PILOT FIELD TEST: THE ABILITY TO AMBULATE FOLLOWING LANDING AS ASSESSED WITH SEAT EGRESS, WALK AND OBSTACLE TESTING

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INTRODUCTION

To date, changes in functional performance have been systematically studied after short-duration space flight. As important as the postflight functional changes have been, full functional recovery has never been investigated or established for long-duration flights. The Pilot Field Test (PFT) experiment, conducted with participation of ISS crewmembers traveling on Soyuz expeditions 34S – 41S, is comprised of several tasks designed to study the recovery of sensorimotor abilities of astronauts during the first 24 hours after landing and beyond. The objective of the Seat Egress – Walk and Obstacle Test, developed by NASA's Russian collaborators at the Institute for Biomedical Problems, is to address this gap in knowledge. This will allow us to characterize the ability of crewmembers to perform critical mission requirements that they will be expected to perform after an unassisted landing following 6 to 12 months in microgravity.

METHODS

A simple test has been designed as a method for quantifying the ability to ambulate following landing. Performance of the Seat Egress – Obstacle Test consists of the subject standing from a seated position without assistance using only their trunk and legs, walking as quickly as possible in a straight line and stepping over an obstacle that has been placed in their path. Three trials are collected and for each subsequent trial, the height of the obstacle increases with increments at 5 cm, 10 cm, and 15 cm. The task is terminated if an obstacle is struck. During testing subjects are equipped with hardware that records body position, foot pressure, and heart rate. A primary measurement derived from the body position sensors is the height of the bottom of the feet during the obstacle step-over. Additional data will be derived from video records. Wireless inertial sensors placed on the subject's head, chest, waist, wrists, and ankles synchronously record angular velocities, linear accelerations, and orientations of those body segments. Sensor position (e.g., relative to the ground or to other sensors) data are not measured directly. Therefore, a software algorithm is currently being developed to estimate sensor displacement using the available kinematic measurements. This method will allow us to use the data from ankle-mounted sensors to determine how high the crewmembers lifted each leg while stepping over the bar.

CONCLUSION

Given the observed decrement in control of standing, walking, and the highly relevant operational nature of this task, our primary goals are to determine functional abilities of long-duration space flight crews immediately after landing. The information gained from the Seat Egress – Obstacle Test will provide critical operational understanding of the capabilities of crewmembers following exploration class missions.