

Supportive Sling for Brachial Plexus Injuries

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Client: Karen Blaschke

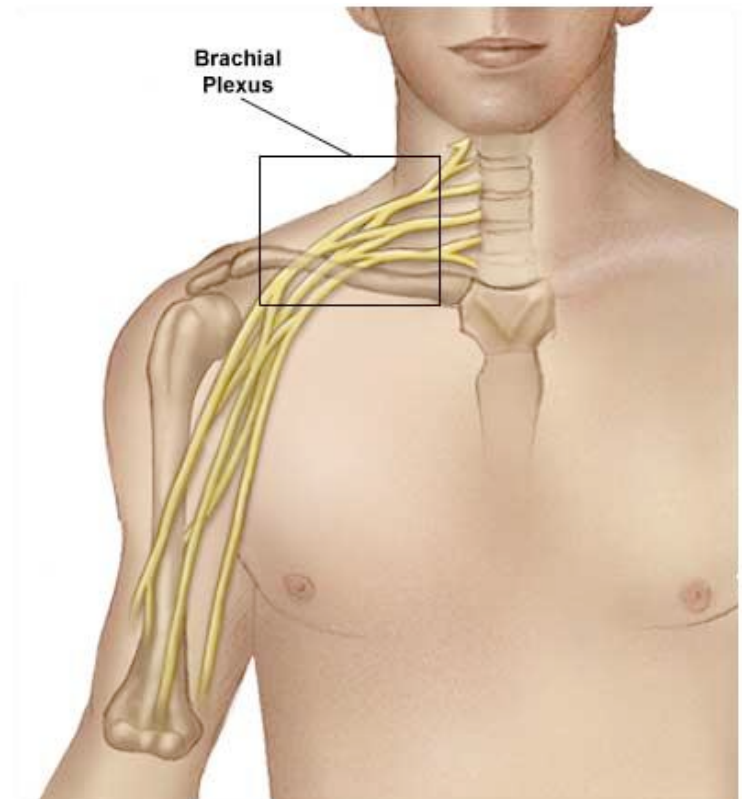
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Nathan Retzlaff, Kayla Stankevitz

Overview

- Brachial Plexus Injuries
- Our Patient-Eric
- Current Slings
- Objectives
- Proposed Sling Designs
- Assessment of Designs
- Construction and Validation

Brachial Plexus Injuries

- Injury to nerves that innervate the arm
- Due to stretch or tear
- Can cause paralysis to the entire arm



Our Patient-Eric

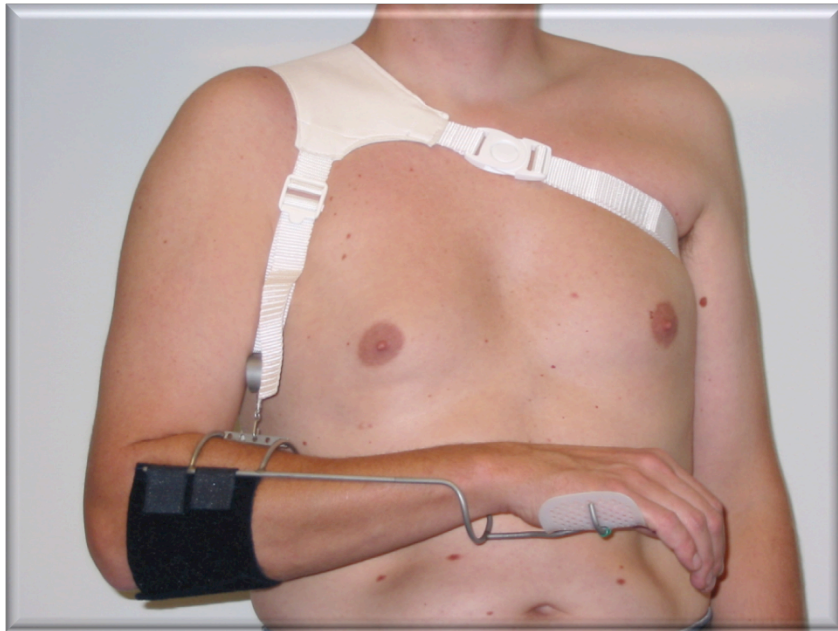
- 38 years old
- No motor control in arm or shoulder, but maintains functional use of hand
- One of approximately 200,000 people a year in the United States who have brachial plexus injuries



