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CHANGES OF PHYSIOLOGICAL CHARACTERISTICS OF LOCOMOTIONS INDUCED BY LONG TERM EXPOSURE TO WEIGHTLESSNESS

Tomilovskaya E.S., Rukavishnikov I.V., Brykov V.I., Saveko A.A., Semenov Yu.S., Kozlovskaya I.B.
State Research Center of the Russian Federation – Institute of biomedical problems RAS, Moscow, Russia
E-mail: finegold@yandex.ru

Alterations in motor system structure and function are the constant consequences of exposure to weightlessness of different duration (Kozlovskaya et al., 1987). The studies performed after space flights (SF) and in onground models have shown that microgravity influences on all the segments of motor system – from structure of muscle fibers to coordination of complex voluntary movements (Shenkman et al., 2000; Grigoriev et al., 2004). In particular, it was shown that there were alterations of gait biomechanics as well as changes of EMG activities in muscles participating in locomotor acts. The current presentation is dedicated to the role of space flight factors in locomotor system's activity. Physiological characteristics of locomotions have been studied in the course of long term SF and after its accomplishment. Our studies revealed the different strategies of treadmill walking and running in weightlessness, which was demonstrated by redistribution of support reactions registered from the special soles. On Earth support loading is equally distributed between heel and tarsal areas of the soles; at the initial months of SF the main load is registered in tarsal areas. Further the tendency to spread of support loading to the heel zones is observed. Apparently this reflects the processes of motor learning to perform locomotions under the new environment conditions. It is necessary to note that the values of support reactions at the same speed of running are much lower in SF. At the same time EMG activity of shin and hip muscles during execution of locomotor acts undergo significant changes in the course of SF: amplitudes and duration of EMG bursts are increased, the involvement of m. soleus in walking is decreased. Recovery of mentioned parameters after space flight takes more than 10 days: on the 12th day after landing some of the parameters were still changed.

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CHANGES IN MUSCLE PROPERTIES DURING A 180-DAY CONFINEMENT (CELSS). PRELIMINARY RESULTS

Treffel L.[1], Du Fang[2], Xu Zi[2], Gauquelin-Koch G.[3], Wang Jingyu[4], Lloret J.C.[3], Custaud M.A.[5], Yuan Ming[4], Gharib C.[6], Li Yinghui[4]
[1]Université Strasbourg, IPHC-CNRS, Strasbourg, France
[2]Space Institute of Southern China (Shenzhen), Shenzhen, 518117, China
[3]CNES, Paris, France
[4]China Astronaut Research and Training Center, Beijing, 100094, China
[5]Université d'Angers, France
[6]Université Claude Bernard Lyon1, France
E-mail: treffelosteopathe@gmail.com

Context. Back pain and muscular atrophy is commonly experienced in space.
Confinement in long duration spaceflight represents a challenge for human body.
The topic of confinement is highly relevant with the aim of Mars conquest.

Methods. 4 subjects (3 males, 1 female) confined in 370 m2 cabin during 180 days compared to 4 subjects in control group. The experience was performed in Space Institute of Southern China in Shenzhen under the name CELSS for Controlled Ecological Life Support System, with the support and collaboration of CNES.

Muscle tone was measured by MyotonPro technology. The location was on different regions like rectus Femoris (Quadriceps), trapezius, lumbar, thoracic, cervical, temporal and masseter muscles. Measurements were taken before confinement, each month during and after confinement the first days at recovery.

Results. We found significant changes in muscle tone during the first three months of confinement. This tendency is particularly true for Lumbar Erector Spinae, Rectus Femoris and Trapezius superior with a global decrease in tone parameters (Stiffness and oscillation frequency) in comparison to control group. Several important variables are lacking to interpret our preliminary results (Pain questionnaire, Actography, plasma components). This will be interpreted later with these variables.

Conclusion. Long-term confinement is an extreme environment, which implies a lot of metabolic adaptation. This experience presented the advantage to isolate confinement effect on human body in order to understand separately stress effect and inactivity linked to confinement. It could lead to better understanding in human physiology in extreme conditions like long duration spaceflight.