



# Smart Clothing with Dynamically Controlled Compression

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## Smart Compression Clothing for Clinical Cardiovascular Intervention

“Smart” compression garments can be controlled dynamically using shape changing materials (such as shape memory alloys (SMA)) enables clinical cardiovascular intervention in both healthy and unhealthy populations. The degree of compression, timing of compression, and type and site of compression (pressure) can be controlled dynamically. Controlling compression allows the ability to gait compression relative to human physiology (e.g., from the cardiac cycle-ECG, movement- foot plant, leg-extension, standing, walking or jogging, position, respiratory patterns, g-forces or relative to shifts in blood volume distribution or fluid loss). The “smart” compression clothing has a wide variety of applications, from consumer uses to clinical interventions to air/space travel.

## Dynamic Compression

Current compression garments are often spandex-type elastic material with static levels of compression. They can become uncomfortable and difficult to put on and remove, especially for unhealthy, recovering or aging populations. The only current alternative to elastic compression stockings are inflatable compression sleeves, which require the wearer to remain stationary, are highly immobile, and require the wearer to be tethered to the inflation source. Neither design offers a solution to the consumer that is simultaneously low profile, mobile, and controllable. This “smart fabric” technology features embedded shape-changing materials that can produce controllable compression without a bulky inflation system. The design, which combines the best features of both elastic and inflatable compression garments (e.g., a slim, low-profile form factor that is easy to wear/remove) allows specific dynamic control over the degree of compression, the timing of compression and could allow for graded compression (e.g., peripherally to more centrally guided pressure) without overly encumbering the wearer.

### **BENEFITS AND FEATURES:**

- Dynamic controllable compression

- Gaits compression relative to human physiology
- Enables clinical cardiovascular intervention
- Slim, low-profile form factor
- Comfortable and easy to put on/remove
- Mobile, requires no tethering to inflation system

## **APPLICATIONS:**

- Healthcare (e.g., cardiovascular assistance)
- Augmenting venous return
- Orthostatic intolerance (e.g., postural orthostatic tachycardia syndrome (POTS))
- Cardiac rehabilitation in heart-failure patients
- Lymphedema venous insufficiency
- Countermeasures for flight; reducing DVT risk during long flights
- Military (e.g., battlefield tourniquets)
- Athletic performance (e.g., compression sleeves for sport and workout scenarios)
- Commercial (e.g., shapewear or corsets)
- Countermeasures for spaceflight (e.g., mechanical counter-pressure space suits, orthostatic intolerance garments)
- Compression garment applications

**Phase of Development** - Proof-of-concept prototype ready for human testing; IRB approval at Mayo Clinic.

## **Researchers**

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