# Does microgravitation influence the optical apparatus of the eye?


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## Background and aim

There are some data in literature about the astronauts' postflight visual acuity and ocular anatomical changes that include globe of the eye flattening in axial direction and hyperopic refraction shifts.
The mechanisms of these changes are not fully investigated.

**The aim** of this study was to assess refraction and accommodation changes in conditions of **dry immersion** - on-Earth model for weightlessness.

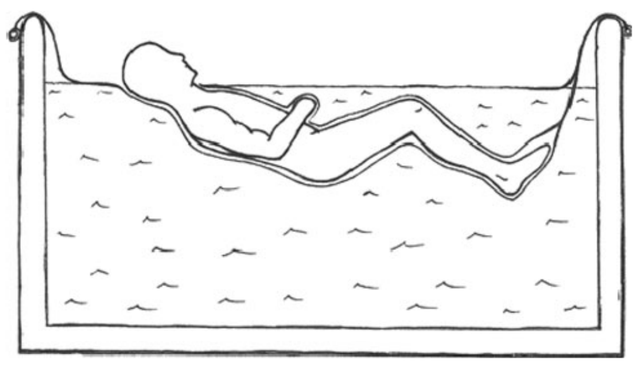
The study was conducted in the framework of the Project "Dry Immersion" at the Institute of Biomedical Problems, Russian Academy of Sciences (Moscow).

## Subject groups

| | Immersion period | Number of subjects |
|---|---|---|
| I experiment | 5 days | 10 males of 25-45 years |
| II experiment | 21 days | 6 males of 25-35 years |

## Dry immersion

«Simulating space in a bathtub»[1]




During the experiment, the subjects were immersed in a bath of warm water, being separated from the water by a freely floating waterproof elastic sheeting.
Subjects were laying in the bath during the whole experimental period (5 or 21 days), except 15 min a day lifting for hygienic procedures (during that time they were also lying horizontally).
**Refraction** and **accommodation** were assessed before and after immersion by means of Righton Speedy-i Autorefkeratometr (in accommodation screening mode).

