UW Adapted Fitness: Grip Strength Improvement Mechanism

DEPARTMENT OF

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Overview

- Project Statement
- Background/Client Description
- Prior work/Competing designs
- Product Design Specification
- Potential Designs
- Design Matrix
- Current Design
- Testing
- Future Work

Project Statement

Task: Design a customized grip strength device for a UW Adapted Fitness member in order to improve function in right hand

Requirements:

- Safety
- User friendly
- Comfort
- Affordability

Figure 1: UW Adapted Fitness, where our client receives rehab therapy [1]

Speaker: Lucy

Background/Client Description

- Our client was a professional skier before a TBI
- Walks with a cane
- Hemiplegic, right side
- Adapting to falls

Figure. 2 Hemiplegia, right side

Speaker: Lucy

Competing Designs

- Active hands grip assist
- Grip strength trainer
- Robotic glove [1]
- Use of electronics
- Shortcomings

Figure 3: Grip mechanism used at the UW adapted fitness center

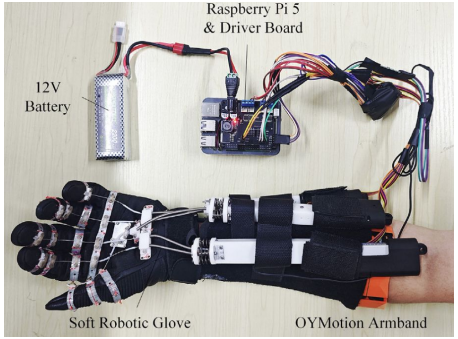


Figure 5: Soft robotic glove to test grip strength

Figure 4: Grip mechanism used at the UW adapted fitness center

Speaker: Lauren

Product Design Specification

- Easy to put on and remove
- Adjustable for different hand sizes
- Improve overall grip extension and flexion
- Quick, safe release in emergencies
- Size of adult hand and lightweight
- Comfortable, safe material

Speaker: Lauren

https://docs.google.com/spreadsheets/d/1vcpyMwRbLbKrU9_imMrZSoZ7LbOWCBkmjzE60Gfgl_o/edit?gid=529386342#gid=529386342 (line to BPAG Expense Spreadsheet)

Design Idea #1: Hook and Bands

- Easy to put on a closed hand
  - Thin Half-glove design
  - 10 Open rings
  - Hook-and-loop wrist strap
- High tension bands pull back fingers
- One band on each finger, attached at a center hook
- Pull back hook to open hand

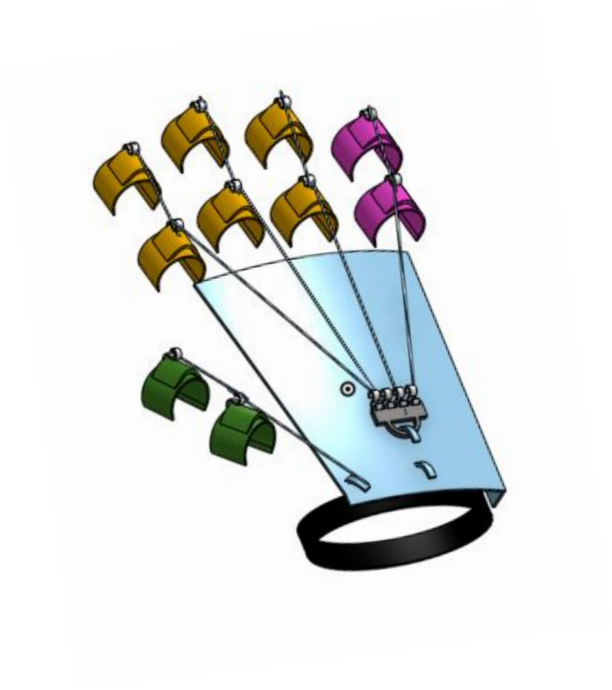


Figure. 6

Speaker: Gabe

Design Idea #2: Balloon Glove

- Hand shaped balloon held in place by rubber clips
- Inflated by a pump on the hook-and-loop wrist band
- Inflates to partially open the hand

