(POSTER) Design and Fabrication of a Custom Wrist Orthosis for Enhanced Patient Comfort

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Tasic, Marko; Hansen, Matthew; Lian, Mang; Mitchell, Demetre; Sarker, Rashedul; Fernandez, Renny; Peterson, Erin; Herzog, Joseph; Olawale, David; and Saqib, Najmus, "(POSTER) Design and Fabrication of a Custom Wrist Orthosis for Enhanced Patient Comfort" (2019). *ASEE IL-IN Section Conference*. 2.
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Introduction and Overview
In the occupational therapy field, therapists are reporting that patients are not using their orthoses for the prescribed period of time to heal their injuries. These patients are reporting that these orthoses are hot, sweaty, bulky, and overall uncomfortable. Our team was tasked to create a custom wrist orthosis that will enhance comfort while maintaining wrist stability and a low fabrication time.

Testing
The team measured the ability of the different materials to withstand bending by using a three point bend machine. The team will also be measuring temperature and humidity. Two temperature and humidity sensors will be used to evaluate the final orthosis design.

Optimization of Design
One of the most important factors when designing the new orthosis is maintaining wrist stability. The orthosis must prevent the wrist from moving in order for the wrist to heal properly. The first fabricated prototype allowed from almost full wrist movement. Subsequent prototypes allowed for significantly less wrist movement. Once this parameter is optimized, focus can shift to optimizing another important factor in the design process: comfort. Comfort can be improved an optimized by changing the ventilation geometry on the orthosis designs. By removing more material from the orthosis, greater comfort can be achieved through reduced temperature under the orthosis as well as reduced humidity (sweat).

Fig. 2. The bend test compared two different thermoplastics being used in prototypes: Ezeform and TailorSplint. Initially, TailorSplint is stronger than Ezeform, however, after being heated both materials have the same strength.

Acknowledgements:
We would like to thank the following people for guidance throughout our project: Dr. Stephen Spicklemire, Dr. George Ricco, Mr. James Emery. We also would like to thank the following students for laying the foundation of this project: TJ LeSeure, Pilar Echeverria, Allison Zwickl, Evan Parduhn, Josh Love

Fabricated System
The team fabricated three prototypes, each with a different design and material. In doing so, the team was able to explore the effects of different designs as well as the properties of the different thermoplastics. The design templates were cut out using a waterjet cutter and then molded onto team members.

Conclusion and Future Work
Once all testing has concluded, the results will be analyzed to determine how effective the new orthosis design is compared to the industry standard. The final prototype will handed off to the school of occupational therapy to perform further testing with graduate OT students.