Active Compression Shoe to Prevent Blood Clots

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FLUX *Letting it Flow*

Background

We designed a shoe that prevents “Deep Vein Thrombosis,” or blood clots, from forming in the calves of sedentary people. Deep Vein Thrombosis is a condition in which blood clots form in the deep vein of the leg. The blood clots can travel to the lungs and cause respiratory failure.

- **More die from blood clots than breast cancer, AIDS, and traffic accidents combined**
- **100,000-180,000 deaths per year in the US**
- **Over 600,000 hospitalizations per year in the US**

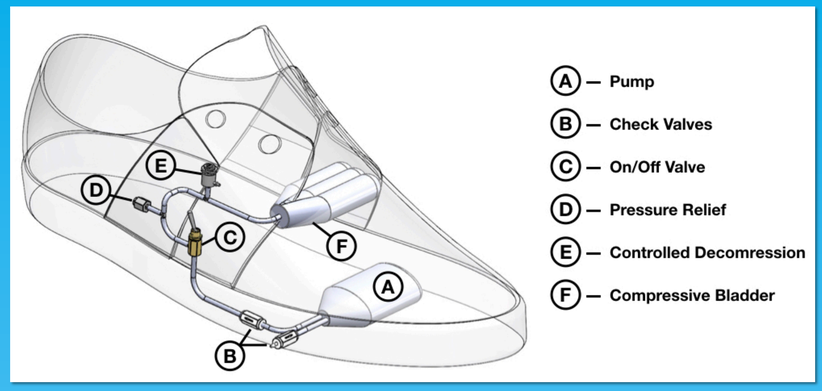
Overview/Design Specs

The user manually activates the device by pressing their foot on the ground from a sitting position. This activates a pump that compresses an air bladder over the top of the foot, compressing the foot and stimulating blood flow into the calf.

- **Compression is applied on and off periodically, simulating the contraction of muscles.**
- **The user activates calf muscles in order to activate compression, further promoting muscle contraction and blood flow**

Working Prototype

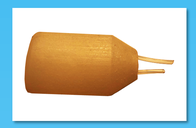
Final Design



Hardware/Key Components

Ⓐ *Pump*

The pumping mechanism is a silicone rubber bladder surrounding open-cell foam for maximal comfort.

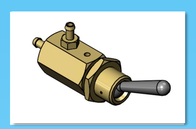


Ⓑ *Check Valves*

The check valves insures insure that air flows in only one direction.

Ⓒ *On/Off Valve*

The ON position diverts air to the compressive bladder, while OFF diverts air to atmosphere.

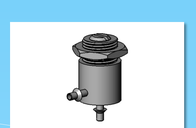


Ⓓ *Pressure Relief*

For safety concerns, the pressure relief valve exhausts air if compressive bladder is pressurized over 400 mmHg.

Ⓔ *Controlled Decompression*

For safety concerns, the pressure relief valve exhausts air if compressive bladder is pressurized over 413 mmHg.



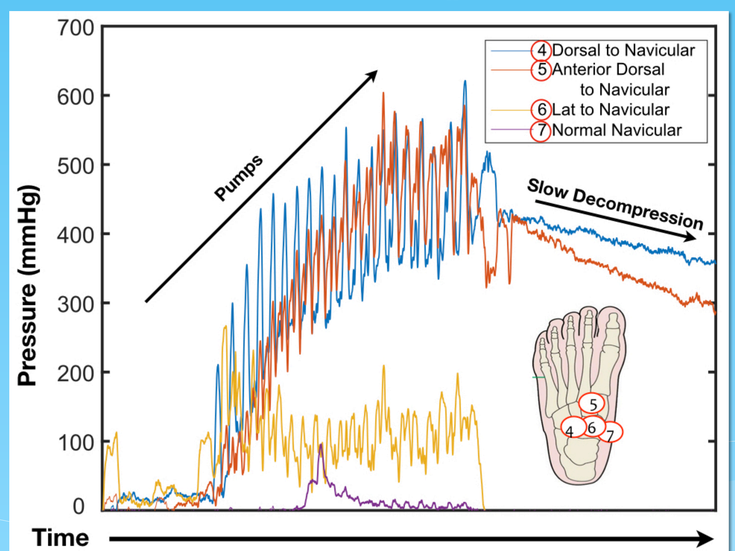
Ⓕ *Compressive Bladder*

The compressive bladder is a silicone-rubber bladder that applies compression to the top of the foot.

Manufacturing Methods

- **A mandrel and cavity were 3D printed**
- **Dragon Skin silicone rubber resin was poured into cavity**
- **The bladders were rolled off the mandrel after setting**

Pressure Testing Results



- **Reaches ~500 mmHg compression in 10 pumps**
- **Decompression is steady and slow**
- **Pressure is Isolated on Dorsal Arch**

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