Upper Extremity Dynamic Sling

Team Leader: Kelly Hanneken
Communicator: Kate Binder
BWIG: Marie Greuel
BSAC/BPAG: Matthew Walker

Client: Mrs. Karen Blaschke, OTR/L, CHT
Advisor: Mitchell Tyler M.S., P.E.

UW BME Design

Agenda

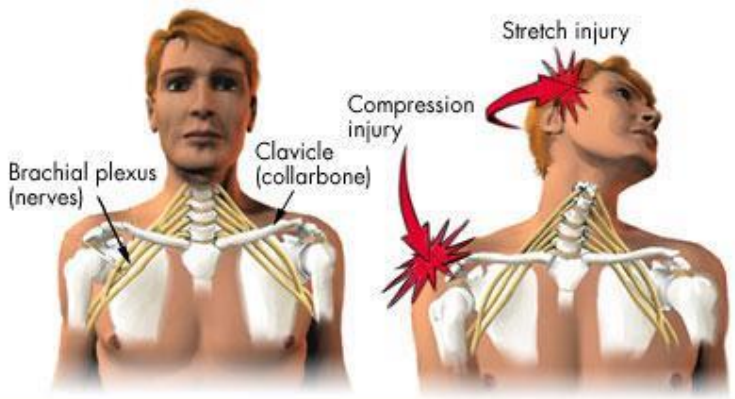
- Problem Statement, Client Info
- Motivation
- Design Constraints
- Last Semester Summary
  - Prototype
  - Evaluation/Testing
- Goals with Timeline
- Budget

Problem Statement

- Client: Karen Blaschke, OTR/L, CHT, Rehabilitation Medicine, UW Hospital and Clinics
- Sling to support upper extremities during running for post brachial plexus injury
- Possibly applied to rotator cuff injuries as well as other impact injuries

Motivation

- Brachial plexus injuries occur in people of all ages
  - Most common in young healthy adults
- Many levels of severity
- Varying recovery periods
- Return to active lifestyle
  - Can’t do so w/o assistance



