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EFFECTS OF DIFFERENT DURATION DRY IMMERSION ON SENSORY ORGANIZATION OF POSTURAL SYSTEM

Abstract

Dry immersion (DI) is one of the most widely used ground-based models of physiological effects of microgravity (Tomilovskaya, 2019). DI accurately and rapidly reproduces most of physiological consequences of short-term space flights such as alterations of vertical balance. The model simulates such factors of space flight as lack of support, mechanical and axial unloading as well as physical inactivity. Ten healthy volunteers 20-40 years old with normal body weight took part in 5 and 21-day DI. To register postural characteristics stabilometric platform was used. The center of pressure (COP) displacement velocity and the average amplitude of COP deviation were registered; the ratio between baseline and post-DI values were analyzed. The subjects stood with eyes open and eyes closed on the solid support and with eyes closed on the soft support (foam pad 20 cm thick), for 40 sec in each condition. Soft support was used for disturbing of the somatosensory input. The study was performed before DI and on the day of DI completion. After 21-day DI in the test on the solid support COP velocity increased on 39% with eyes open and on 32% – with eyes closed. However on foam support COP velocity did not increase as well as the average amplitude of COP deviation in all conditions. After 5-day DI in the test on solid support the COP deviation amplitude didn't change with eyes open and increased in 26% with eyes closed; on the soft support it increased by 68%. Moreover in this condition the significant difference in COP deviation amplitude between 5 and 21-day DI groups was observed. According to the ratio between the COP amplitude values with eyes open and closed on the solid support – Romberg Coefficient (RC) - the volunteers were divided into 2 subgroups. After observing these subgroups separately, we found that in subgroup with RC>1 COP amplitude in the test on the soft support after 5-day DI increased by 39%, in group with RC<1 – by 212%. Such drastic increase could be interpreted as the absence of somatosensory flow redundancy (Shishkin, 2020), which didn't manifest in easier conditions (solid support). We consider that increase in COP velocity after 21-day DI in simple conditions reveals the general deterioration of postural balance while drastic increase in amplitude in complicated condition exhibits low contribution of vestibular system to vertical balance maintance. Supported by the Russian Science Foundation, project No.19-15-00435.