Ocular Outcomes Comparison Between 14- and 70-day Head-down Tilt Bed Rest

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BACKGROUND

• Ophthalmological changes have been recently reported in some astronauts involved in long-duration space missions:
  - Elevated intracrani al pressure resulting from μG-induced cephalad fluid shifts may be responsible for most of these findings
  - Head-down tilt bed rest (HDTBR) produces cephalad fluid shifts; used to simulate the effects of μG on the human body

PURPOSE

• To compare structural and functional ocular outcomes between 14- and 70-day HDTBR in healthy human subjects.
• Hypothesis: 70-day HDTBR induces ocular changes of greater magnitude as compared to 14-day HDTBR

METHODS

• Experimental protocols:
  - 14-day HDTBR
  - 70-day HDTBR

• In both studies:
  - Two integrated, multidisciplinary studies conducted at NASA Flight Analogs Research Unit (FARU): 14- and 70-day 6º HDTBR
  - NASA standard HDTBR screening procedures (healthy adults)

NASA bed rest studies STANDARDIZED CONDITIONS

✓ Subject to rest in bed at all times
✓ Monitoring by a subject monitor and an in room camera 24 hrs a day
✓ Daily measurement of vital signs, body weight, fluid intake and fluid output
✓ No napping permitted between 6:00 am and 10:00 pm
✓ Standardized diet

NASA Flight Analogs Research Unit (FARU)

70 days HDTBR Duration 14 days

OCULAR EXAMS:

YES 2 office visits Pre-BR
YES Weekly (FARU)
YES 2 office visits During BR
YES Weekly (FARU)
YES 1 office visit Post-BR

RESULTS

• Pre/post-HDTBR differences in near visual acuity, spherical equivalent, IOP and SD-OCT average RNFL thickness were compared between the two studies

• In both studies:
  - subjects remained asymptomatic throughout the duration of HDTBR
  - distance and near visual acuity was 20/20 or better pre- and post-HDTBR in all subjects
  - modified Amsler grid, red dot test, color vision, confrontational visual field were within normal limits at all visits
  - no detectable changes on stereoscopic color fundus photography

CONCLUSIONS

• There were no significant pre/post-HDTBR differences between 14- and 70-day HDTBR for the structural and functional ophthalmological variables evaluated
• Further HDTBR studies with different duration and/or angle of tilt and/or environmental conditions (e.g., high CO₂ exposure during HDTBR) may help determine the validity of the HDTBR analog to investigate microgravity-induced ophthalmological changes

SUPPORT

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DISCLOSURE

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