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EFFECT OF ARTIFICIAL GRAVITY WITH EXERCISE ON SPACEFLIGHT DECONDITIONING IN HUMANS AND PROJECT FOR ASSESSMENT OF ARTIFICIAL GRAVITY IN H-II TRANSFER VEHICLE IN INTERNATIONAL SPACE STATION — AS WELL AS THE DEEP SPACE GATEWAY.

Abstract

Spaceflight deconditioning impairs several systems, including neurovestibular, fluid/electrolyte, cardiovascular, musculoskeletal, bone metabolism, and autonomic regulation. We examined whether the artificial gravity by shortSatoshi Iwase, Naoki Nishimura, Kunihiko Tanaka, Tadaaki Mano, and Kazuhito Shimada

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Spaceflight deconditioning impairs several systems, including neurovestibular, fluid/electrolyte, cardiovascular, musculoskeletal, bone metabolism, and autonomic regulation. We examined whether the artificial gravity by short arm centrifuge with exercise ameliorate these deconditioning induced by simulated microgravity. The experimental position during centrifuge was lying down position with their legs up. The diameter of the device was 2.8 m, the loaded G was 1.4G at the heart level, and the intermittent G load was 30 min per day. Fluid shift was compared using bio-impedance. Before and after the bedrest, the anti-G score was calculated as the sum of [the loaded G] x [endured time in second], and the countermeasure group exhibited significant higher score compared with the control. Muscle sympathetic nerve activity in post-experimental level was enhanced in basal levels as compared with the pre-experimental level. Cardiac output showed no significant changes between pre- and post-experimental levels of Myatrophy and bone metabolism showed no significant difference between the pre- and post-experimental level, however, post-experimental level of the both was decreased in the control. In addition, artificial gravity induced by short radius centrifuge with ergometric exercise 30 min per day was effective in improving the orthostatic tolerance. In 2017, a novel artificial gravity project was proposed. A centrifuge device with exercise is to be installed in the H-II Transfer Vehicle X (Konotori) attached to the International Space Station of the Japanese area of KOBO. This device will validate the effectiveness of artificial gravity under actual weightlessness in space. This device is to be also proposed to be installed in the deep-space gateway station, and projected to be established on the moon as the base, as well as to be installed in a spacecraft for the return voyage to the Mars.