Heart Rate Response during Mission-Critical Tasks after Space Flight

N.M. Arzeno[1], S.M.C. Lee[1], M.B. Stenger[1], E.L. Lawrence[1], S.H. Platts[2], J.J. Bloomberg[2]
[1]Wyle Integrated Science and Engineering Group, Houston, TX; [2]NASA, Johnson Space Center, Houston, TX

Adaptation to microgravity could impair crewmembers' ability to perform required tasks upon entry into a gravity environment, such as return to Earth, or during extraterrestrial exploration. Historically, data have been collected in a controlled testing environment, but it is unclear whether these physiologic measures result in changes in functional performance. NASA's Functional Task Test (FTT) aims to investigate whether adaptation to microgravity increases physiologic stress and impairs performance during mission-critical tasks. *PURPOSE:* To determine whether the well-accepted postflight tachycardia observed during standard laboratory tests also would be observed during simulations of mission-critical tasks during and after recovery from short-duration spaceflight. *METHODS:* Five astronauts participated in the FTT 30 days before launch, on landing day, and 1, 6, and 30 days after landing. Mean heart rate (HR) was measured during 5 simulations of mission-critical tasks: rising from (1) a chair or (2) recumbent seated position followed by walking through an obstacle course (egress from a space vehicle), (3) translating graduated masses from one location to another (geological sample collection), (4) walking on a treadmill at 6.4 km/h (ambulation on planetary surface), and (5) climbing 40 steps on a passive treadmill ladder (ingress to lander). For tasks 1, 2, 3, and 5, astronauts were encouraged to complete the task as quickly as possible. Time to complete tasks and mean HR during each task were analyzed using repeated measures ANOVA and ANCOVA respectively, in which task duration was a covariate. *RESULTS:* Landing day HR was higher ($P < 0.05$) than preflight during the upright seat egress (7% ± 3), treadmill walk (13% ± 3) and ladder climb (10% ± 4), and HR remained elevated during the treadmill walk 1 day after landing. During tasks in which HR was not elevated on landing day, task duration was significantly greater on landing day (recumbent seat egress: 25% ± 14 and mass translation: 26% ± 12; $P < 0.05$). *CONCLUSION:* Elevated HR and increased task duration during postflight simulations of mission-critical tasks is suggestive of spaceflight-induced deconditioning. Following short-duration microgravity missions (< 16 d), work performance may be transiently impaired, but recovery is rapid.