BIOE 451/452: Bioengineering Design

An opportunity for students to tackle and solve a design problem in bioengineering

Gait Activated Venous Return

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"The GAVRD is portable, easy to use, and does not interfere with the patient's daily activities."
—GAVRD Team Documentation

Team Members:
Deanna Dial, Cameron McGriff, Molly Mullican, Patrick Spicer

BIOENGINEERING DESIGN AT RICE

Rice University
Dept. of Bioengineering
6100 S, Main St. - MS142
Houston, TX 77005

Phone: 713-348-4156
Fax: 713-348-5877

THE BROWN FOUNDATION, INC

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Bioengineering Design Challenge

The venous system in the circulatory system is constructed to return blood to the heart for re-oxygenation. In the legs, the venous system is at the most stress as it must overcome the effects of gravity and the change in pressure to pump blood upwards. Due to inactivity, pregnancy, or obesity, the mechanism of venous blood return may become inefficient and lead to multiple pathologies, including edema, varicose veins, and deep vein thrombosis. If edema, the pooling of fluid in the legs, is left untreated it can result in varicose veins, the twisting and bulging of veins in the legs due to the increase in blood. The greatest risk is vein thrombosis, the formation of blood clots in the legs, as they may break off and cause severe complications in the other parts of the body, and may even result in death. A common strategy to address these problems is compression stockings, which are effective for prevention, but not treatment and sequential compression devices, which are not portable.

Appropriate Solution

Team GAVRD of BIOE 451/452 designed the Gait Activated Venous Return Device, a user friendly compression therapy design that combines the effectiveness of a sequential compression device with the portability of a compression stocking to improve venous blood return in the legs. There are three main components to the design: the cuff, the soles, and the wedges. As the user steps on the sole the vertical displacement in the step is converted to pressure in a cuff around your leg. The sole contains wedges that are attached to wires that are wrapped around a pulley and attached to a cuff around the leg. As the wire is pulled, the cuff is pulled tighter, causing an increased pressure.

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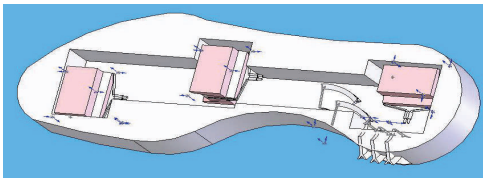
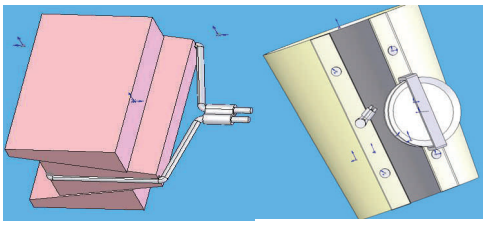


An assembly of wedges, wires and pulleys is used in the sole.



Vertical displacement pulls the wires.

Wires tighten the cuffs.