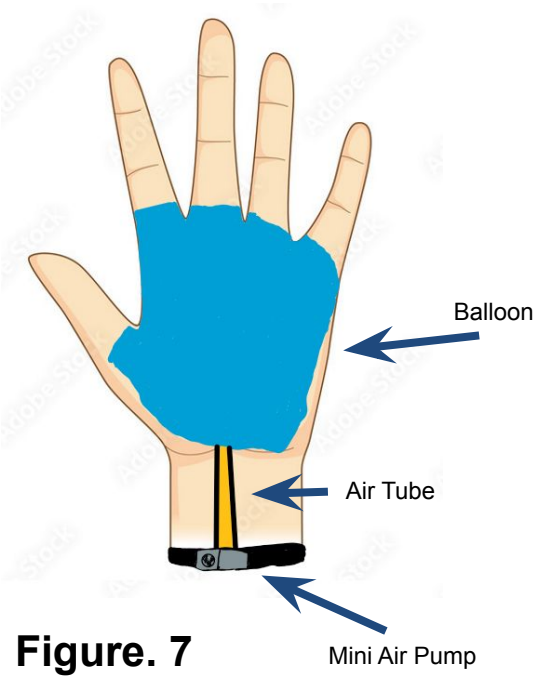


Figure. 7

Speaker: Gabe

Design Idea #3: Hinge Mitten

- Mitten shaped device on the palm
- Mitten starts in closed position, so the hand only needs to open partially to put it on
- Hook and loop strap hold's mitten in place
- Hinge inside operated by a motor on the wrist
- Hinge slowly opens and pushes fingers into the open hand position

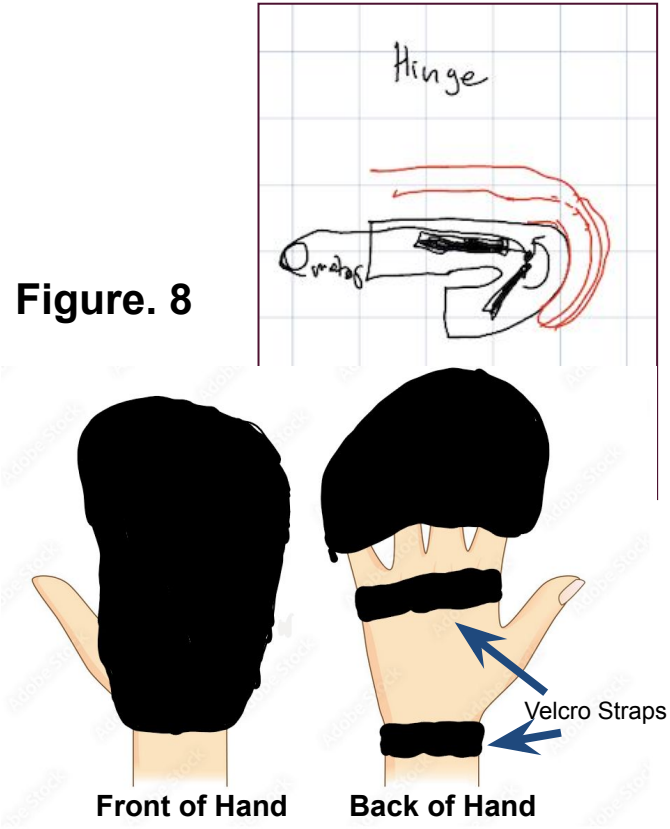


Figure. 8

Speaker: Gabe

Design Matrix

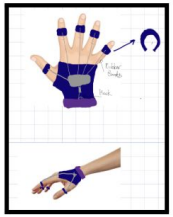
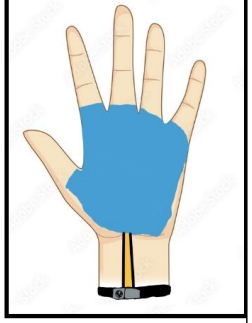
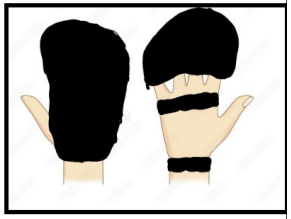
		Design 1: Hooks & Bands		Design 2: Balloon Glove		Design 3: Hinge Mitten	
							
Criteria	**Weight**	Score (Max 5)	Weighted Score	Score (Max 5)	Weighted Score	Score (Max 5)	Weighted Score
Range of Motion	25	5	25	2	10	3	15
Patient Comfort	25	2	10	3	15	4	20
Amplification	20	4	16	2	8	2	8
Adjustability	15	3	9	4	12	4	12
Safety	10	3	6	5	10	4	8
Cost	5	4	4	2	2	3	3
Total	**100**	70		57		66	

Figure 9:

Speaker: David

Current Design

- The current design uses multiple rings to clip onto each finger made out of silicon

