A Model to Demonstrate Compression Sleeve Technology on the Lymphatic System

Team 12
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Overview

- Client Background
- What is Lymphedema?
- About Compression Sleeves
- Project Purpose
- Optimal Design
- Testing and Results
- Future Work
- Budget
- Acknowledgements
- Questions
Client Background

• Susan Callison
  ▫ Received surgery to remove 32 lymph nodes as treatment for breast cancer
  ▫ Developed lymphedema in 2009
  ▫ Founded the Lymphedema Sleeve Company

www.lymphedemasleeveco.com/index.php
What Is Lymphedema?

• Accumulation of interstitial fluid
• Due to damage of lymphatic system
• Primary vs. Secondary Lymphedema
• Symptoms
  ▫ Pain, swelling, heaviness and difficulty of use

Arm with severe lymphedema
Diagram of lymphatic flow during lymphedema
About Compression Sleeves

- Compression sleeve can be applied to affected limb to manage lymphedema
- Sleeve increases pressure placed on interstitial fluid increasing movement of lymph toward the venous system
- Many types and compression levels

Solidea Micromassage Sleeve  Competitor Sleeve
Project Purpose

• Create a physical model to show effects of Solidea Slimming Sleeve on lymphatic system
  ▫ Model a lymphatic system in the arm
• Show effects of gravity, muscles, and compression sleeve
• Effects of external factors on lymphatic system
  ▫ Average pressure, fluid flow and fluid volume
  ▫ Lymphedema induced pressure, obstructed fluid flow and increased fluid volume
• Create an arm that can test different compression sleeves' effects on lymphatic system
Design Layout - Bone and Muscles

“Stagnant” muscle on bone

Bone and hinge

Completed muscle and bone design
Design Layout - Electrical System

Switchbox

Arduino

Solenoids

Design of PCB

3D Representation of PCB
Design Layout - Lymphatic Layer

- Lymphatic Schematic
- Peristaltic Pump
- Lymphatic Packets
- Muscle Tendon Covering
- Lymphatic System
Design Layout - Skin and Sleeve

- Upper Arm Tissue
- Lower Arm Tissue
- Tubing to Solenoids
- Fluid Pump
- Solidea Sleeves
- Outlet Cups
Testing and Results

- Tested various parameters of sleeve (sleeve on versus off) and arm (muscle activity versus no activity) but always in a state of lymphedema
Future Work

- Improvement of skin and subcutaneous tissue layer
- Use of a better developed lymphatic vessel system
- Automated lifting of lower arm and eventual lifting of upper arm as well
- Increasing muscle interaction
- Showing influence of micromassage texture on the skin
# Budget

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Questions?
References

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