding in terms of style, comfort, and fit. Bespoke orthopedic footwear typically takes several weeks sometimes and for a longer time to manufacture. One of the most critical time factors here is the custom fabrication of the lasts used to make the shoes. This lengthy step can be reduced strongly with the help of additive manufacturing. Optimized fitting accuracy represents a further advantage, particularly in orthopedics. Customers know about 3D printing and they expect the use of 3D technologies. Therefore, companies are starting to adjust 3D technologies in the design and development of footwear production throughout the product life cycle. The footwear design developed based on 3D design software enables changes of the 3D shoe heel and Functional properties of footwear for severe foot deformities and disorders. In addition to footwear functional properties, creative design based on 3D allows quick design modification and visualization. The final design of shoes is manufactured by combining traditional manufacturing techniques.

The study aims are to analyze heels for orthopedic footwear design using 3D printing technologies and different materials and accurately predicting the effect of compressive loads on the heel of the design. In this work investigated 3D printed a special design footwear heel using SLS and FDM technology different thermoplastic materials, as PA12, ABS and PLA were used. Data analysis and research results of compression tests were compared with results of theoretical modeling tasks. The theoretical prediction results of compressive loads and ultimate strength are consistent with simulations and experimental results.

Keywords: 3D printing, Footwear, Heel, Orthopedics, Polymers