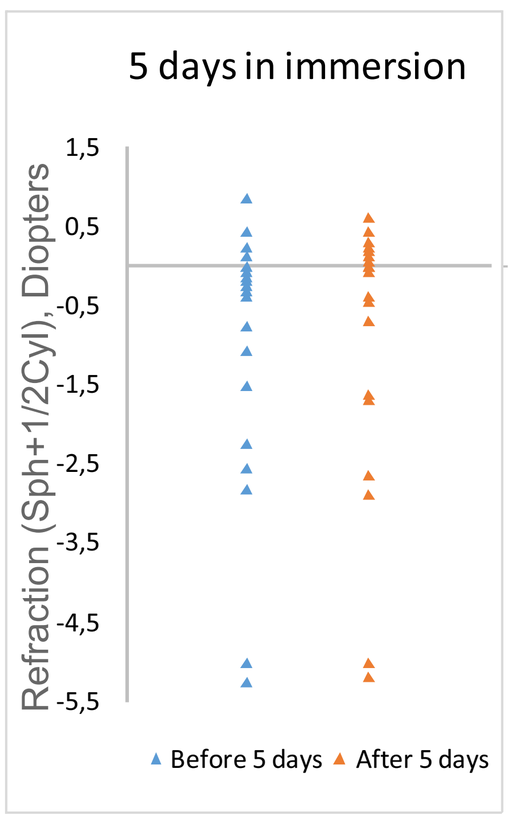
## Results

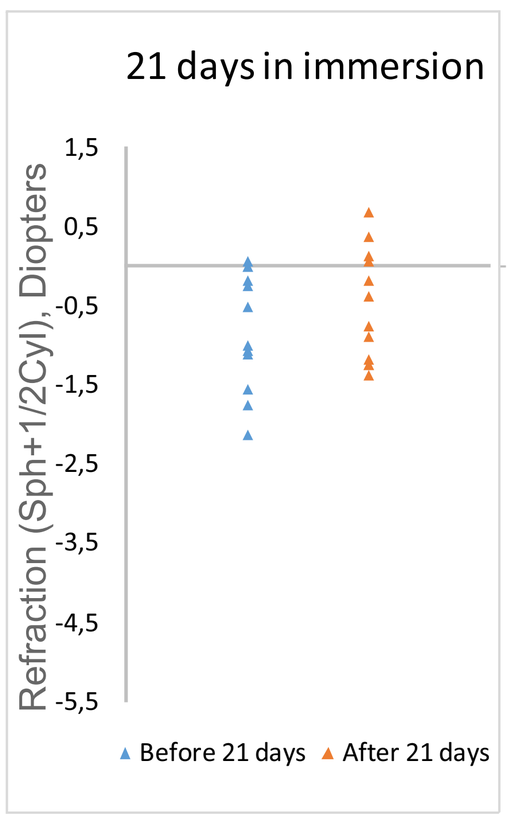
### Refraction

We found some tendency to hyperopic refraction shift in both groups (table 1). The differences are not statistically significant, that may be due to the small sample size and low sensitivity of the statistical criterion used.

**Table 1. Refraction difference After - Before immersion:**

| | 5 days | 21 days |
|---|---|---|
| Average, diopters | 0.11 | 0.29 |
| Confidence interval | (-0.06)-(+0.28) | (-0.28)-(+0.86) |

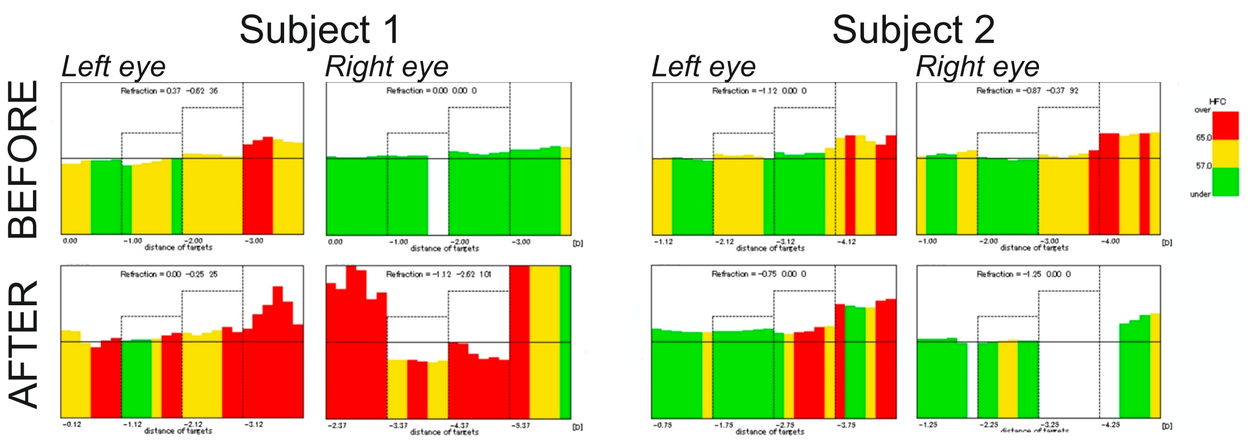



### Accommodation

In view of hyperopic shifts reported in astronauts and their typical near presbyopic age (35-50 years), it seems important to investigate accommodation function changes. However, we couldn't find any publications on measuring accommodation in space.
In our model experiment we studied accommodation response and accommodation microfluctuations. The data obtained appeared to be insufficient for reliable conclusions. In experiment I, the duration of immersion was too short; in experiment II, the number of subjects was too small. As a result, we could only report substantial interindividual variability.

For examle, the accommodogramms obtained before and after immersion (21 days) in two subjects are shown.




## Conclusions

Dry immersion shows a tendency to produce hypermetropic refraction shift, similar to the space flights.
It seems that dry immersion might be a promising model to study refraction shift in astronauts.
Further studies are needed.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## References


1. https://room.eu.com/article/simulating-space-in-a-bathtub
2. Lee, A. G., Mader, T. H., Gibson, C. R., Brunstetter, T. J., & Tarver, W. J. (2018). Space flight-associated neuro-ocular syndrome (SANS). Eye (Basingstoke), 32(7), 1164–1167.