

## Forces Driving Design

Every year **millions of Americans are affected** by lower leg edema, a condition that can result in deep vein thrombosis and peripheral vascular disease. **Approximately 1,700 people die every year** because there are no simple, convenient counter-measures to prevent these conditions. Current solutions include bulky, expensive sequential compression devices or compression stockings.

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

## Design Criteria

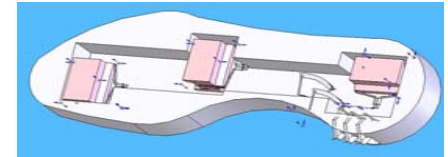
- Adequate graduated therapeutic pressure
- No external power source for easy portability
- Low profile to wear with normal clothing
- Comfortable
- Low cost
- Easy to use
- Easy to clean



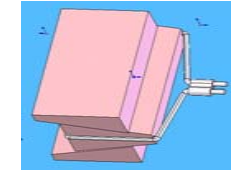
**Fig. 1:** The GAVRD introduces sequential pressure into a portable device.

## The GAVRD Design

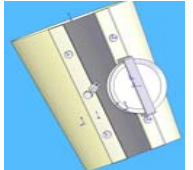
- Shown in Fig. 1, the GAVRD combines the mobility of compression stockings with the dynamic pressure of sequential compression devices.
- Wedges in the sole (Fig. 2 & 3) transfer vertical force from walking into compression in cuffs around the lower leg (Fig. 4).
- Three sections of the gait cycle correspond to three cuffs to provide sequential compression in stride.



**Fig. 2:** An assembly of wedges, wires and pulleys is used in the sole.



**Fig. 3:** Vertical displacement pulls the wires.



**Fig. 4:** Wires tighten the cuffs.

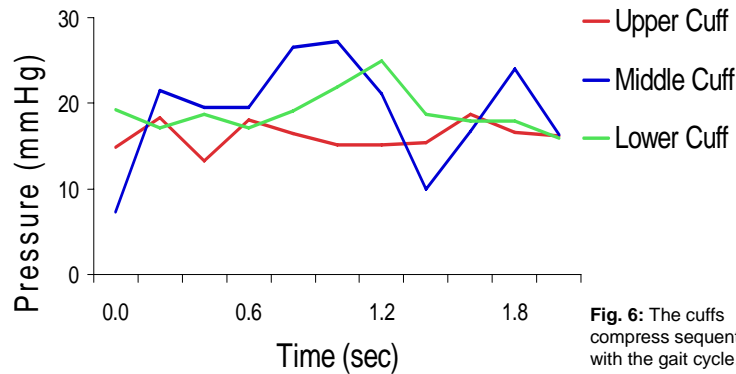
## Testing the GAVRD

- Sphygmomanometers altered to remove cuffs and attach small, air-filled bags.
- Bags inserted between subject's leg and GAVRD cuffs.
- Pressure readings monitored through BioPac.
- Test participant walks with device on treadmill (Fig. 5).
- Stationary pressure in all cuffs range from 15-20 mmHg



**Fig. 5:** Pressures were measured in each cuff as subject walked on treadmill.

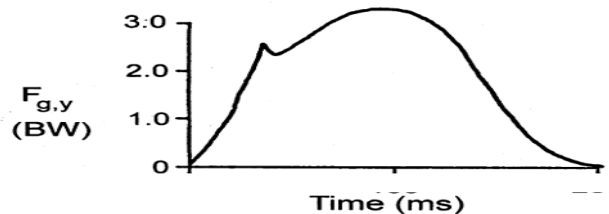
## Dynamic Sequential Compression in Stride



**Fig. 6:** The cuffs compress sequentially with the gait cycle.

a) The middle cuff compresses first, followed by the lower and upper cuffs.

b) Pressure measurements can be compared to normalized force data for time points throughout the gait cycle.



## User Survey (n=4)

Category	Rating
<b>Comfort (10 = like sock)</b>	<b>6.75</b>
Could wear for 1 or more hours per day	75%
<b>Low Profile (10 = lowest)</b>	<b>7</b>
Could wear with clothes owned	100%
<b>Ease of Use (10 = easiest)</b>	<b>8.25</b>
Average time to put on	3 min
<b>Ease to Clean (10 = easiest)</b>	<b>5.75</b>
Average time to clean	15 min
<b>Low Cost (10 = least expensive)</b>	<b>10</b>
Would purchase for \$250	100%

## Discussion

G-Dynamo has developed a working prototype which:

- Is portable
- Is easy to use
- Provides sequential pressure linked to the gait cycle

Further development is necessary to:

- Provide more effective pressure
- Insure reliable results from each cuff

## Acknowledgements

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