

OPTIMIZING POSTURAL CONTROL ASSESSMENT IN ASTRONAUTS AND HEAD-DOWN BEDREST SUBJECTS

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INTRODUCTION

In space, astronauts undergo physiological adaptations, such as changes in sensorimotor processing, to acclimate to microgravity conditions. However, these adaptations pose challenges upon astronauts' return to Earth, particularly in postural control. Astronauts struggle with balance and coordination during the early post-flight period. Understanding these adaptations and their implications is key for optimizing astronaut health and performance, especially in anticipation of upcoming Artemis lunar missions. Head-down bedrest (HDBR) is a ground-based spaceflight analog that allows for additional research to be conducted into this adaptation and recovery period to test potential countermeasures before spaceflight. This research aims to delve into the assessment of postural control in both HDBR subjects and astronauts, providing insights essential for mission preparedness and the development of effective countermeasures.

METHODS

The NeuroCom Equitest Computerized Dynamic Posturography (CDP) system will serve as the primary tool for evaluating various aspects of postural control. While the continuous Equilibrium score (cEQ) has been the standard measure for assessing sway in astronauts and HDBR subjects, this study will explore additional quantitative outcomes provided by the CDP system, including—but not limited to—root mean square, minimum time to contact, and path length. Data from previous Space Shuttle and International Space Station missions, as well as the Flight Analog Project, will be utilized to analyze post-flight and post-HDBR decrements. Statistical analyses, including receiver operating characteristic (ROC) curves, will be employed to determine the diagnostic accuracy of these outcome measures and identify the most effective indicators of post-bedrest and post-spaceflight decrements.

EXPECTED RESULTS

Through retrospective analysis of CDP data, this study aims to identify the most sensitive and specific outcome measures for assessing initial decrement and recovery post-flight and post-HDBR. These identified measures will then be used for subsequent investigations into postural control. Additionally, it is hypothesized that the optimal outcome measures for assessing postural control will be consistent across both HDBR subjects and post-spaceflight astronauts, indicating common underlying mechanisms of sensorimotor adaptation and recovery from microgravity and spaceflight analog environments.

CONCLUSION

This study has implications for astronaut health, offering improved mechanisms for studying and assessing postural control post-spaceflight and post-bedrest. By refining these mechanisms and identifying more effective assessment strategies, this research paves the way for the development of interventions and countermeasures, ensuring the safety and well-being of crew members during future space exploration endeavors.

ACKNOWLEDGMENTS

This work is supported by NASA's Human Research Program Human Health Countermeasures Element.