Understanding the effects of spaceflight on head-trunk coordination during walking and obstacle avoidance

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Background: Prolonged exposure to spaceflight conditions results in a battery of physiological changes, some of which contribute to sensorimotor and neurovestibular deficits. Upon return to Earth, functional performance changes are tested using the Functional Task Test (FTT), which includes an obstacle course to observe post-flight balance and postural stability, specifically during turning. **Aims:** To quantify changes in movement strategies during turning events by observing the latency between head-and-trunk coordinated movement. **Hypothesis:** It is hypothesized that subjects experiencing neurovestibular adaptations will exhibit head-to-trunk locking ('en bloc' movement) during turning, exhibited by a decrease in latency between head and trunk movement. **Sample:** FTT data samples were collected from Shuttle and ISS missions. Samples were analyzed three times pre exposure, immediately post-exposure (0 or 1 day post) and 2-to-3 times during recovery from the microgravity environment. **Methods:** Two 3D inertial measurements units (XSens MTx) were attached to subjects, one on the head and one on the upper back. This study focused primarily on the yaw movements about the subject's center of rotation. Time differences (latency) between head and trunk movement were calculated at two points: the first turn (Fturn) to enter the obstacle course (approximately 90^{o} turn) and averaged across a slalom obstacle portion, consisting of three turns (approximately three 90^{o} turns). **Results:** Preliminary analysis of the data shows a trend toward decreasing head-to-trunk movement latency during post-flight ambulation, after reintroduction to Earth gravity in Shuttle and ISS astronauts. **Conclusion:** It is clear that changes in movement strategies are adopted during exposure to the microgravity environment and upon reintroduction to a gravity environment. Some subjects exhibit symptoms of neurovestibular neuropathy ('en bloc movement') that may impact their ability to perform post-flight functional tasks.

Meeting information:

Name: Canadian Space Summit 2013

Location: Ottawa, Canada

Date: November 14-15, 2013

Website: http://www.css.ca/index.php?option=com_content&view=article&id=427&Itemid=57