



Inconspicuous Ankle Foot Orthosis (AFO) for teen



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Client

Debbie Eggleston

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October 04, 2024



Problem Statement

Project Description:

Design an AFO tailored for young individuals diagnosed with FSHD to facilitate natural gait [1].

AFO Requirements:

- Support dorsiflexion to prevent foot drop
- Prevent inversion
- Discrete, thin, and non-rigid design
- Initial prototype budget: \$300



Background/Motivation

Facioscapulohumeral muscular dystrophy (FSHD): genetic disorder causing progressive muscle weakness [2]

Client: Debbie Eggleston

Patient: high school student with FSHD concerned about the visibility of traditional AFOs

Competing Designs

- Flexible - dynamic AFO
 - Natural gait pattern
 - Reduces Three-Point-System
- Rigid
 - No range of movement
- Jointed
 - Full range of motion
 - Bulky



Figure [1]: Flexible AFO [3]



Figure [2]: Rigid AFO [4]



Figure [3]: Jointed AFO [5]

Design 1:

- Carbon fiber casing
- Circular hinge on the medial side [6]
- Internal spring for dorsiflexion
- Powermesh straps [7]

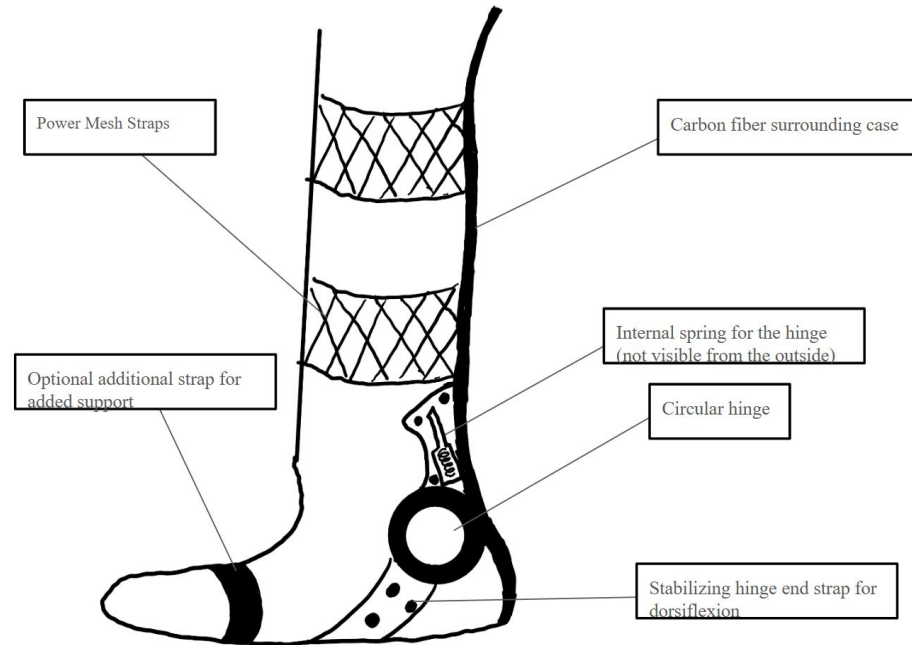


Figure [4]: Hinge design sketch

Design 2:

- Rotator dial with bungee
- Adjustable velcro straps
- Non-rigid material
 - Neoprene, etc.
- "Athletic"
- Does not support inversion

Bungee Brace

(right foot)

* dimensions to come



Figure [5]: Bungee Brace Design Sketch, Medial View

Design 3:

- Carbon fiber body
- Straps made of TPE Filament
 - Thermoplastic Elastomer
 - Flexible and clear
- Angled at 10 degrees
- Medial support from ankle instability

Strap Brace

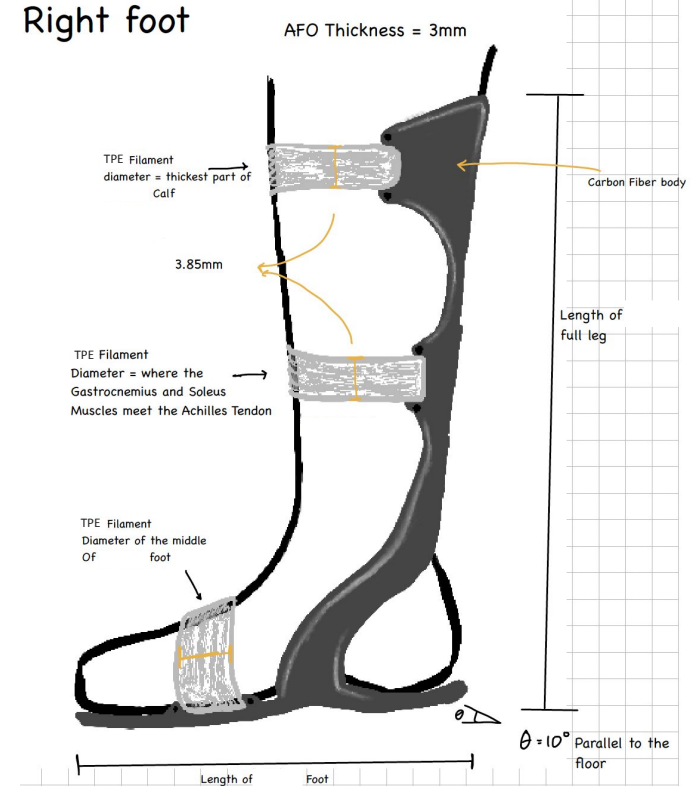


Figure [6]: Strap Brace Design Sketch, Medial View



Design Criteria

Support (20%)