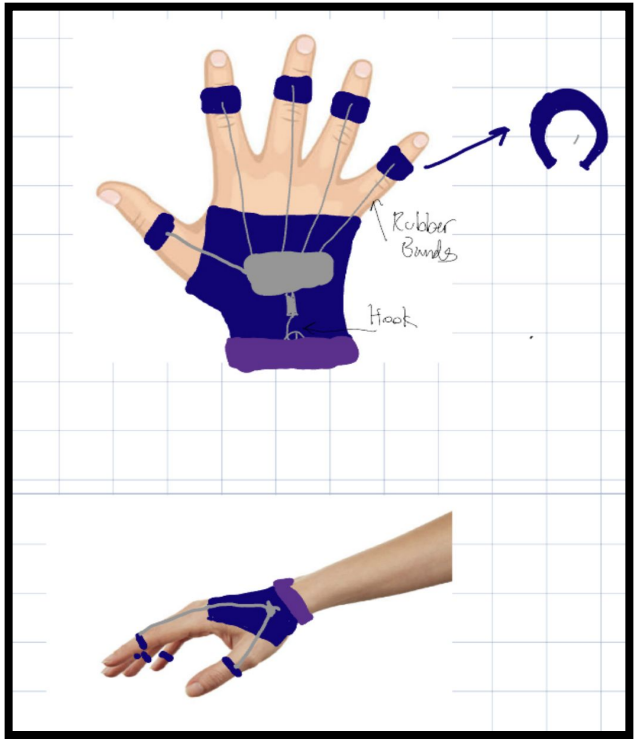


Figure. 10

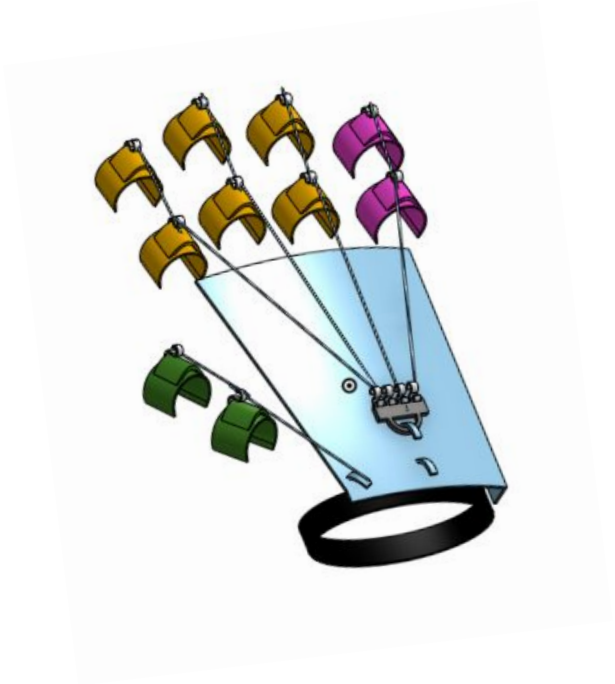


Figure. 11

Dimensions for Clients Hand:
Wrist Diameter: 6.5 cm
Distance from Wrist to Tip of Middle Finger: 23 cm
Circumference of Wrist: 17.5 cm

Speaker: David

Testing

- Test band snap risk and hook smoothness
- Time how long it takes to put on and take off
- Track changes in grip strength with a hand dynamometer
- Use device to help release objects or perform simple tasks
- Survey comfort

Figure 12: Hand Dynamometer [6]

Speaker: Sydney

Future Work

- Finalize budget
- Create and begin fabrication plan
- Custom-fit finger rings (adjustable or 3D-printed soft loops)
- Explore alternative band materials
- Collect patient-reported outcomes
- Collaborate with team leaders of Adapted Fitness

Speaker: Sydney

Acknowledgements

Simon Nam

Client: Dr. Kecia Doyle

Advisor: Professor Randy Bartels

Pictures References

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[6] “Home Gym Machine with Weights,” Top5Best. [Online]. Available: https://top5best.com/home-gym-machine-with-weights. [Accessed: Oct. 1, 2025].

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[1] J. Zhang et al., “Bionic soft robotic glove with EMG-based gesture and grip strength synchronized prediction for grasping assistance,” Biomedical Signal Processing and Control, vol. 112, p. 108516, Aug. 2025, doi: https://doi.org/10.1016/j.bspc.2025.108516
[2] K. Doyle, “Adapted Fitness and personal training,” Kinesiology, https://kinesiology.education.wisc.edu/academics/certificates/adapted-fitness-and-personal-training/ (accessed Sep. 30, 2024).