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NEUROPLASTICITY OF THE OTOLITH MEDIATED OCULAR COUNTER ROLL DURING CENTRIFUGATION IN 14 FIRST TIME FLYER AND 16 FREQUENT FLYER COSMONAUTS.

Abstract

The otolith system is essential for balance and hence it is very robust1. Long duration exposure to microgravity inevitable causes unloading of the otolith system. A previous study in 25 cosmonauts revealed a decrease in the ocular counter roll (OCR) of cosmonauts after spaceflight, highlighting a deconditioned otolith-mediated vestibulo-ocular reflex2. Behaviour of returning cosmonauts after their first flight is very distinct from those who have prior space experience. Hence, there must be some sort of memory of previous spaceflights. We hypothesise that there must be also a difference in ocular counter roll. The current study reports on the difference between the otolith mediated OCR in first time flyers versus second time flyers. A group of 30 cosmonauts where exposed to off-axis rotation before and after spaceflight. Cosmonauts were divided in 2 groups given their spaceflight experience: first time flyers (N=14) and second time flyers (N=16). Cosmonauts OCR were assessed before flight (BDC), 3 and 9 days after return (resp. R+3, R+9) by using the VVIS mini centrifuge in the Gagarin Cosmonaut Training Center (GCTC) near Moscow. While securely fasten in the chair, OCR measurements were recorded at a maximal rotation speed of 251/s while seated in a right ear out position for the CCW rotation and left ear out position for the CW rotation (fig1). This induced an acceleration of 1 G outward, providing a 45 degree tilt stimulus to the otolith system. The OCR was detected 60 seconds after maximal speed was obtained, while fixating a central dot on a screen that was positioned in front of the rotating subject. Results: The first time flyers had a 63Our data (fig 2) show that the otolith mediated OCR is affected by space flight experience of the cosmonauts. This suggests that the reduction of the otolith reflex is not only peripherally generated but certainly has a central component. This suppression seems lesser after return to earth in second time flyers, possibly because of a faster recovery after return, or due to adaptation and learning urging a smaller degree of suppression of the initially erroneous otolith signals. Hence the brain

copes more efficiently with the peripheral generated vestibular signal, rather than suppressing it.