Thesis Project Portfolio

Development of a Dynamic Tensioning Ankle Brace for Chronic Ankle Instability

(Technical Paper)

Impact of Additive Manufacturing Techniques on Underrepresented Patient Demographics in the Bracing Industry

(STS Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Sciences

University of Virginia • Charlottesville, VA

In Fulfillment of the Requirements of the Degree Bachelor of Science

in Biomedical Engineering, School of Engineering

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Spring, 2022

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Sociotechnical Critique

My STS thesis portfolio consists of a technical paper and a research paper that address the impact that additive manufacturing could have on the bracing industry. The capstone project that the technical paper focuses on is the full product development of a personalized dynamic tensioning ankle brace through additive manufacturing techniques. Similarly, the research paper identifies the impacts that the widespread adoption of additive manufacturing could have on combating the inherent biases within the current bracing industry. Both papers explore the potentials that additive manufacturing has to positively impact the orthotic bracing patient population.

The technical project was inspired by the opportunity to work with Icarus Medical Innovations, a small company based out of Charlottesville Virginia that embraces additive manufacturing techniques to produce personalized orthotic bracing solutions. This includes the use of patient anatomy scans, CAD modeling, and 3D printing. There is an extremely large market gap in the orthotic bracing industry for cheap and effective braces that are not commercial-off-the-shelf products. In an attempt to expand their product base, the capstone team sought to develop an ankle brace that employs the same production techniques as the knee brace in order to provide support for chronic ankle instability. Utilizing the iterative process, the team designed 3D printed ankle braces that use a BOA dial to apply a corrective force for pronation and drop foot. Using additive manufacturing techniques, it is possible to customize the product to the specific patient needs. This allows for the fabrication of an alternative to COTS braces that provides superior stability and comfort.

Utilizing the technical project as motivation, the research paper explores the impact that additive manufacturing could have on the patient population of the bracing industry. The current

industry is heavily reliant on mass production of commercial-off-the-shelf orthotics. This form of production creates a bias towards the 50th percentile male that results in socio-economic discrimination towards populations such as women and disbaled demographics. Using the lense of Actor-Network Theory and the politics of artifacts, the research paper explores the possible effects that additive manufacturing can have on fostering equal opportunity and availability of products towards a greater percentage of the bracing industries patient population. Through the use of 3D printing, it is possible to make effective bracing solutions in a cost effective manner with a high level of stability and comfort. A greater array of products at affordable prices results in a greater percentage of the patient population having the opportunity to treat their condition. This, in turn, reduces the patient population impacted by socioeconomic discrimination based on their demographic.

The thesis portfolio presents new opportunities for orthotic braces through the use of additive manufacturing techniques. This production method allows for personalization of the braces to the patient anatomy through the use of patient anatomy scans and 3D printing. Fabrication of parts through this manufacturing technique allows for customization of the brace to the patient anatomy which, in turn, provides increased comfort and stabilization. As a result, a greater percentage of the patient population will have access to affordable bracing solutions. By adopting additive manufacturing, biases in the bracing industry towards underrepresented patient demographics can be eliminated.