PRELIMINARY RESULTS USING GALVANIC VESTIBULAR REDUCTION AS A NON-PHARMACEUTICAL TOOL FOR MOTION SICKNESS MITIGATION

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Introduction: Alterations in vestibular sensory processing following G-transitions lead to motion sickness and spatial disorientation upon return to Earth’s gravity. The use of non-pharmaceutical mitigation for motion sickness has several potential advantages over drug treatment options. The purpose of this study was to validate a non-pharmaceutical tool using galvanic vestibular reduction (GVR) to mitigate G-transitional induced motion sickness and spatial disorientation.

Methods: Using a repeated measures counter-balanced design, motion sickness and perception are obtained during Coriolis cross-coupling stimuli on a rotating chair across three GVR treatment interventions: throughout stimulus testing (prevention), following symptom onset (rescue), and placebo control. Subjects perform up to 10 sets of pitch head movements during constant rotation. For each set, head movement is cued every 10 seconds, alternating between pitch forward (chin resting to chest) and pitch backward (head upright) for a total of 7 forward and backward movements. During each head movement, subjects are asked to use a joystick to record the magnitude of their perceived rotation along all three axes. During the 2-minute pause between sets, motion sickness symptom scoring was obtained using the Pensacola Diagnostic Index and subject discomfort (0-20) ratings. Performance on a sensorimotor and cognitive test battery is measured during a fourth session to map changes in GVR level with functional performance.

Results: Fifteen of 30 subjects have completed testing to date. Preliminary findings suggest GVR may be more effective in reducing symptoms in subjects who self-report less susceptibility on a pre-test motion sickness susceptibility questionnaire. Based on the joystick measures, GVR significantly reduces both the magnitude (mean 22% - 34%) and duration (mean 42% - 49%) of perceived roll and pitch sensation with head movements during constant rotation. It is important to note that comparable levels of GVR (up to 2.5mA) does not impair performance on a functional test battery including mobility and balance tasks.

Discussion: Our preliminary findings suggest GVR may be useful in reducing disorienting roll and pitch illusions associated with Coriolis cross-coupling stimuli. While transfer to post-flight treatment will need to be validated, the potential advantages of our non-pharmaceutical countermeasure approach would be to provide rapid therapeutic effect while allowing continuous titration of GVR amplitude during recovery to maintain operational performance.