Current Slings

GivMohr Sling

- Cannot be worn under clothes
- Hand isn't free

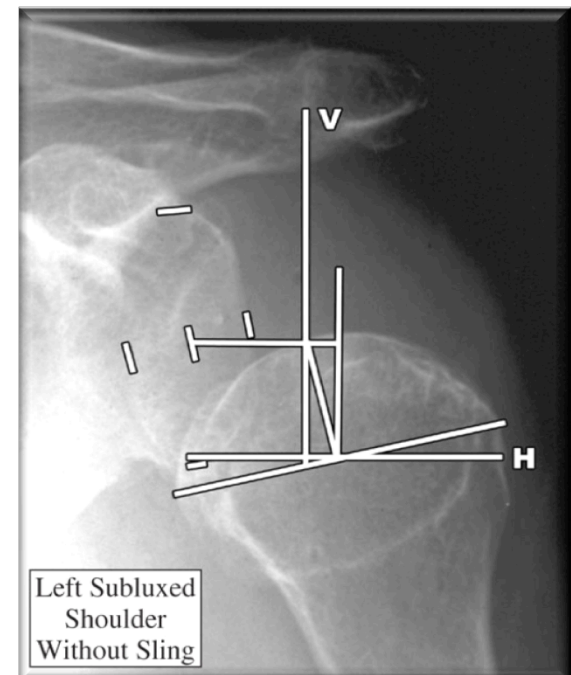


Wilmer Sling

- Uncomfortable distribution of weight
- Hand isn't free

Objectives of Design

- Reduce shoulder subluxation
- Hold elbow at a 90° angle with lower arm forward
- Conceal the majority of the sling beneath clothing
- Enhance comfort (i.e. weight distribution, straps)
- Cosmetic enhancement of deteriorated muscle
- Facilitate one-handed application and removal
- Allow variable elbow positions via a hinge mechanism
- Adhere to budgetary constraints



