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EFFECTS OF SUITED AND UNSUITED LOCOMOTOR GAITS IN SIMULATED FRACTIONAL GRAVITY ENVIRONMENTS ON THE MUSCLES OF THE LOWER LEG

Abstract

Past research efforts have focused on the energy difference between different locomotion methods in fractional gravity at different speeds, suggesting that skipping is energetically more efficient than walking and running in these environments. While this may be more beneficial from an energy standpoint, the full range of reasons behind the gait transition and locomotion style selection have not been researched. This includes damage to the muscles of the leg, which is prevented by a transition from walking to running. In a space environment, these factors will play a role in astronaut health and injury prevention. For this study, subjects use the main 4 locomotion methods (walking, running, skipping and loping), on a treadmill for intervals of one minute while being supported by the Active Response Gravity Offload System (ARGOS) at Johnson Space Center, which is a calibrated analog for activity on other planets. Electromyography (EMG) will be used to monitor muscle activation during these tests, along with the Ariel Performance Analysis System (APAS) that is used for video-based motion analysis, to extrapolate the force exerted on the lower limbs. These intervals will be performed under 1g, .38g and .17g conditions, to simulate gravity conditions on Earth, Mars and the Moon, respectively. The tests shall be performed once unsuited, and then again while the subjects wear the pressurized lower torso of the NDX-2 spacesuit. This will allow comparison between suited and unsuited locomotion patterns, as the movements in a pressurized spacesuit is different than in unencumbered locomotion. This study will compare the impact of these types of locomotion in simulated fractional gravity environments in order to determine the possible long term effects of movement in novel space environments caused by muscle activation patterns and force exerted on the muscles of the lower leg.