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

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LESSONS LEARNED FROM COUNTERMEASURES REDUCING THE NEGATIVE PHYSIOLOGICAL EFFECTS OF MICROGRAVITY BASED ON THE SEVENTH RUSSIAN SUPER-LONG MISSION

Abstract

Methods that may help to maintain cardiovascular and motor functions in microgravity at the preflight level are still being developed. Super-long missions is viewed as a step towards future exploration missions. Six Russian cosmonauts performed super long-duration missions on Mir space station: 326, 2 cosmonauts 360, 312, 438 and 379 days. Joint U.S./Russian mission lasted 340 days and was successfully accomplished by Scott Kelly and Mikhail Kornienko (MK). In this study the intensity of in-flight physical exercise and postflight motor changes were analyzed regarding the cosmonaut who completed a one-year mission and in comparison with 6 cosmonauts who participated in half-year missions in the past while using similar countermeasures against the adverse effects of microgravity. In space, physical work capacity of the crewmember was measured by means of a locomotion test MO-3. After return to Earth cosmonauts' physical performance was assessed by evaluating locomotion electromyography parameters as well as by measuring the maximum voluntary contraction and strength endurance. During the first on-orbit MO-3 test the physiological cost index grew by 18.4After flight while assessing the efficacy of exercise countermeasures with respect to the stabilization of the neuro-muscular system, it was found that 3 days after recovery the EMG maximum amplitude of m. soleus increased by 7.8Isokinetic test results indicated that compared to the controls, MK showed more significant changes in the maximum voluntary strength of leg extensors. The decrease in the strength of leg flexors at every angular velocity measured was similar in MK data and in the controls. In MK data, the strength endurance of femoral flexors increased by 19The one-year mission data has demonstrated high efficacy of countermeasure program fulfilled by MK who successfully accomplished the mission maintaining adequate physical performance throughout the entire flight; the level of postflight changes was comparable to data in the group of cosmonauts who made 6-month missions.