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THE EFFECT OF PREVIOUS SPACEFLIGHT ON OTOLITH-MEDIATED OCULAR  
COUNTER-ROLL IN COSMONAUTS AFTER LONG DURATION SPACEFLIGHT**Abstract**

**INTRODUCTION** The otolith system plays an essential role in the estimation of verticality, where an otolith driven eye movement, the Ocular Counter-Roll (OCR), is important to ensure gaze stabilization, as the eyes tilt in the opposite direction to the direction of the head tilt. Long duration exposure to microgravity, as experienced aboard the International Space Station (ISS), will cause a deconditioning of the otolith system. As a result, cosmonauts will experience balance disorders and problems with gaze stabilization after returning on Earth. The aim of this study is to measure the effect of long-term spaceflight on the otolith-mediated OCR, in cosmonauts, with focus on the difference between first time flyers versus frequent flyers.

**MATERIAL AND METHODS** 44 cosmonaut experiments were performed, first time flyers (1F, N=14) and frequent flyers (FF, N=30), were exposed to off-axis centrifugation before and after their 6-month space mission to the ISS. The OCR induced by the Visual and Vestibular Investigation System (VVIS) mini centrifuge was assessed and recorded for 20 seconds at a maximal velocity of 254/s, out of a total duration of 5 minutes centrifugation. The OCR measurements were further statistically analyzed in SPSS, with  $p < 0,05$  as significance threshold.

**RESULTS** We found a significant decrease in OCR early postflight (R3/5, three to five days after return) for both the 1F group and the FF group. The post-flight OCR decrease in the 1F group was

significantly different from the FF group with a greater reduction in the 1F group. A full recovery was seen nine to eleven days after their return (R9/11).

**CONCLUSION** The FF group suffered less from a deconditioning of the otoliths, because they may have acquired an adaptation from previous space missions, demonstrating a learning effect. The results argue for that for important missions, e.g. to the Moon or Mars, it is more advisable to send experienced cosmonauts or astronauts because they are noticeably less affected by microgravity regarding the vestibular system.