70 DAYS OF 6 DEGREES-HEAD DOWN TILT BED REST AND ITS IMPACT ON OCULAR PARAMETERS

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Ocular changes such as visual impairment and intracranial pressure (VIP) have been observed in astronauts returning from long-duration spaceflight. Changes may be attributed to the shift in body fluids due to microgravity. It remains to be determined whether 6° head-down bed rest is a good analog for VIP.

**Visual Impairment and Intracranial Pressure (VIP) Syndrome:**
May include the following symptoms:
- Hyperopic shift
- Cotton wool spots
- Choroidal folds
- Edema of the Optic disc (papillodema)
- Optic nerve sheath distention
- Globe flattening

**PURPOSE**
Investigate the effects of 6° head-down bed rest on ocular structures and function.
Determine if 6° head-down bed rest is a suitable ground-based analog for modeling and studying the VIP Syndrome.

**METHODS**
- 16 subjects (15M, 1F, age range 29-54 years): healthy, normotensive, non-smoker, normal weight
- Participated in 70 days of 6° HDT bed rest
- Control group and exercise group
- Measurements used in this study:
  - Best corrected visual acuity (BCVA)
  - Spherical equivalent
  - Intraocular pressure (IOP)
  - Retinal nerve fiber layer (RNFL) thickness by OCT
- Statistical methods:
  - Complete repeated measures experimental design
  - Collected longitudinally at several time points before, during and after bedrest, and for subjects' left and right eyes at each time point.
  - Repeated measures data submitted to a mixed-effects linear regression with a-priori contrasts comparing subjects' closest pre-bedrest observation to each subsequent observation available per outcome.

**RESULTS**

**For the following variables, "Pre/Post" was defined as the CLOSEST Pre and Post observations to bedrest. Other in-bed time points were also utilized.**

- Subjects' closest pre-bedrest observations were between 3 and 6 days pre-bedrest.
- Subjects' first bedrest observation was usually day 3 of bedrest (BR3).
- Subjects' mid-bedrest observation was usually day 30 of bedrest (BR30).
- Subjects' last bedrest observation was usually day 65 of bedrest (BR65).
- Subjects' closest post-bedrest observations were between 2-3 days post.

**Fig. 1. IOP changes during pre-/in-/post-bedrest.**
- IOP significantly increased from a mean of 12.90 mmHg in pre-BR to 13.86 mmHg in post-BR.
- IOP in pre-BR is significantly different from all the in-BR and post-BR time points.
- Mean Average RNFL Thickness by Spectralis optical coherence tomography (OCT) significantly increased from a mean of 100.84 μm in pre-BR to 102.03 μm in post-BR (p < 0.001).
- No in-bed measurements were taken for RNFL Thickness.

**Fig. 2. Spherical Equivalent changes during pre-/in-/post-bedrest with the Retinomax device.**
- Mean Spherical Equivalent significantly decreased from pre-BR to post-BR (p<0.001) with both the Retinomax and Reichert devices.
- Spherical Equivalent Retinomax was significantly different from the last BR day and post-BR, -0.496 to -0.289 (p<0.001).