

MANUFACTURING OF CUSTOM CARBON FIBER ANKLE-FOOT ORTHOSES (AFO)

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Introduction

- Custom unidirectional carbon fiber ankle foot orthoses (AFO) are manufactured for patient's post-stroke



Fully manufactured AFO

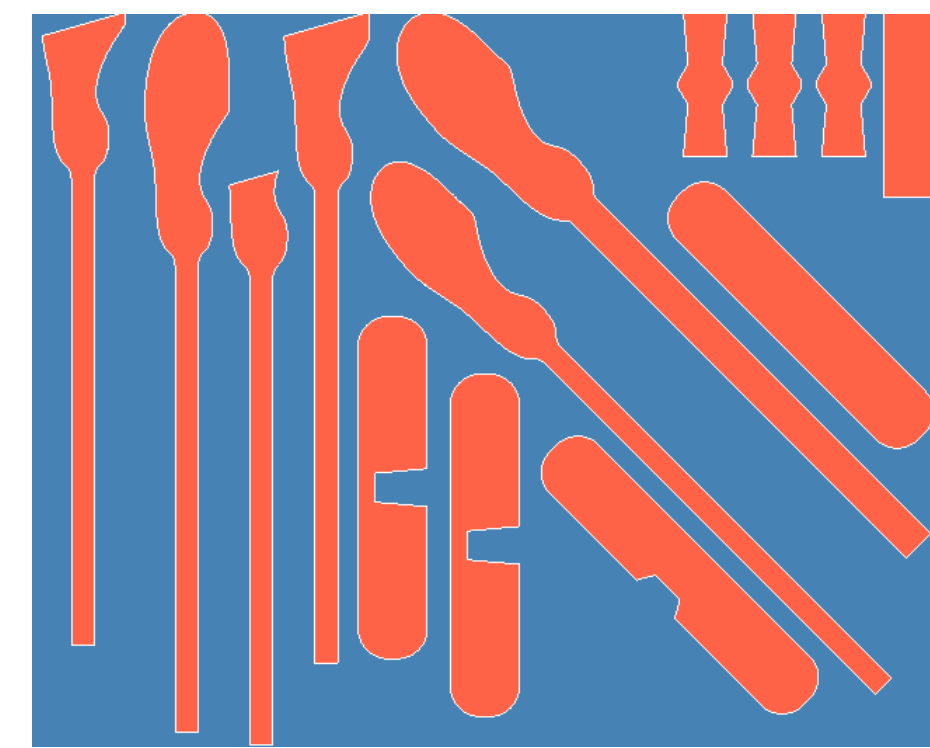
- AFO provide stability maneuverability based on individual patient's needed support
- Stiffness of AFO are tailored to meet the requirements for each patient

Objectives

- Streamline the ply generation and layup sequence
- Reduce the amount of wrinkling present during and after the layup process
- Manufacture a visually appealing AFO
- Produce an AFO that is durable enough for patient use and correct size
- Optimize the comfort of each AFO design

Manufacturing

- Plies are generated based on the anatomical measurements and stiffness requirements of the patient
- Plies were cut in different fiber directions in order to increase the strength of the overall part



Nested sheet of AFO plies

- The footplate is designed in a manner that provides a natural rocking motion when walking