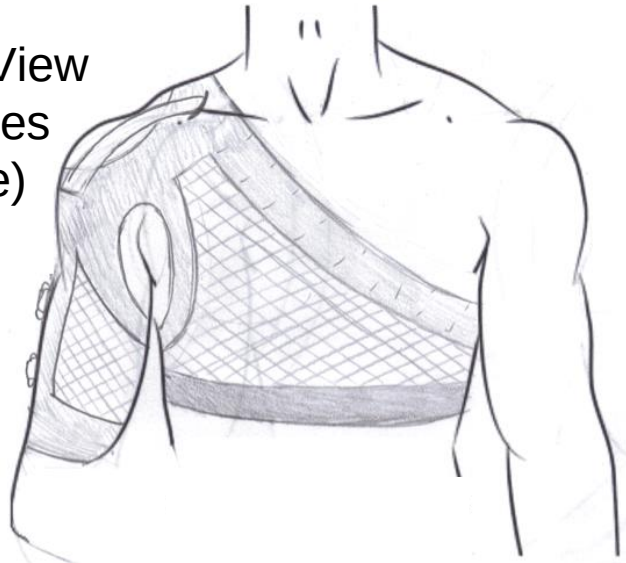
Design Constraints

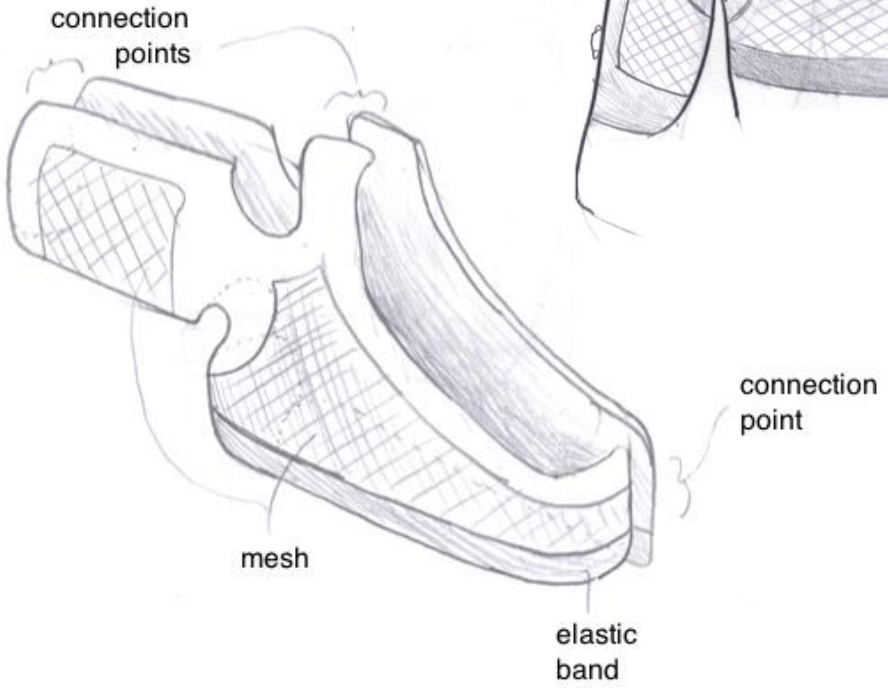
Functions:

- Assist user while running / during exercise
  - Maintain “normal” body mechanics
- Prevent shoulder slouching
- Adjust to different body types / disability level
- One-handed assembly
- Comfortable, breathable, lightweight
- Washable

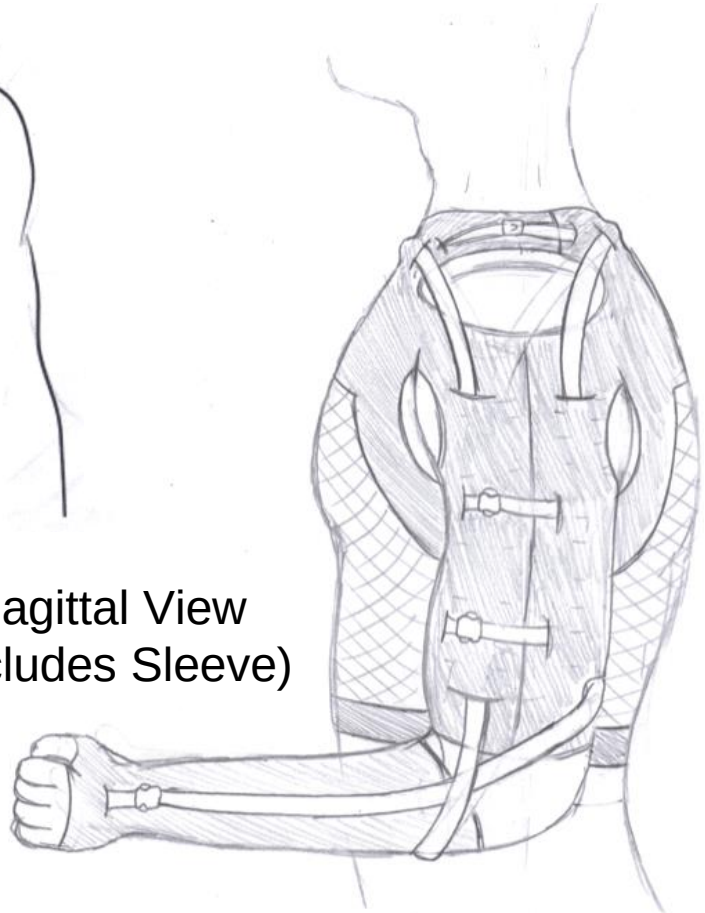
Our Design

Anterior View (Excludes Sleeve)



