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EFFECTS OF ARTIFICIAL GRAVITY ON THE MUSCULOSKELETAL SYSTEM

Abstract

Delving into the gravitational realm, this review article navigates the complex landscape of Artificial Gravity and its effects on the musculoskeletal system, unraveling the enigma that surrounds the application of this technology. Hence, this paper explores the impact of artificial gravity on the musculoskeletal system, analyzing both its positive and negative effects. With that objective in mind, we analyzed several research on the topic, centering the investigation on the use of short-arm centrifuge experiments. First conceived in the 19th century as a countermeasure to the severe physiological effects of the microgravity environment, artificial gravity was not a priority when scientists realized that short-duration spaceflights had minimal effects on human physiology. However, with new and ambitious plans for upcoming lunar and Martian long-duration missions, the interest in artificial gravity has resurged. The experience gained in more than 50 years of human spaceflight shows the need for effective countermeasures like that of artificial gravity. One of the proposed countermeasures was resistance exercises, which although beneficial, do not fully fulfill the task of preserving muscle mass, which results in time-consuming efforts by astronauts. The limitations of the current exerted exercises in the ISS, outline the potential of artificial gravity as a more complete integrated solution. Although the implementation of artificial gravity presents logistical and financial challenges, its potential benefits make it a very interesting technology to invest in for future space missions. Bed-rest studies simulating microgravity effects, like for instance the ones performed in the AGBRESA, provide valuable insights into the physiological responses to artificial gravity. However, there are concerns regarding the possible negative side effects of using it, since the alternation of artificial gravity and weightlessness could harm human physiology. Hence, in this article we analyze the studies on subjects performing a bed rest study, specifically addressing the effects on the musculoskeletal system; finally, we review the different potential side effects and give a conclusion of our findings. In conclusion, this review emphasizes the important role of artificial gravity as a countermeasure against the damaging effects of weightlessness on the musculoskeletal system. Future endeavors in space exploration require technologies that better handle the mitigation of the effects of weightlessness like that of artificial gravity. Thus, there should be more investment in the research of it.