Discreetness (20%)

Safety (15%)

Flexibility (15%)

Ease of Attachment
and Removal (10%)

Customizability (5%)

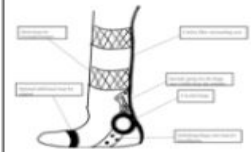
Cost (5%)

Ease of
Manufacture (5%)

Design Matrix



Criteria	Weight	Design 1 Hinge Design		Design 2 Bungee Brace Design		Design 3 Strap Design	
		Score	Weighted Score	Score	Weighted Score	Score	Weighted Score
Support	20	3/5	12	3/5	12	5/5	20
Discreetness	20	3/5	12	5/5	20	4/5	16
Safety	15	3/5	9	4/5	12	4/5	12
Flexibility	15	4/5	12	5/5	15	3/5	9
Customizability	10	4/5	8	5/5	10	3/5	6
Ease of Attachment and Removal	10	2/5	4	3/5	6	4/5	8
Cost	5	4/5	4	5/5	5	4/5	4
Ease of Manufacture	5	5/5	5	4/5	4	3/4	3
Total	100	66		84		78	



Updated Design

- Carbon Fiber support added
- Implements ideas from both designs 2 and 3

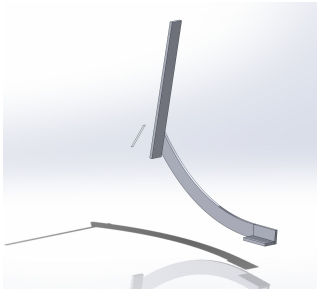


Figure [7]: Lateral View of Carbon Fiber Support in Solidworks

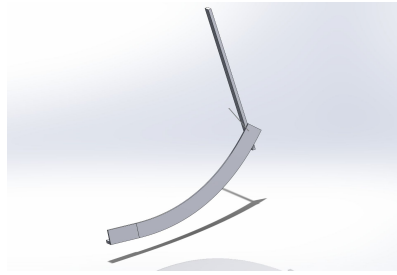


Figure [8]: Medial View of Carbon Fiber Support in Solidworks

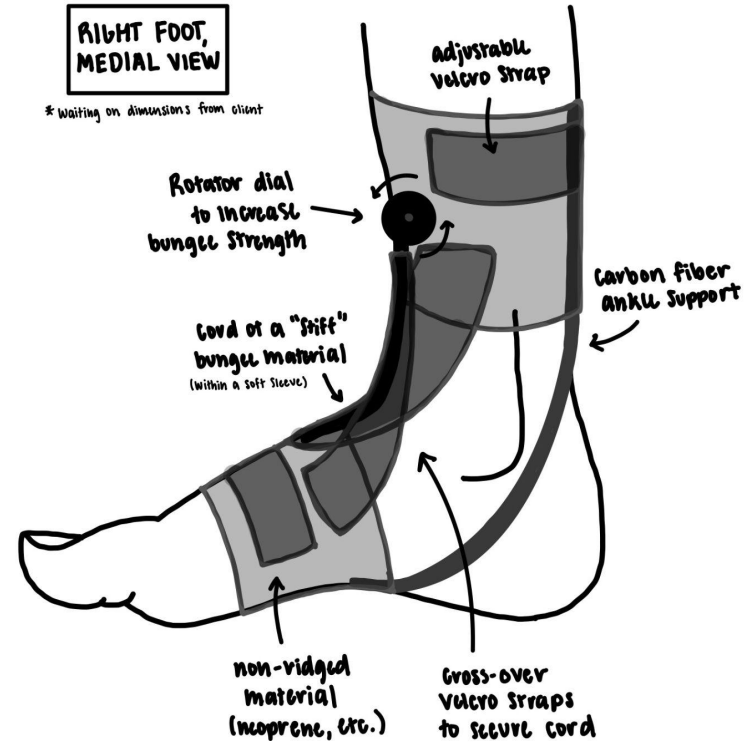


Figure [9]: Right Foot Medial View of Updated Design



Future Work/Expected Difficulties

- Durability of the device
 - Carbon fiber
 - Elasticity of materials
- Weighing functionality versus discreteness
- Testing in Solidworks
- Fabrication Plans
- Future testing



Acknowledgements:
Debbie Eggleston
Dr. Brandon Coventry



References

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- [7] T. Industry, "What is Mesh Fabric? Different Types of Mesh Fabric," *Textile Industry*, Oct. 31, 2023. <https://www.textileindustry.net/what-is-mesh-fabric-types-of-mesh-fabric/>



Questions?