

## Postflight Quiet Stance Stability of Astronauts Following Recovery From a Simulated Fall

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### INTRODUCTION

Astronauts returning from space flight universally present with postural ataxia. Throughout the Space Shuttle Program, measurement of ataxia has concentrated on sway in the anterior-posterior plane. Implementation of an interdisciplinary pre- and postflight study (Functional Task Test, FTT) designed to evaluate both astronaut postflight functional performance and related physiological changes has allowed the investigation of postural instability by characterizing dynamic stabilographic sway patterns.

### METHODS

Six astronauts from short-duration (Shuttle) and three from long-duration (ISS) flights were required to recover from a simulated fall. Subjects with eyes open, wearing running shoes lay prone on the floor for 2 minutes and then quickly stood up, maintained a quiet stance for 3 minutes, arms relaxed along the side of the body, and feet comfortably placed on the force plate. Crewmembers were tested twice before flight, on landing day (Shuttle only), and 1, 6, and 30 days after flight. Anterior-posterior (AP) and medial-lateral (ML) center-of-pressure (COP) coordinates were calculated from the ground reaction forces collected at 500 Hz. The 3-minute quiet stance trial was broken into three 1-minute segments for stabilogram diffusion analysis. A mean sway speed (rate of change of COP displacement) was also calculated as an additional postural stability parameter.

### RESULTS/CONCLUSION

While there was considerable variation, most of crewmembers tested exhibited increased stochastic activity evidenced by larger short-term COP diffusion coefficients postflight in both the AP and ML planes, suggesting significant changes in postural control mechanisms, particularly control of lower limb muscle function. As expected, postural instability of ISS astronauts on the first day postflight was similar to that of Shuttle crewmembers on landing day. Recoveries of stochastic activity and mean sway speed to baseline levels were typically observed by the 30<sup>th</sup> day postflight for both long-duration and short-duration crewmembers. Dynamic postural stability characteristics obtained in this low-impact study complement the data measured with computerized dynamic posturography.