A Model to Demonstrate Compression Sleeve Technology on Lymphedema

Team Partners: Nicole Lavoie and Christine Tartaglia

Client: Susan Callison Sponsor: Dr. John Enderle and the School of Engineering Department of Biomedical Engineering, University of Connecticut, Storrs, CT 06269

Introduction

- Lymphedema is a disease in which the lymphatic fluid in the body does not drain properly, causing swelling in various regions of the body.
- Lymphedema can often occur as a result of radiation and surgery to treat cancer as well as from burns, and other injuries.
- The use of a compression sleeve is a common treatment for lymphedema.
- Sleeves can be used to apply pressure on the interstitial fluid to increase movement of the lymph toward the venous system.
- Compression sleeves can cause constant pressure over the entire area, some capillaries inferior to the skin will compress and collapse rather than be pressurized to increase fluid flow.
- The lymphedemasleeveco.com uses a compression sleeve founded by Solidea, a company that sells their compression sleeve as a means for weight loss and decreasing cellulite.

Project Purpose

The client believes that the wave pattern of the Solidea compression sleeve applies a graduated pressure along the arm, as well as a zigzagging pressure across the arm allowing microcirculation to occur similar to methods used to treat lymphedema. She would therefore like this project to discuss the following:

- Using a physical model of an arm, show how the sleeve decreases fluid buildup
- The effects of gravity and muscle interaction with the sleeve
- How this same arm is affected by other compression sleeves

Design Layout

Component Key

1. Compressor
2. Air muscle
3. Lymphatic System
4. Skin
5. Solidea Sleeve
6. Pump
7. Solenoid
8. Switchbox

Testing and Results

Testing Protocol

- Run peristaltic pump for two minutes prior to testing to fill up packets and cause "lymphedema".
- Put on compression sleeve and decide muscle testing state.
- Run pump at steady flow for two minutes, activate muscle state, and open lymphatic drainage tubes except for tube at shoulder to mimic axillary node damage.
- Stop pump, measure packet volume output.

Testing Parameters

- No sleeve versus Solidea sleeve
- Flexing muscle activity versus extending muscle activity versus no muscle activity
- Continuous lymphatic fluid input versus no input

Results varied upon defined testing protocol.

Acknowledgements

Dr. John Enderle
Dr. Philip Alimendinger
Serge Doyon
Marek Wartenberg
Dr. Montgomery Shaw
Dr. Mei Wei
Dr. Donald Peterson
Peter Glade
John Fikiet
Susan Callison
Dr. Leslie Shor