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HUMAN SPACEFLIGHT SYMPOSIUM (B3)
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Author: Ms. Kristina Roche
Canada

Mrs. Ana Diaz
Massachusetts Institute of Technology (MIT), United States
Dr. Andrew Smith
Canada

SHORT-TERM READJUSTMENT TO GRAVITY AFTER LONG DURATION SPACEFLIGHT

Abstract

Humans experience significant physiological changes during long-duration space missions, particularly the cardiovascular and musculoskeletal systems. Knowledge regarding human performance in the period immediately after reentry to the Earth's gravitational field (1G) is relatively limited yet extremely important for future Mars missions. Upon return to gravity, space travelers experience the effects of reduced bone density, decreased muscle tone, decreased cardiac output, necytolysis, fluid shifting, and orthostatic intolerance. During a long duration spaceflight to Mars, space travelers will undergo 6-9 months of microgravity prior to exposure to Martian gravity (0.38G). Upon landing, there will be no human aid available to assist the inaugural mission's members initial activities, as is available on Earth.

This paper describes a proposed experiment investigating human performance after exposure to a prolonged period in microgravity. This empirical research proposal aims to create a body of knowledge pertaining to independent function and readjustment to gravity upon return to Earth from the International Space Station (ISS) after a long-duration space mission. The experiment would consist of two separate phases. The initial phase would consist of the preparation and refinement of the experimental protocol using a ground-based bed rest study. The second and main phase would consist of the application of the experiment protocol to astronauts immediately after their return from the ISS.

The space travelers' goal would be to exit the landing capsule unassisted and make their way to a predetermined destination unaided. Performance and physiologic parameters would be continuously monitored with qualified personnel available to assist in case of medical emergency. Investigators would be present to communicate with the subjects, and to collect valuable data, including physiological indicators (heart rate, blood pressure, respiratory rate, volume status, and body positioning), psychological effects, logistical details, and video surveillance. Knowledge gained through this experiment would identify potential problems in future unassisted landings, and would support the planning of a human mission to Mars.