

# **Inconspicuous Ankle Foot Orthosis (AFO) for teen**

November 1st - November 8th 2024

Client: Debbie Eggleston

Advisor: Dr. Brandon Coventry

Team Members:

Anya Hadim (Team Leader)

Lucy Hockerman (BSAC)

Presley Hansen (Communicator)

Alex Conover (BPAG)

Grace Neuville (BWIG)

## **Problem Statement:**

Ankle foot orthoses (AFOs) are designed to provide dorsiflexion support during the swing phase of walking. These devices are primarily used to treat muscular dystrophies. For this project, we are focusing on young individuals diagnosed with Facioscapulohumeral Dystrophy (FSHD), the most common type of muscular dystrophy. The team aims to design a brace for teens that assists with ankle dorsiflexion, promoting safer walking while remaining easily concealable and flexible enough to allow for functional ankle movement. The brace will be tailored specifically for the client, Maggie Eggleston. Key objectives for the device include positioning the ankle in adequate dorsiflexion, maintaining a slim, discreet design, and ensuring sufficient flexibility to minimize movement restriction.

## **Status Update:**

The team purchased new materials in hopes of resolving the issue caused by the strength of the bungee cord and the plastic lock slipping during walking. Additionally, the team updated the SolidWorks design, printed the second iteration, and is currently working on assembling the final prototype for Grace's dimensions. The team hopes the lock laces will function as intended; otherwise, the design will be modified to incorporate a carabiner method for the bungee cord.

## **Summary of Weekly Team Member Design Accomplishments (Include time spent):**

### Anya:

- Went to REI with Lucy to purchase new materials given the feedback from show and tell (90 mins)
- Purchased the lock laces, nylon fabric, and updated cost spreadsheet (30 mins)
- Researched the costs of the onyx filament and the makerspace printer availability (20 mins)

- Met with the team to update Grace's dimensions and finalize fabrication plan/timeline (90 mins)
- Met with Alex to sew the lock laces (40 mins)

Lucy:

- Went to REI with Anya to purchase new materials given the feedback from show and tell (90 mins)
- During team meeting, re-measured Grace's foot dimensions and created a new curve for a second prototype for future Runeasi testing (1 hour)
- Researched about Runeasi and possible useful data for testing (45 mins)
- Emailed with Mikel to confirm Runeasi usage next week (25 mins)

Presley:

- Played around with Solidworks and SimulationXpress Analysis Wizard to come up with a plan for stress testing (1.5 hrs)
- Met with team to update Grace's dimensions and finalize fabrication plan/timeline (1 hr)
- Continued communication with advisor and client (15 min)

Alex:

- Researched other materials to use in the prototype (30 minutes)
- Worked on carbon fiber research (15 minutes)
- Continued to update about the funding situation (15 minutes)

Grace:

- Worked on solidworks part (3 hours)
- Met with team to update solidworks dimensions (1 hour)

**Weekly/Ongoing Difficulties**

We hope that with our updated dimensions, the carbon fiber part will print more accurately to fit Grace's foot and wrap around it snugly (we were struggling with dimensions for the 3D Arc tool on Solidworks). This will enable us to assemble the entire prototype and conduct testing on Grace before finalizing and constructing the prototype tailored to Maggie's dimensions.

**Upcoming Team and Individual Goals**

**Team:**

- Conduct runeasi testing on Grace using final prototype adhered to Grace's dimensions

**Individual:**

Anya:

- Assemble final prototype for grace with team
- Meet with Lucy and Mikel (Badger Athletic Performance lab PI) to learn how to do runeasi

- Conduct runeasi testing on Grace
- Plan of fabrication for mold from cast

Lucy:

- Meet with Lucy and Mikel (Badger Athletic Performance lab PI) to learn how to do runeasi
- Finish the 2nd version of the prototype 3D print (possibly using the reinforced carbon fiber material)
- Conduct runeasi testing for Grace’s prototype

Presley:

- Assemble final prototype for grace with team
- Finish Solidworks testing with SimulationXpress Analysis Wizard on “carbon fiber” part
- Plan fabrication for mold of cast
- Continue communication with client and advisor

Alex:

- Work on fabrication of mold of cast
- Work on fabrication of final prototype for final deliverable
- Conduct runeasi testing on Grace

Grace:

- Finish the 2nd version of the 3D printed support
- Conduct runeasi testing
- Create fabrication plan of final prototype

**Project Timeline**

Project Goal	Deadline	Team Member Assigned	Progress	Completed
Meet with Client	9/17/2023		100%	
→ email client with dates		Presley	100%	
→ create question list		All	100%	
→ write summary and put in notebook		All	100%	
PDS Draft	9/22/2023		100%	
→ submit draft		Anya	100%	
Design Ideas and Matrix	9/29/2023		100%	
→ create design 1		All	100%	
→ create design 2		All	100%	

→ create design 3		All	100%	
→ compare designs in matrix		All	100%	
Preliminary Design Presentation	10/06/2023		100%	
→ upload to website		Grace	100%	
Preliminary Deliverables	10/13/2023		100%	
→ email report and notebook		Presley		
→ upload report to website		Grace		
→ peer/self evaluations		All		
Decide on Final Design	10/13/2023		100%	
→ get feedback from client on design		All		
Show and Tell	10/27/2023		100%	
→ create an initial prototype		All		
Final Poster Presentation	12/08/2023		0%	
→ invite client		Presley		
→ post on website		Grace		
Final Deliverables	12/13/2023		0%	
→ submit final notebook and report		Presley		
→ submit peer/self and client evaluations		All		

## Expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor Cat#	Date	QTY	Cost Each	Total	Link
<b>Ankle Brace - Component 1</b>										
Ankle Brace	Cloth brace	Abiram		Amazon		10/10/2024	1	\$14.88	\$14.88	<a href="#">Link</a>
Gel padding	medical grade padding	Sheche kin		Amazon		10/10/2024	1	\$15.81	\$15.81	<a href="#">Link</a>
Gel sock	Compressive sock to support the carbon fiber	KEMFORD		Amazon		10/10/2024	1	\$15.95	\$15.95	<a href="#">Link</a>

Plastic cord locks	End of the bungee	Heado US	Amazo n	10/10/2024	1	\$3.98	\$4.20	<a href="#">Link</a>
Nylon Fabric	fabric/cloth to sew carbon fiber	MYUR EN	Amazo n	11/6/2024	1	\$12.61	\$12.61	<a href="#">Link</a>
Bungee pt 2	stronger bungee to support better dorsiflexion	LuckyS traps	Amazo n	10/23/2024	1	18.99	\$20.03	<a href="#">Link</a>
Bungee	thinner bungee	Huouo o	Amazo n	10/25/2024	1	\$6.32	\$6.32	<a href="#">Link</a>
Mini caribener	small sized caribener to hold bungee	REI	REI	11/4/2024	1	\$6.00	\$6.00	In-sto re
Shock cord	thinner and stronger bungee	REI	REI	11/4/2024	1	\$5.95	\$6.61	In-sto re
Lock laces	lock laces to fix the slipping problem of the plastic cord lock	Lock Laces	Amazo n	11/4/2024	1	\$12.65	\$12.65	<a href="#">Link</a>
<b>Carbon Fiber piece - Component 2</b>								
Carbon Fiber (N/A)							\$0.00	
Metal for prototype	Fabrication of back support						\$0.00	
3D printing prototype	3D printing of back support				1	1.40	\$1.40	*cover ed by our given \$50 per team
						<b>TOTAL:</b>	<b>\$116.46</b>	