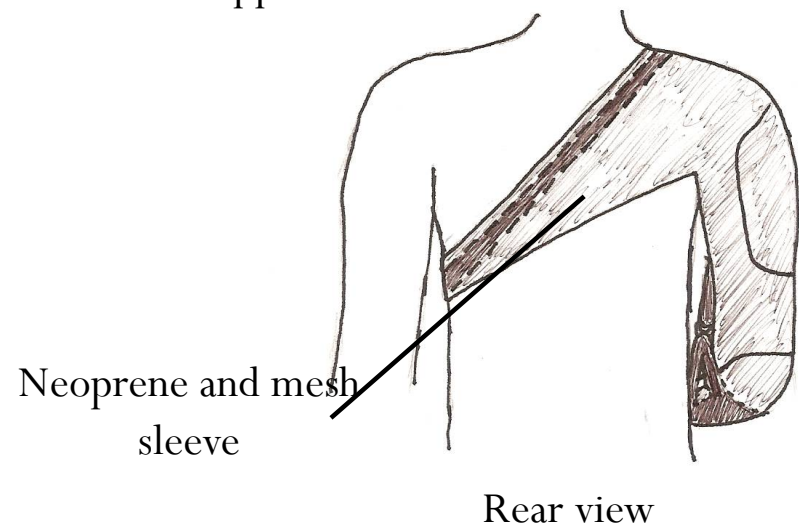
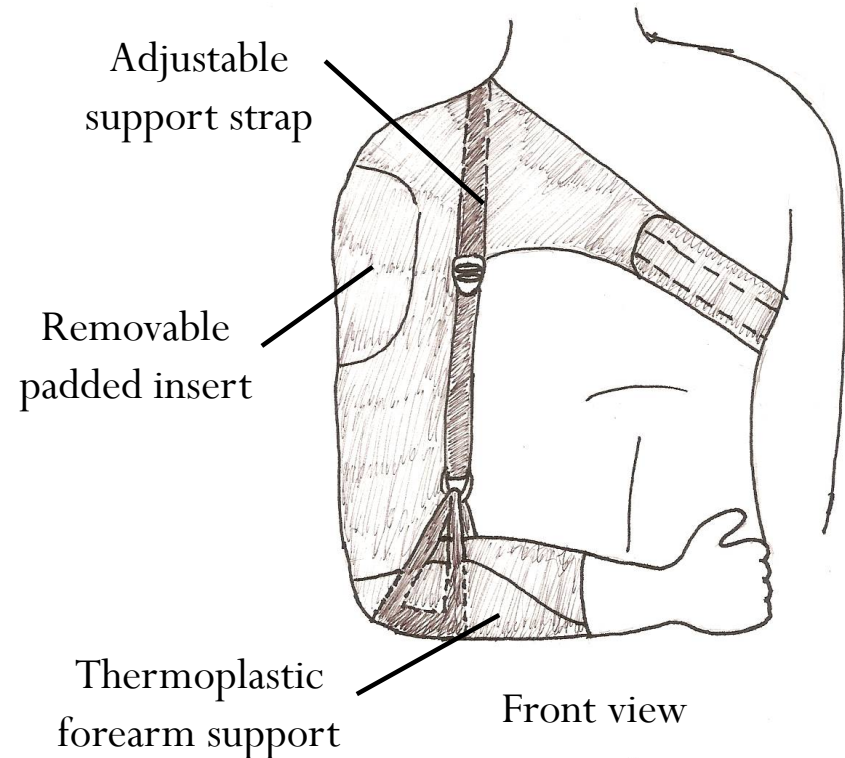
Design #1- Sleeve

- Pros

- Easy to put on
- Fits under clothing
- Will reduce shoulder subluxation by lifting elbow
- Adjustable strap enables some elbow position variation
- Adds cosmetic appeal by adding bulk to injured arm

- Cons

- Sleeve may prone to overheating
- Requires a great deal of fabrication (i.e. material, sewing)



