Inconspicuous Ankle Foot Orthosis (AFO) for teen

October 18th - October 25th, 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 began fabricating the first prototype. Anya and Alex sewed the bungee cord and plastic lock to the foot sleeve and tested the mechanism. Meanwhile, Lucy and Presley worked on the SolidWorks design to prepare for 3D printing the carbon fiber attachment. Anya consulted with the Makerspace team for SolidWorks assistance and confirmed the use of their printer for the 3D printing process. Based on issues encountered with the initial prototype, the team ordered updated materials for the next iteration.

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

<u>Anya:</u>

- Ordered the new materials for the updated prototype (30 mins)
- Researched bungee cords and printers for carbon fiber attachment (1 hour)
- Met with Makerspace for solidworks help (2 hours)
- Met with Alex to sew bungee cord and plastic lock (90 mins)
- Updated team lab archives and progress report (2 hours)

- Met with team to discuss fabrication plans (45 mins)

Lucy:

- Researched, prepared and attempted to improve the SolidWorks design (4 hours)
- Met with team to discuss fabrication plans (45 mins)
- Met with team to update on fabrication progression (45 mins)

Presley:

- Met with team to discuss fabrication plans (45 mins)
- Met with team to update on fabrication progression (45 mins)
- Continued communication with client (15 minutes)
- Researched TPE and TPU as materials for initial Solidworks prototype (15 minutes)

Alex:

- Sewed the first prototype together; bungee to the compression sleeve (1 hour)
- Researched various methods of carbon fiber production (30 min)
- Met with the team to discuss fabrication plans (45 min)

Grace:

- Met with team to discuss fabrication plans (45 mins)
- Met with team to update on fabrication progression (45 mins)

Weekly/Ongoing Difficulties

The bungee cord pulls up the foot sleeve rather than supporting the foot and prevent foot drop. The team needs to figure out a way to attach it to a rigid piece (preferably the carbon fiber attachment), so that this problem does not occur. Seeking help for Solidworks designing also still needs to occur.

Upcoming Team and Individual Goals

Team:

- Continue fabrication of the prototype
- Receive details on funding request
- Finish Solidworks design and begin 3D printing

Individual:

Anya:

- Fix Solidworks design and take appropriate measurements for it (xyz coordinates on Grace's foot)
- Resew the foot sleeve using the new bungee cord
- 3D print out Solidworks design using Markforged Onyx Pro printer

Lucy:

- Meet with 1-1 with Solidworks tutor, run simulations with Presley, and 3D print

Presley:

- Run simulations in Solidworks to find breaking points, strength, etc.
- Work with team through fabrication process of initial prototype
- Continue communication with client

Alex:

- Keep updating our expenses in the spreadsheet
- Continue to find out and research the best methods to work with carbon fiber
- Get our first prototype done by Friday 10/25 or Sunday 10/27

Grace:

- Continue to brainstorm ways to improve our design
- Help with prototype fabrication as needed
- Help with testing 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		0%	
→ 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	
Ankle Brace - Component 1										
Ankle Brace	Cloth brace			Amazon		10/10/2024	1	$11.90	$11.90	
Strong glue	medical grade glue								$0.00	
Gel padding	medical grade padding			Amazon		10/10/2024	1	$14.99	$14.99	
Gel sock	Compressive sock to support the carbon fiber			Amazon		10/10/2024	1		$0.00	
Plastic cord locks	End of the bungee			Amazon		10/10/2024	1	$3.98	$3.98	
Fabric	fabric/cloth to sew carbon fiber								$0.00	
Bungee	Bungee to			Amazon		n/a (alread	2	n/a	$0.00	

	support dorsiflexion - use what we have					y had)				
Carbon Fiber piece - Component 2										
Carbon Fiber (N/A)									$0.00	
Metal for prototype	Fabrication of back support								$0.00	
3D printing prototype	3D printing of back support								$0.00	
Category 3										
									$0.00	
									$0.00	
								TOTAL:	**$30.87**	