Upon return from long-duration spaceflight, 100% of crewmembers experience motion sickness (MS) symptoms. The interactions between crewmembers’ adaptation to a gravitational transition, the performance decrements resulting from MS and/or use of promethazine (PMZ), and the constraints imposed by mission task demands could significantly challenge and limit an astronaut’s ability to perform functional tasks during gravitational transitions.

**Background**

Stochastic resonance (SR) is “noise benefit”: adding noise to a system might increase the information (examples to the left and above). Stochastic vestibular stimulation (SVS), or low levels of noise applied to the vestibular system, improves balance and locomotor performance (Goel et al. 2015, Mulavara et al. 2011, 2015).

**Methods**

Healthy subjects (n=20) performed two identical counterbalanced sessions, one in which they received 400 µm SVS and one with 0 µm SVS. The protocol was as follows:

1. **Familiarization/baseline of 4 functional tasks:** Each task was performed 3-5 times or until performance was consistent.
2. **Motion sickness induction:** Walk the obstacle course while wearing up/down reversing prisms (forward twice, reverse twice, forward once, reverse once) then read poster while making large up/down head movements at 1.33 Hz. Every 2 minutes subjects reported MS symptoms, this lasted 30 minutes or until MS=8.
3. **Post-motion sickness task performance:** Perform each task again after motion sickness induction.

**Results**

Without SVS, only 40% of subjects lasted the full 30-minute MS induction protocol, while 65% of subjects lasted the full 30 minutes with SVS, which is nearly a significant increase (p=0.056). On average, subjects lasted 22.6 minutes without SVS and lasted 24.7 minutes with SVS.

Subjects showed significant improvement from baseline when performing the prone-to-stand test. The results are promising and future work includes comparing MS progression between PMZ and SVS directly in subjects that are provoked to a minimum of nausea. Low levels of SVS stimulation may serve as a non-pharmacological countermeasure to replace or reduce the PMZ dosage requirements and concurrently improve functional performance during transitions to new gravitational environments after spaceflight.

**References**