Custom gradient compression stockings may prevent orthostatic intolerance in astronauts after space flight

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Orthostatic intolerance after space flight is still an issue for astronauts as no in-flight countermeasure has been 100% effective. NASA astronauts currently wear an inflatable anti-gravity suit (AGS) during re-entry, but this device is uncomfortable and loses effectiveness upon egress from the Shuttle. We recently determined that thigh-high, gradient compression stockings were comfortable and effective after space flight, though to a lesser degree than the AGS. We also recently showed that addition of splanchnic compression to this thigh-high compression stocking paradigm improved orthostatic tolerance to a level similar to the AGS, in a ground based model. **Purpose:** The purpose of this study was to evaluate a new, three-piece breast-high gradient compression garment as a countermeasure to post-space flight orthostatic intolerance. **Methods:** Eight U.S. astronauts have volunteered for this experiment and were individually fitted for a three-piece, breast-high compression garment to provide 55 mmHg compression at the ankle which decreased to approximately 20 mmHg at the top of the leg and provides ~15 mmHg over the abdomen. Orthostatic testing occurred 30 days pre-flight (w/o garment) and ~2 hours after flight (w/ garment) on landing day. Blood pressure (BP), Heart Rate (HR) and Stroke Volume (SV) were acquired for 2 minutes while the subject lay prone and then for 3.5 minutes after the subject stands up. To date, two astronauts have completed pre- and post-space flight testing. Data are mean ± SD. **Results:** BP [pre (prone to stand): 137 ± 1.6 to 129 ± 2.5; post: 130 ± 2.4 to 122 ± 1.6 mmHg] and SV [pre (prone to stand): 61 ± 1.6 to 38 ± 0.2; post: 58 ± 6.4 to 37 ± 6.0 ml] decreased with standing, but no differences were seen post-flight w/ compression garments compared to pre-flight w/o garments. HR [pre (prone to stand): 66 ± 1.6 to 74 ± 3.0, post: 67 ± 5.6 to 78 ± 6.8 bpm] increased with standing, but no differences were seen pre- to post-flight. **Conclusion:** After space flight, blood pressure and stroke volume are normally decreased and heart rate is usually elevated to compensate. In this small group of subjects, breast-high gradient compression stockings seem to have prevented these negative effects of spaceflight.