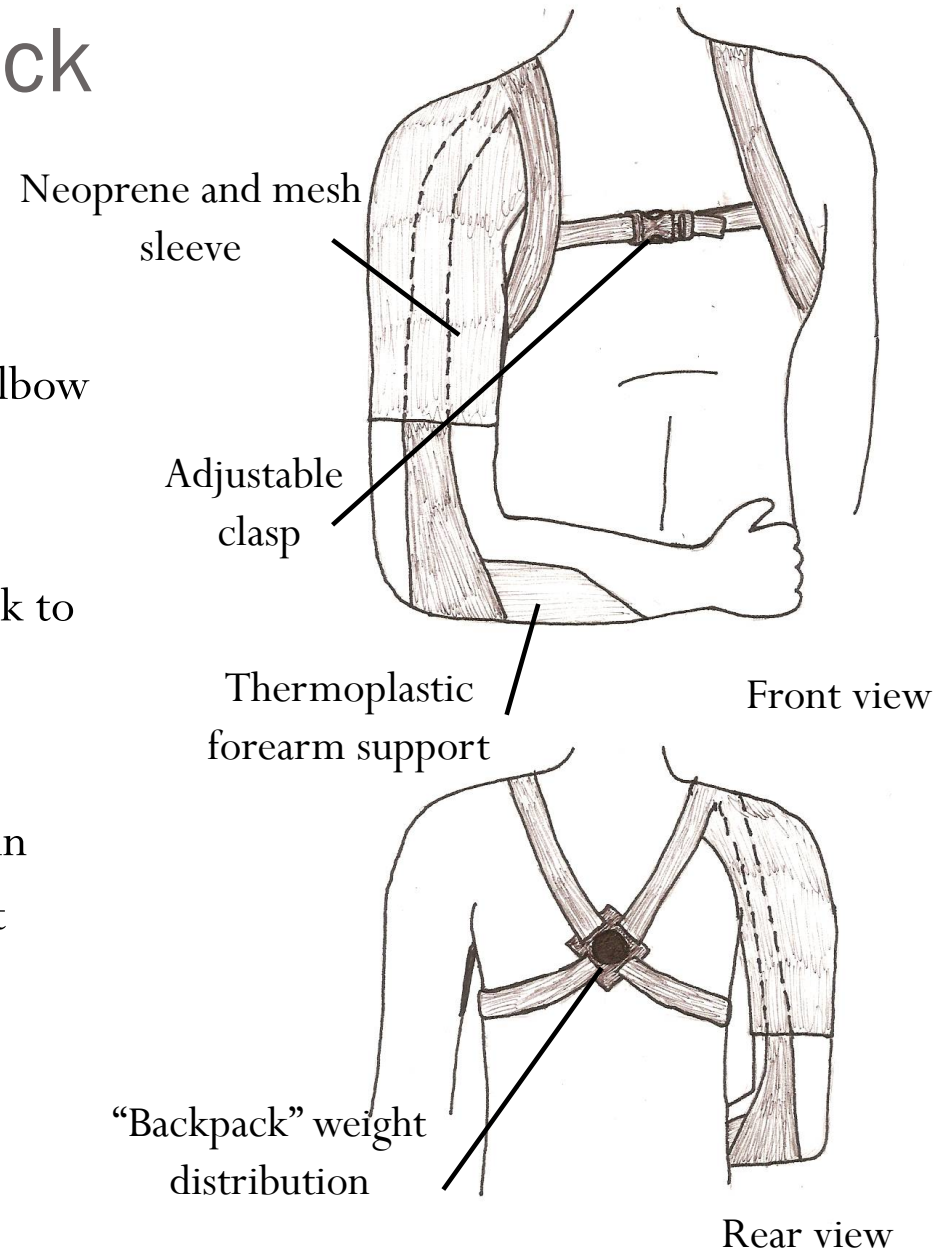
Design #2- Backpack

- Pros

- Will reduce subluxation by lifting elbow
- Fits under clothing
- Enhances weight distribution
- Adds cosmetic appeal by adding bulk to injured arm

- Cons

- Straps may be uncomfortable on skin
- Adjustment of elbow position is not possible as is



