Authors

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Introduction

This study investigates how gravity affects facial anatomy, specifically eyelid and eyebrow heights.

- **Eyelid height:** Changes in muscle tension and soft tissue.
- **Eyebrow height:** Alterations in muscle tone or vascular structure.
- **Correlations:** Shared mechanisms between eyelid and eyebrow adaptations.

This research uses a dataset from the Jules Stein Eye Institute, comparing values on Earth and in space. We aim to contribute to the growing body of knowledge about human adaptation to the space by our study.

Methods

- **Data Preparation:** Used a cleaned dataset with splitted names and dates, and no NA value, ensuring consistency in column names.
- **Analysis:** Used paired t-tests to compare means and calculated correlations between measurements.
- **Visualization:** Box plots, scatter plots, dot plots, and line plots illustrate key differences.

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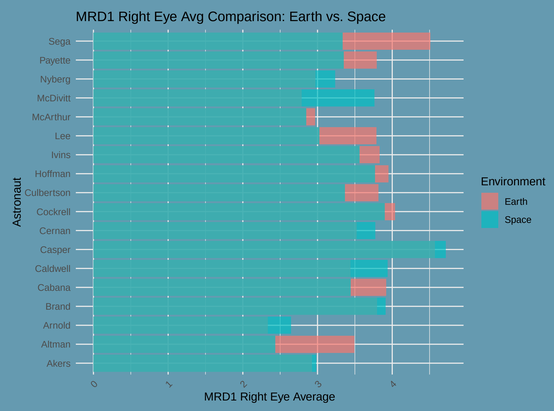
Gravity's Influence on Astronauts' Eyelid and Eyebrow Heights

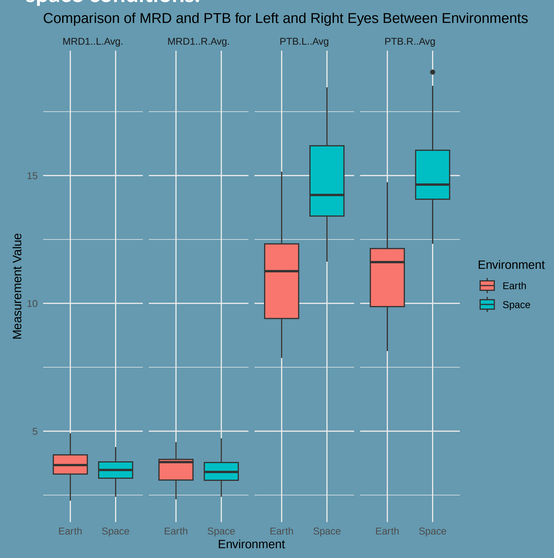
Findings

- **Individual Variability:** Astronauts' facial features respond differently to microgravity, with varying degrees of change observed.
- **Environmental Influence:** Gravity significantly affects the relationship between eyelid and eyebrow positions, with distinct differences between Earth and space.
- **Microgravity-Induced Changes:** Increased variability in facial measurements in space suggests microgravity impacts astronauts' facial anatomy over time.

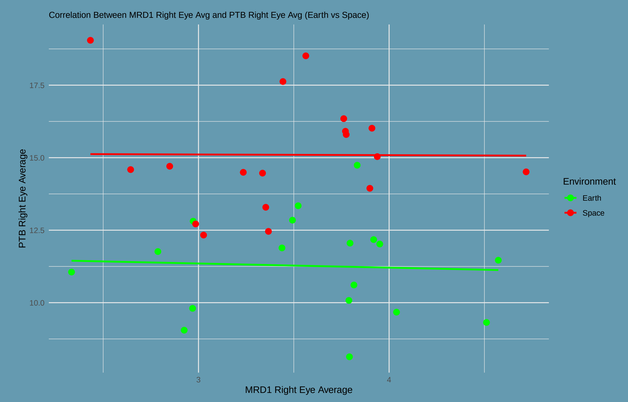
These results have implications for astronaut health during long-term space missions.



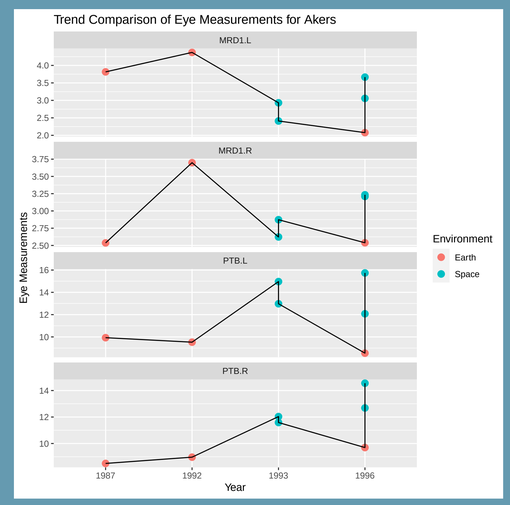
- Demonstrates the complexity of individual responses to microgravity.
- Shows that MRD1 measurements vary between Earth and space conditions.



- Shows variations in measurement spread between Earth and space conditions.
- Highlights the potential impact of microgravity on facial measurements.



- Suggests potential correlations between MRD and PTB measurements.
- Provides insights into how different eye measurements might change in microgravity.



- Reveals subtle changes in eye measurements between Earth and space environments.
- Demonstrates the potential long-term impacts of microgravity on facial anatomy.

Applications

- **Astronaut Health Monitoring:** Eyelid and eyebrow metrics as non-invasive health indicators.
- **Helmet Design:** Adaptive helmet features to accommodate changes in facial anatomy.
- **Medical Applications:** Relevance to aging populations and rehabilitation for bedridden patients.

Limitations

- **Small Sample Size:** There is a limit on the generalization of findings to the broader astronaut population.
- **Uncontrolled Confounding Variables:** Factors such as age were not explicitly adjusted for in the analysis, which may influence results.
- **Measurement Variability:** Potential inconsistencies in data collection methods.

Future Directions

- **Larger Sample Sizes:** Expand the study with more astronauts.
- **Testing Countermeasures:** Explore facial muscle exercises and artificial gravity.
- **Simulated Gravity Studies:** Conduct parabolic flights and bed rest experiments.
- **Machine Learning Analysis:** Develop predictive models for facial changes.

The full study can be found here: