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

Ms. Alina Saveko

State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, asaveko@gmail.com

Mr. Vitaly Brykov

State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, hopardd@yandex.ru

Mr. Nikolay Osetskiy

State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, dominicanian13@mail.ru

Mr. Ilya Rukavishnikov

Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, sapsan.box@gmail.com

Ms. Inna Sosnina

State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, radostniyden@mail.ru

Dr. Sergey Ryazanskiy

State Scientific Center of Russian Federation, Institute of Biomedical Problems, Russian Academy of Sciences, Russian Federation, srez@mail.ru

Dr. Alexey Grishin

Yu.A. Gagarin Research and Test Cosmonaut Training Center, Russian Federation, agrishin1@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

SUPPORT REACTION DISTRIBUTION IN THE COURSE OF TREADMILL WALKING IN SPACE

Abstract

Exposure to long term space flight (SF) is constantly followed by deep changes in biomechanical and physiological characteristics of locomotions (Kozlovskaya, 1979; Gazenko, 1990). The core mean of the Russian countermeasure system is interval high intensity locomotor training. However at the moment our knowledge on the peculiarity of walking and running execution under conditions of SF is very limited. The aim of this work was to study biomechanical characteristics of the soles support reactions during walking in active regimen of treadmill on Earth, in the course of long term SF and after its accomplishment. 13 Russian cosmonauts onboard the ISS (age $50,28 \pm 7,14$, mass $89,4 \pm 7,7$ kg, mission duration 146 ± 73 days) took part in the study. The experimental sessions were carried out twice before SF, at the end of each flight month and twice after landing – on 8th and 12th days after SF accomplishment. Distribution of support reactions (SR) were analyzed in the course of walking on Russian treadmill BD-2 in active regimen (when the treadmill motor is on). The velocity of walking was chosen by the cosmonauts themselves and consisted $3,11 \pm 0,8$ km/hrs on average. The values and distribution pattern of support reactions were

assessed using specially designed measuring soles "Diasled" (Company "VIT", Russia). Each sole has 88-100 pressure sensors which allow to get the detailed picture of support reaction distribution along the sole. The peak amplitudes of support reactions for two main support areas – the metatarsal and the heel one – were analyzed separately. The study has revealed significant redistribution of support reactions in the course of SF: during the 1st month of SF increase of peak amplitudes of SR on 11, $67 \pm 2,34\%$ in metatarsal areas and decrease of SR amplitude in heel area of the soles were obtained. These changes remained the same in the course of the rest 5 months of SF and even on the 8th days after landing. At the same time the values in both areas of SR decreased from the 1st to the 5th month of SF and increased greatly after SF accomplishment. Analysis of SR values during midstance period of stride has also shown progressive significant decrease of SR in the course of SF and their sharp increase after landing. The study is supported by Russian Academy of Sciences (63.1).