



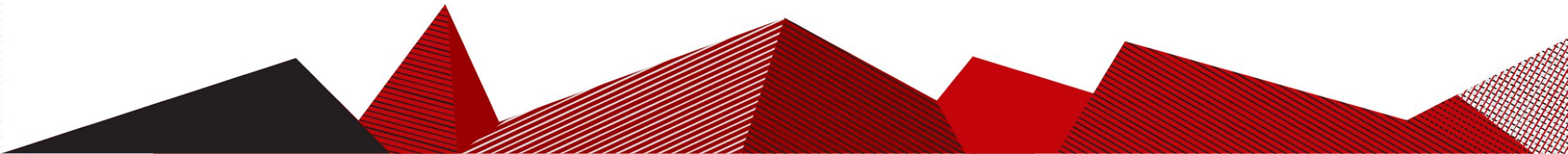
Climber's Forearm Trainer

Brittany Glaeser, Kaitlin Lacy, Noah Pollard, Grace
Johnson, Gabby Snyder



Overview

- Problem Statement
- Background
- Design Specifications
- Preliminary Designs
- Design Matrix
- Future Work
- References and Acknowledgements

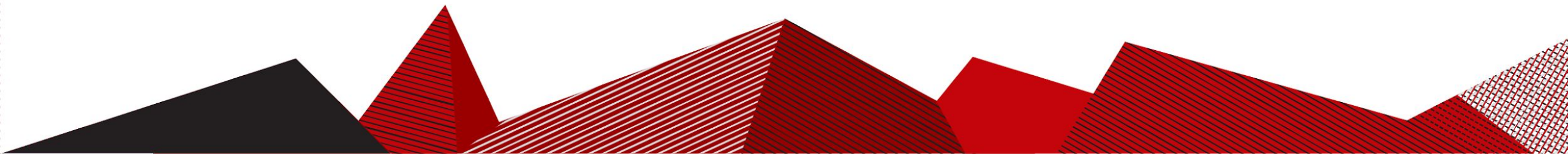


Problem Statement

A device is needed for the prevention and treatment of 'Climber's Elbow'. Ideally the device would allow for resisted, slow eccentric training for the wrist extensors and flexors as well as pronators and supinators.

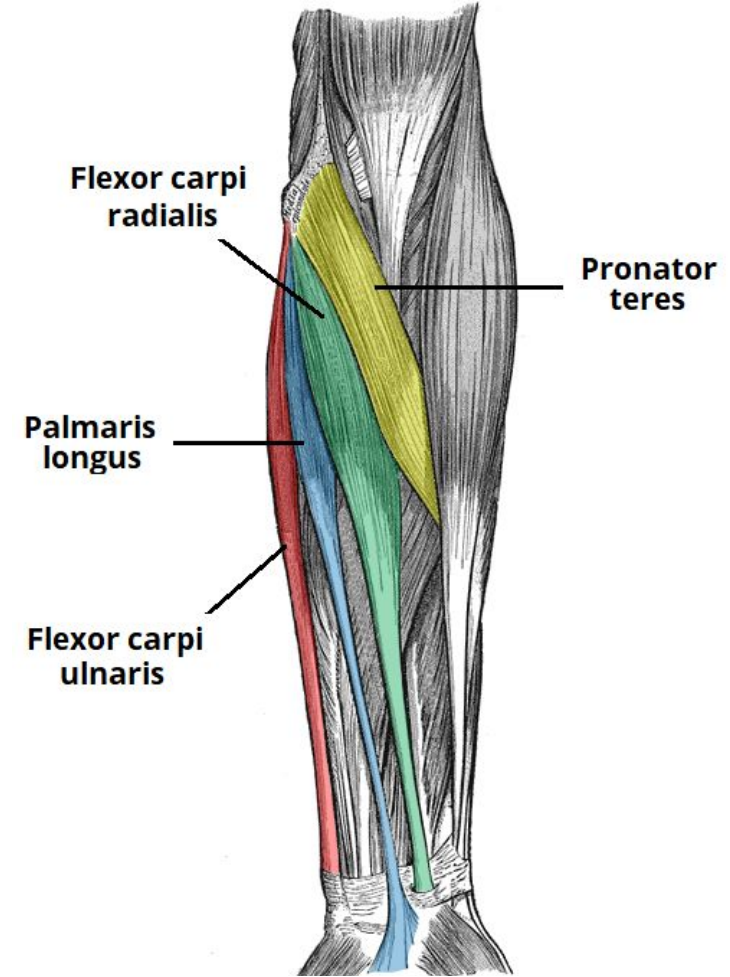
Updates:

- Specific muscles and tendons affected
- Adjustable resistances
- Portable

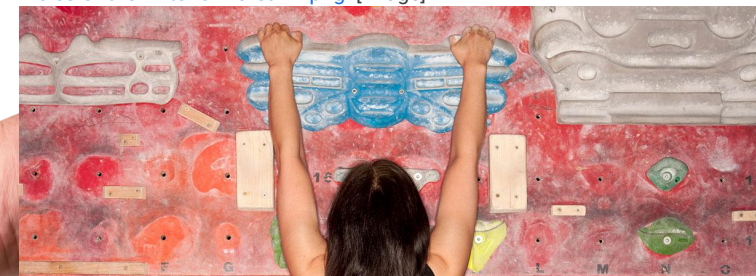


Background

- Four flexor muscles [1]
 - All connect to medial epicondyle [1]
 - Share common tendon [1]
- Emphasize the pronator teres
- Overuse causes damage to the tendon [2],[3]
 - Medial Epicondylitis (Climber's Elbow)
- Most current designs focus on flexors
 - Imbalance in strength [4]



TeachMe Series (2019).
<https://teachmeanatomy.info/wp-content/uploads/Superficial-Flexor-Muscles-of-the-Anterior-Forearm.png>. [image].

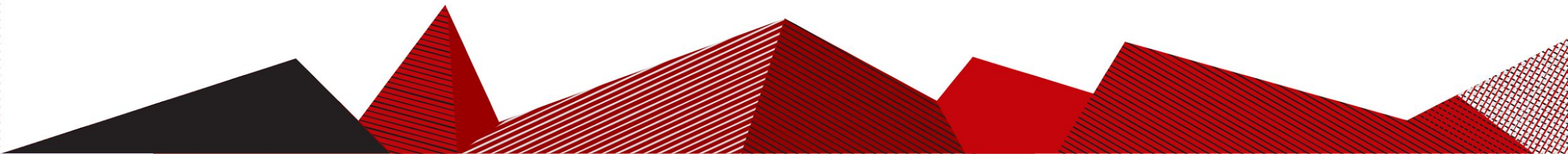


Martin, M. (2019).
<https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcT8gr66TJy0N-yv51WciccAflr-IIOIKftkH2vj-LYNPflvKbBQ>. [image].

Black Diamond Inc. (2019).
http://www.blackdiamondequipment.com/on/demandware.static/-/Sites-bdel/default/dw37df3819/products/bouldering/800150_forearm_trainer_web.jpg. [image].