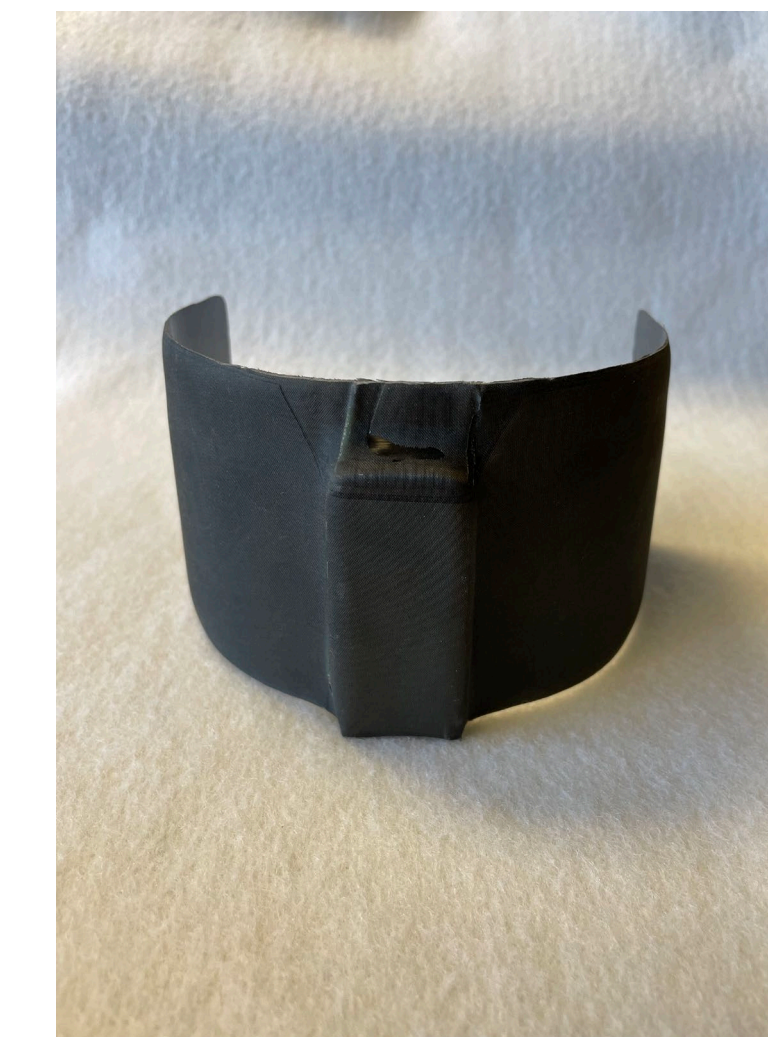


Rocking motion layup made in the footplate

- The devices have a low profile to provide a comfortable fit and maintain a light weight
- AFO are done in a two-step manufacturing process
- The footplate and strut are done in one manufacturing process and cuff is done in a separate manufacturing process

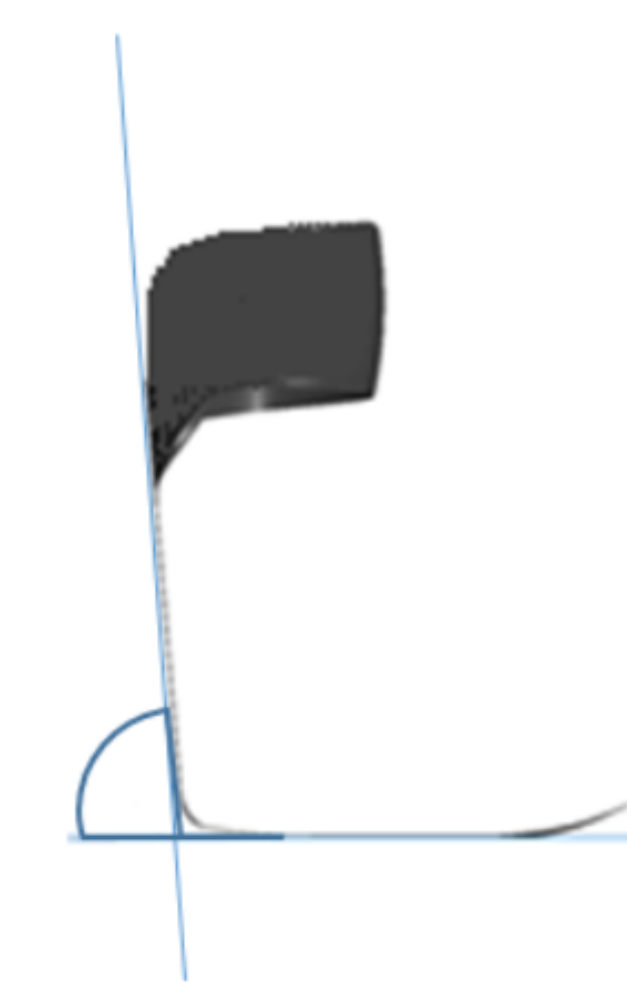
Assessment

- Manufactured AFO are visually inspected for any defects
- Defects include wrinkles, delaminations, and fiber quality



Fully developed cuff

- The stiffness of the strut, footplate, and cuff are tested to ensure comfort of patient is met
- Strut height, cuff width, and footplate geometry are made in order to ensure a good fit for the patient



Assessment measurements made after manufacturing

Future Work

- Optimize the ply generation cutting process
- Standardize the quality assessment practices
- Streamline the bagging and debulking process during layup
- Improve the manufacturing quality further
- Reduce waste of pre-preg while cutting the plies
- Develop new footplate geometry based on patient requirements



Fully manufactured AFO with padding and strap

Acknowledgements

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