

Long duration head-down tilt bed rest studies: safety considerations regarding vision health

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Visual symptoms reported in astronauts returning from long duration missions in low Earth orbit, including hyperopic shift, choroidal folds, globe flattening and papilledema, are thought to be related to fluid shifts within the body due to microgravity exposure. Because of this possible relation to fluid shifts, safety considerations have been raised regarding the ocular health of head-down tilt (HDT) bed rest subjects. HDT is a widely used ground-based analog that simulates physiological changes of spaceflight, including fluid shifts. Thus, vision monitoring has been performed in bed rest subjects in order to evaluate the safety of HDT with respect to vision health.

Here we report ocular outcomes in 9 healthy subjects (age range: 27-48 years; Male/Female ratio: 8/1) completing bed rest Campaign 11, an integrated, multidisciplinary 70-day 6 degrees HDT bed rest study. Vision examinations were performed on a weekly basis, and consisted of office-based (2 pre- and 2 post-bed rest) and in-bed testing. The experimental design was a repeated measures design, with measurements for both eyes taken for each subject at each planned time point.

Findings for the following tests were all reported as normal in each testing session for every subject: modified Amsler grid, red dot test, confrontational visual fields, color vision and fundus photography. Overall, no statistically significant differences were observed for any of the measures, except for both near and far visual acuity, which increased during the course of the study. This difference is not considered clinically relevant as may result from the effect of learning. Intraocular pressure results suggest a small increase at the beginning of the bed rest phase ($p=0.059$) and lesser increase at post-bed rest with respect to baseline ($p=0.046$). These preliminary results provide the basis for further analyses that will include correlations between intraocular pressure change pre- and post-bed rest, and optical coherence tomography measurements of the retina.