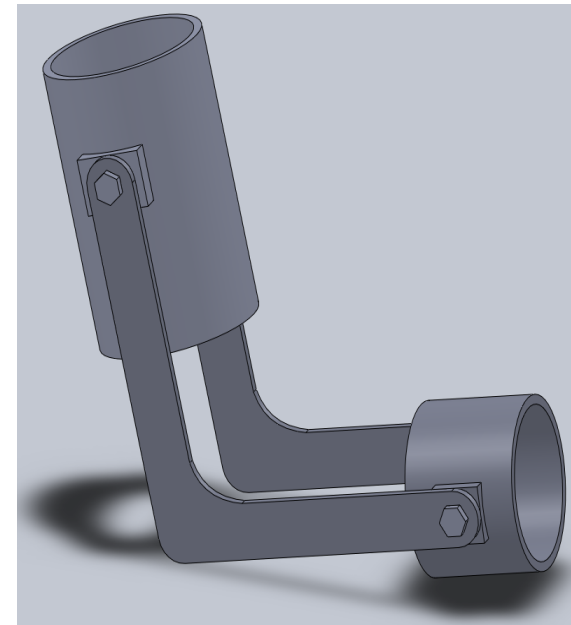
Design #3- Boomerang

- Pros

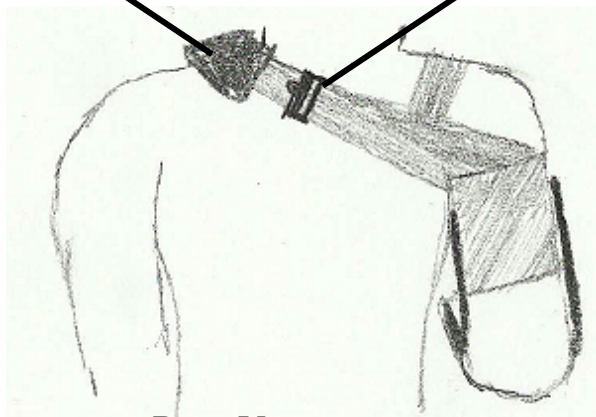
- Reduces subluxation
- Can be worn under clothing

- Cons

- Rigidity of boomerang could become uncomfortable
- Complex to put on with one arm
- Limits adjustability of elbow flexion

