IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Human Physiology in Space (2)

Author: Dr. Elena Tomilovskaya
Institute for Biomedical Problems, Russian Federation, finegold@yandex.ru

Prof. Millard Reschke
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States, millard.f.reschke@nasa.gov
Mr. Igor Kofman
KBR, United States, igor.kofman-1@nasa.gov
Mr. Vladimir Kitov
Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, arctg@yandex.ru
Mrs. Natalya Lysova
FSC RF-IMBP, Russian Federation, fomin-fomin@yandex.ru
Mr. Nikolay Osetskiy
State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, dominicanian13@mail.ru
Ms. Marissa Rosenberg
KBR, United States, marissa.j.rosenberg@nasa.gov
Dr. Alexey Grishin
Yu.A. Gagarin Research and Test Cosmonaut Training Center, Russian Federation, agrishin1@yandex.ru
Prof. Elena Fomina
State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, fomin-fomin@yandex.ru
Prof. Inesa Kozlovskaya
State Scientific Center of the Russian Federation - Institute of Biomedical Problems of the Russian Academy of Sciences, Russian Federation, ikozlovs@mail.ru
Dr. Ilia Rukavishnikov
SSC RF-Institute of Biomedical Problems RAS, Russian Federation, sapsan.box@gmail.com

VOLUNTARY MOVEMENTS DISORDERS IMMEDIATELY AFTER LONG TERM SPACE FLIGHT AND DYNAMICS OF THEIR RECOVERY. RESULTS OF ONGOING EXPERIMENT "FIELD TEST"

Abstract

The perspective of interplanetary missions looks more and more realistic at present time. However, there is considerable data showing a significant decrease of physical capacity of the cosmonauts after long-duration space flights. It is evident that the most impaired systems and functions are those that rely on gravity, i.e. voluntary movements, especially those are required to maintain a vertical body position. It is clear at this time that vestibular and the relationship to locomotion and motion sickness results in a dramatic decrease of functional capacity of the crew during the first hours and days after landing. While the severity of particular symptoms varies, disturbances in spatial orientation and alterations in accuracy of voluntary movements are persistently observed after long-term space flights.

A joint Russian-American team is carrying out a study which addresses specifically the functionality of the neurovestibular system and performance on critical sensorimotor tasks and cardiovascular function

immediately after landing. The study consists of 11 tests performed at different stages of recovery after long duration space flight. Most of these tests are based on rather simple natural movements which are required of crewmembers in the event that a landing following weightless spaceflight in order to safely escape/exit the spacecraft on Earth or other planetary surface without assistance. These tests include, but are not limited to: (a) transition from seated and prone positions to standing upright, (b) walking, stepping over obstacles, (c) tandem walking, (d) dysmetria, etc. Most testing is performed in the medical tent at the landing site while others which require more complex hardware are performed later in Star City and Johnson Space Center. The results of the studies with participation of 42 crew members of ISS long term missions show a significant decline of functional capacity, accuracy of voluntary movements, especially in the task of postural corrective responses and complicated locomotor task, as well as a high level of motion sickness on the landing day (all 42 subjects presented with motion sickness during deorbit entry). The recovery process in dependence of complexity of the test requires from 24 hours to 30 days.

The study is supported by the Russian Academy of Sciences (63.1) and NASA HRP.