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COMPARATIVE ANALYSIS OF WALKING CHARACTERISTICS IN ACTIVE AND PASSIVE MODES OF TREADMILL DURING LONG-TERM SPACE FLIGHTS

Abstract

Having set a goal to study the dynamics of biomechanical parameters of the ground reaction force (GRF) of the feet while cosmonauts walk during long space flights (SF), we proceed from the basic concept that motor disorders occupy an important place in the complex of disorders caused by microgravity, which are accompanied by a number of changes in the state of both the muscle periphery and the leading sensory inputs - supporting, muscular, vestibular (A. I. Grigoriev, 2004), and contribute to an overall decline in GRF values in SF (J. K. De Witt, 2014). The study was conducted in the framework of the onboard experiment "MOTOKARD". Locomotor tests were performed on board of the Russian Segment of International Space Station on a monthly basis during SF, and two sessions were performed of the experiment before and two sessions - after SF. 14 Russian crew members took part in the experiment, the duration of flight consisted from 5 to 6 months. To estimate the biomechanical parameters of walking, the data of the podogram was used, recorded by 190-197 pressure-sensors inbuilt in measuring insoles under the feet of cosmonauts during walking with the recommended speed 1.24-2.48 mph in passive and active modes of the treadmill track. In passive mode, the track is driven by the force of the cosmonaut's legs, and in the active mode - by the electric drive. The total GRF of walking in the passive mode were higher than in the active one in all the experimental sessions: before SF - by 22.261.36However, the average speed of walking, as a rule, in the passive mode was lower, than in the active mode: before the SF - by 3.850.34The data obtained in the study indicate the advantages of using the passive mode of treadmill to prevent hypogravitational disorders, because walking in the passive mode is accompanied by a more intimate contact of the foot with the surface of the treadmill and, as a result, is associated with an increase of the level of support afferentation. The study is supported by Roscosmos.