POSTURAL RESPONSES FOLLOWING SPACE FLIGHT AND GROUND BASED ANALOGS

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With the transition from the Shuttle program to the International Space Station (ISS), the opportunity to fly sensorimotor experiments in a weightless environment has become increasingly more difficult to obtain. As a result, more investigations have turned to ground-based analogs as a way of evaluating an experiment's viability. The two primary analogs available to most investigators are 6° head down bed rest (HDBR) and dry immersion (DI). For the time being, HDBR investigations have been associated with studies conducted in the United States while the Russians and several other European Union states have concentrated their efforts on using DI as the space flight analog of choice. While either model may be viable for cardiovascular, bone and other system changes, vestibular and sensorimotor investigators have retained serious reservations of either analog's potential to serve as a replacement for a true weightless environment. These reservations have merit, but it is worthwhile to consider that not all changes associated with sensorimotor function during space flight are the result of top-down modifications, but may also be due to the lack, or change, of appropriate support surfaces applying force to the bottom of the feet. To this end we have compared quiet stance postural responses between short duration Space Shuttle flights, long duration ISS flights and HDBR of varying duration. Using these three platforms, representing different modifications of support we investigated postural ataxia using a quiet stance model. Quiet stance was obtained by asking the subjects to stand upright on a force plate, eyes open, arms at the side of the body for three min. From the force plate we obtained average sway velocity in two axes as well as length of line (stabilogram). These parameters were then related to EMG activity recorded from the medial gastrocnemius and lateral tibialis. It is significant to note that postural ataxia measured as quiet stance shows analogous changes between HDBR and space flight. Primary differences across short duration, long duration space flight and HDBR are related to the length of exposure associated with both space flight and HDBR.