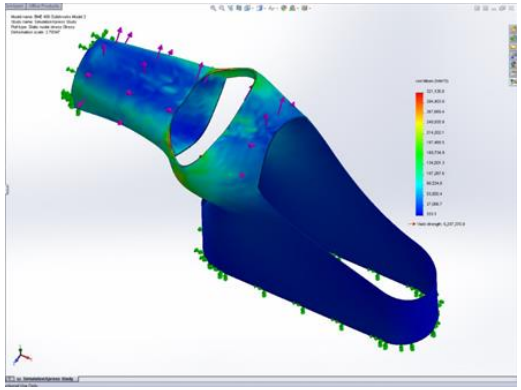


Sagittal View (Includes Sleeve)



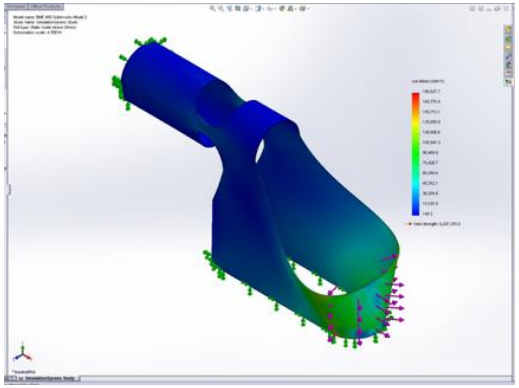
Prototype

Evaluation

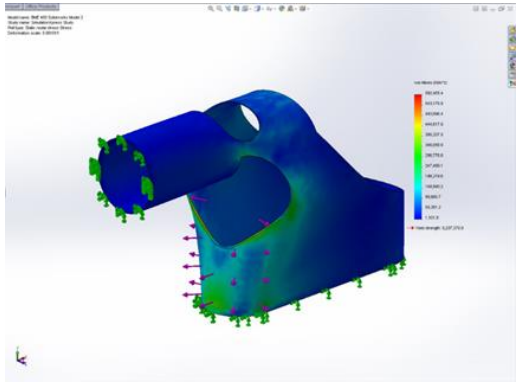


Von Mises Stress resulting from 50 N of force on top of sleeve and shoulder strap

Average factor of safety at 50 N is 32, much higher than our desired factor of safety of 2.



Von Mises Stress resulting from 50 N of force on outside axillary strap of non-injured side



Von Mises Stress resulting from 50 N of force on axillary strap of injured side

Goals and Timeline

Quantitative Testing: Cyclic Loading Tests

- Neoprene
- Tension Cables

- Investigate how materials hold up over entire recovery period (strength/fatigue)
  - Ensure structural integrity of material is maintained
- Timeline: March 10 - 14

Goals and Timeline

Quantitative Testing: Motion Capture/Kinect

- Run on treadmill while wearing device
- Determine if normal body mechanics are maintained during use
- Can take measurements of interest
- Timeline: March 24 - 28

Goals and Timeline

Qualitative Testing: Survey

- Have subjects wear device during running/exercise
- Complete survey
- Evaluate comfort, ease of use, and overall impression
- Timeline: April 7 - 18

Budget

- Past expenses total: $322
  - Spring 2013: $80
  - Fall 2013: $242
- Projected future costs: $175
  - Need more:
    - Neoprene ($80)
    - Tension cables ($35)
    - Strap and sewing supplies ($60)
- Estimated cost of single device: $100 - $120

Acknowledgements

- Mitchell Tyler M.S., P.E., *Advisor*
- Karen A. Blaschke OTR/CHT, *Client*

References

Mayo Clinic. 2011. Brachial plexus injury. http://www.mayoclinic.com/health/brachial-plexus-injury/DS00897

Mayo Foundation for Medical Education and Research. 2013. http://www.mayoclinic.com/health/medical/IM03050

UC San Diego Health System Neurology. 2011. Brachial Plexus Injury. http://neurosurgery.ucsd.edu/brachial-plexus-injuries/

Questions?