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PHYSIOLOGICAL CHARACTERIZATION OF A COMPACT SHORT RADIUS CENTRIFUGE ARTIFICIAL GRAVITY TEST PLATFORM

Abstract

Intermittent exposure to artificial gravity on a short radius centrifuge (SRC) with exercise is a promising, comprehensive countermeasure to the cardiovascular and musculoskeletal deconditioning that occurs as a result of prolonged exposure to microgravity. To date, the study of artificial gravity has been done using bedrest and SRC's with subjects positioned radially with the head at the center of rotation. A recent proposal to put a human centrifuge on the International Space Station highlighted the reality that near-term inflight SRC's would likely be confined to radii shorter than has been typically used to date in terrestrial analogs. The unique positioning required by such a constraint would result in physiological effects such as accelerations on the head and potential changes in level of muscle activation and exercise exertion, which in turn could impact the effectiveness of artificial gravity as a countermeasure. Using a novel test platform on board the SRC at MIT that confines the centrifuge to a 1.4 m radius, positions the subject on their side, and includes a cycle ergometer, we have begun to characterize the physiological responses to various exercise regimens while exposed to 1G at the feet. We present data on heart rate, blood pressure, surface EMG, and foot force and discuss implications for optimizing future countermeasure protocols.