

EFFICACY OF STOCHASTIC VESTIBULAR STIMULATION TO IMPROVE LOCOMOTOR PERFORMANCE IN A DISCORDANT SENSORY ENVIRONMENT

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INTRODUCTION: Astronauts exposed to microgravity face sensorimotor challenges incurred when readapting to a gravitational environment [1, 2]. Sensorimotor Adaptability (SA) training has been proposed as a countermeasure to improve locomotor performance during re-adaptation, and it is suggested that the benefits of SA training may be further enhanced by improving detection of weak sensory signals via mechanisms such as stochastic resonance when a non-zero level of stochastic white noise based electrical stimulation is applied to the vestibular system (stochastic vestibular stimulation, SVS) [3]. The purpose of this study was to test the efficacy of using SVS to improve short-term adaptation in a sensory discordant environment during performance of a locomotor task.

METHODS: Twenty-seven healthy subjects (age 18-55) were recruited and tested for a perceptual threshold to a 1 Hz bipolar binaural sinusoidal electrical current being applied between electrodes placed on their mastoid processes. Subjects were then randomly and blindly assigned to a group receiving 0-30 Hz Gaussian white noise electrical stimulation at 50% of their perceptual threshold (50% stim group) or a control group receiving sham zero amplitude stimulation (control group) during performance of the Functional Mobility Test (FMT). The FMT was comprised of a course on a compliant foam surface requiring subjects to quickly walk through and around various locomotion and balance challenging obstacles without touching them (such as hurdles to step over, “portals” and “gates” to walk through, and “slalom” sections to navigate around). Subjects performed a total of 12 trials, nine of which were done under conditions of visual discordance by wearing up/down vision reversing prisms. Adaptation rate for the time to complete the course (TCC) was analyzed for trials between the two groups. Three subjects were eliminated from analysis for failing to improve in TCC across trials with visual discordance (greatest percent improvement from first trial with goggles was less than the mean minus two standard deviations across the groups). Of the remaining 24 subjects (50% stim group: $n = 12$, control group: $n = 12$), adaptation rates between the two groups were analyzed using an independent samples t -test with significance set at $p < 0.1$.

RESULTS: No subjects reported any adverse effects of receiving vestibular stimulation. Adaptation rates of the 50% stim group were found to be significantly faster than rates of the control group [$t(16.18) = 2.00, p = 0.062$].

CONCLUSION: Although a small effect, our study indicates that SVS is capable of improving short-term adaptation in a sensory discordant environment during a locomotor task.

REFERENCES:

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