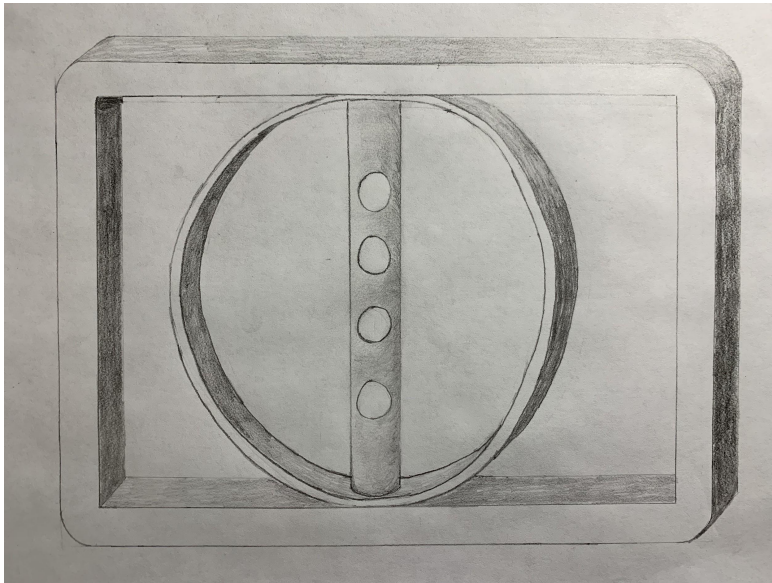
Design Specifications

- Targets the pronator teres
- Portable for at-home use
- Frame of device life in service of five to ten years
 - Force-generating components would need replacement/maintenance
- User safety and comfort
 - Release mechanism
- Accuracy within one to two pounds of target weight
- Accommodates different sized forearms and strengths
- Meets standards according to the ASTM standards for Fitness Equipment (F2276-10)

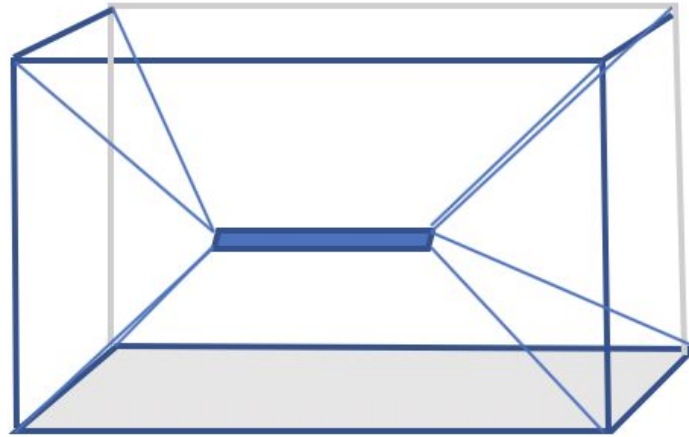


Preliminary Designs

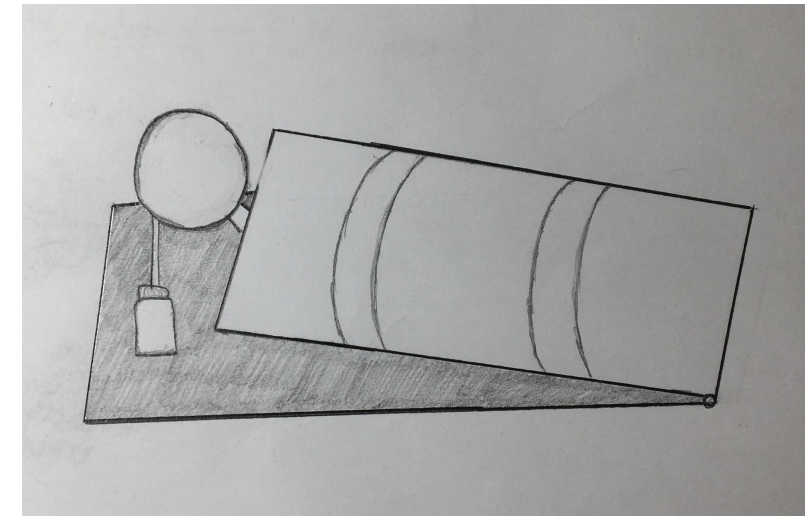
“Resistance Ring”



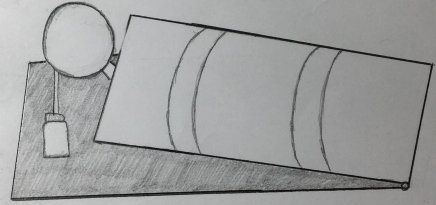
“Resistance Cube”