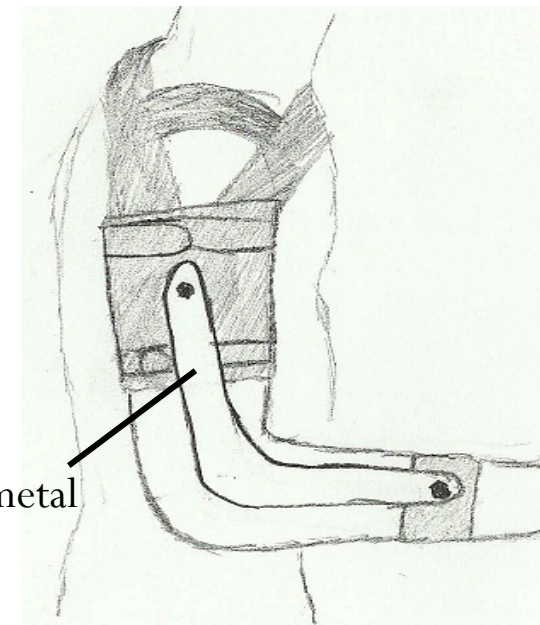


Padded strap Adjustable clasp



Rear View

Polymer/lightweight metal

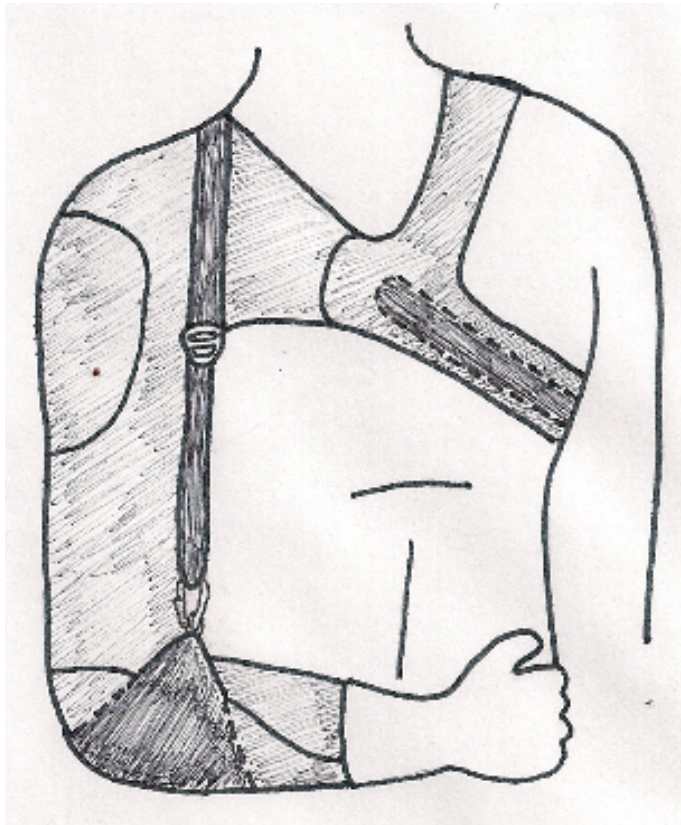


Front View

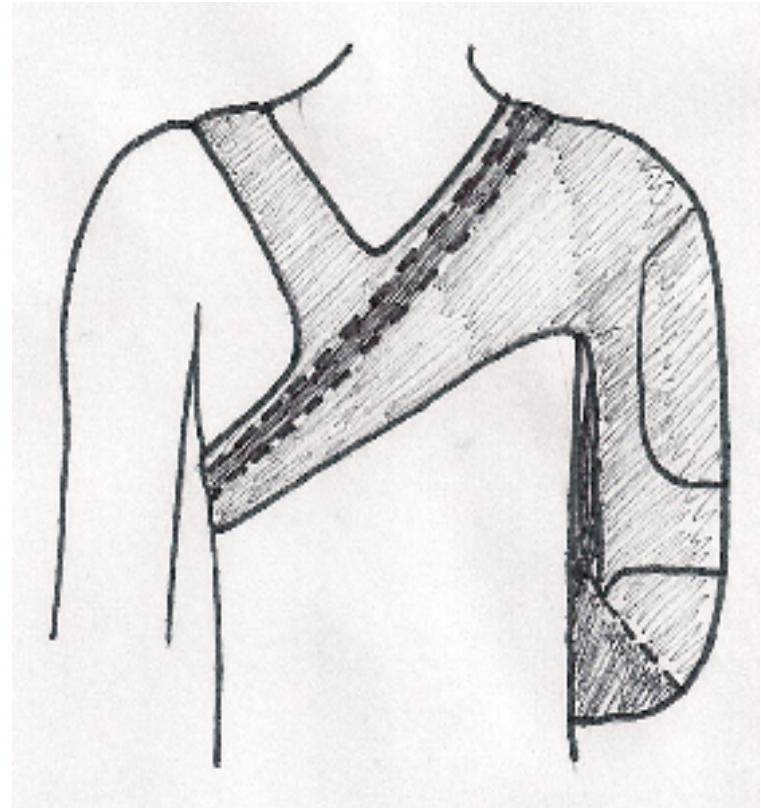
Design Matrix

Criteria	Weight	Sleeve	Backpack	Boomerang
Subluxation reduction	30	25	27	20
Easily worn/put on	15	14	12	8
Ability to conceal under clothing	15	15	15	15
Weight distribution	10	7	9	6
Cost	10	8	6	6
Fabrication complexity	10	9	8	6
Carrying position	5	2	2	4
Cosmetic enhancement	5	5	5	4
TOTAL	100	85	84	69

Final Design



Front view



Rear view

Prototype Testing

- Force Gauge Test: Pre-Prototype
- Subluxation Test: Distance between acromion and humeral head
- Comfort testing: Patient will wear the sling for a day, give feedback



Future Work

- Orthopedics and Orthotics consultation
 - Receive input on materials
 - Assistance with fabrication
- Order Parts
- Prototype Fabrication
- Testing
- Adjustments
- Final Report/Presentation



Acknowledgements

- Karen Blaschke
- Dr. Chris Brace
- Eric

Questions



Sources

Picture sources:

- <http://www.sammonspreston.com/content/images/SPRProductImages/Regular/92724501.JPG>
- http://www.medical-look.com/systems_images/Brachial_Plexus.jpg
- <http://www.3me.tudelft.nl/live/pagina.jsp?id=6fbaf8e6-091b-481a-bf05-be0894b19e58&lang=en>
- <http://www.givmohrsling.com/>

Information sources:

- <http://www.mayoclinic.org/brachial-plexus/>
- <http://www.givmohrsling.com/>
- <http://www.3me.tudelft.nl/live/pagina.jsp?id=6bcfc892-62c9-46d7-b5b8-b8a3b7365b73&lang=en>