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DEPENDENCE ON VISUAL FEEDBACK IN FORCE DISCRIMINATION CONTROL DURING THE FIRST HOUR AFTER LANDING AND FURTHER RECOVERY

Abstract

Changes in the level and interaction of afferent systems in weightlessness significantly affect the processes of forming and realization of motor programs (Kozlovskaya I.B. et al., 1987). Motor control in weightlessness is mainly based on signals of visual afferentation, since it is least dependent on gravity level (Young L.R. Shelhamer M., 1990; Bloomberg J.J. et al., 2015). It is currently unclear how the dependence on visual feedback changes in motor control during the acute recovery period after long-term space flights, which is important for planning and assessing the risks of Lunar and Martian expeditions. The purpose of the study was to obtain quantitative data of alterations in force discrimination ability in the presence and absence of visual feedback during the first hour after landing and on the 3-4th, 7-8th and 10-12th days after the long-term space flights (SF). The work was carried out according to the program of the Field Test Russian-American space flight experiment. 16 Russian cosmonauts (mission duration 146+/-73 days) in the study performed the force discrimination task. The task consisted of 1 attempt

to make the maximal voluntary contraction (MVC) when squeezing the hand dynamometer. Next, the participants held the compression force at the target level of 30 percent of MVC, while looking at the graph of the compression force displayed in real time for 15 seconds, then closed their eyes and maintained the same compression force for another 15 seconds. The most significant changes are observed during the first hour after landing. During the first hour after landing, there was a significant decrease in MVC force by 10.05+/-3.34 kg compared to the pre-flight values, but the values of this force were recovered on the 3rd-4th day after SF. It is noteworthy that the difference between the average force of the dynamometer compression with and without visual feedback while applying a static force of 30 percent MVC for 15 seconds at each condition changed from 1.28+/-0.84 kg before flight to 2.11+/-0.44 kg when measured during the first hour after landing, and the pre-flight values of this measurement were not recovered even on the 10-12th day after SF. The study is supported by the Russian Academy of Sciences (63.1) and NASA Human Research Program.