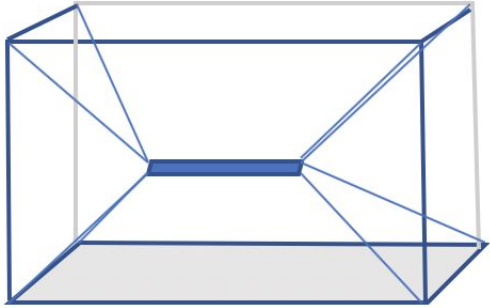
“Hydraulic Arm Press”



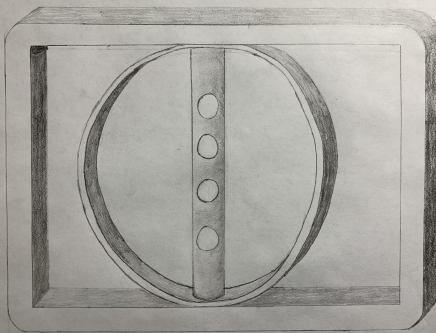
Design Matrix



Hydraulic Arm Press



Resistance Cube

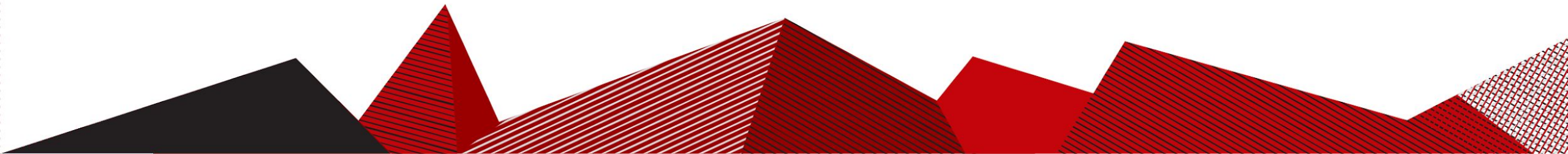


Resistance Ring

Criteria	Design	Weights		Hydraulic Arm Press		Resistance Cube		Resistance Ring	
Effectiveness (25)		4/5	20	4/5	20	5/5	25	5/5	25
Ease of Use (15)		4/5	12	5/5	15	4/5	12	4/5	12
Adaptability (15)		5/5	15	5/5	15	5/5	15	3/5	9
Cost (10)		3/5	6	3/5	6	5/5	10	3/5	6
Comfort (10)		4/5	8	5/5	10	4/5	8	4/5	8
Safety (10)		2/5	4	5/5	10	2/5	4	3/5	6
Portability (5)		3/5	3	4/5	4	4/5	4	4/5	4
Durability (5)		5/5	5	4/5	4	3/5	3	4/5	4
Ease of Fabrication (5)		5/5	5	4/5	4	5/5	5	2/5	2
Total (100)			78		88		86		76

Future Work

- Revise and complete final design
 - Focus on the wrist extensors and rotation
 - Completely portable
- Continue research on materials to be used in the design
 - Types of Bands
- Begin creating a parts list
- Continue collaborating with our client



References and Acknowledgements

We would like to thank our client, Dr. Vandivort, our advisor, Dr. Masters, and Dr. Davis from the anatomy department for each of their contributions to our project.

References:

1. E. Davis, PhD, private communication, Sept. 2019.
2. Axelrod, I. (2019). *How to Prevent and Treat Rock Climber's Elbow*. [online] Moja Gear. Available at: <https://mojagear.com/journal/2014/04/01/got-elbows-a-guide-to-coping-with-climbers-elbow/> [Accessed 7 Sep. 2019].
3. Morrison MD, W. and Smith, A. (2019). *Tendinitis: Symptoms, causes, and treatment*. [online] Medical News Today. Available at: <https://www.medicalnewstoday.com/articles/320558.php> [Accessed 7 Sep. 2019].
4. Edwards, A. and Evans, K. (2019). *Stretches to Avoid Elbow Pain from Climbing - Gripped Magazine*. [online] Gripped Magazine. Available at: <https://gripped.com/indoor-climbing/stretch-to-avoid-elbow-pain-from-climbing/> [Accessed 9 Sep. 2019].