Scientists one step closer to stopping bone loss during spaceflight

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(PhysOrg.com) -- Bone loss in long-duration spaceflight has been identified for decades as a significant problem affecting astronauts. More recently, scientists have found that the absence of gravity is causing astronauts on the International Space Station to lose up to 10 times more bone mass in key regions of the body each month than most post-menopausal women do in the same period of time back here on Earth.

Now, by simulating spaceflight conditions through the use of long-duration bedrest, researchers at the University of Washington have found -- for the first time -- a way to prevent bone loss in a specific region of the hip. Using bedrest as an analog of spaceflight, UW scientists are at the mid-point of a study in which 22 volunteers remain in bed, in a six-degree, head-down tilt position for 84 days.

The head-down tilt mimics many of the physiologic adaptations astronauts experience during spaceflight, such as bodily fluid shifts toward the head. The bedrest confinement mimics the complete "unloading" of the musculoskeletal system that astronauts feel as they float through space due to the lack of gravity, which accelerates bone loss. Half of the study participants are randomized to perform individually prescribed intermittent treadmill exercise similar to workouts by astronauts in space -- but with one important difference: they are pulled towards the treadmill surface by a harness applying greater force than what the research team has previously measured during walking and running on the International Space Station treadmill.

"We have found that we can, on average, prevent bone loss in an important region of the hip with this intervention," said Dr. Peter Cavanagh, UW professor of orthopaedics and sports medicine, and principal investigator of the study. "No bedrest study ever before has accomplished this."

The results from the first half of the study are "extremely promising," Cavanagh said. Of the five study subjects so far who have been assigned to the exercise group, bone loss in 4 of the 5 subjects has been prevented in important skeletal regions by the treadmill exercise countermeasure, while the six non-exercising control subject participants all lost bone mass.

Cavanagh said the study results will impact bone health in space and on Earth by better informing exercise prescriptions for astronauts on future space missions, while furthering scientists' understanding of the role individualized exercise programs play in addressing age- and gender-related osteoporosis back on Earth.

Funded by NASA and the National Space Biomedical Research Institute (NSBRI), the study is titled "A Quantitative Test of On-Orbit Exercise Countermeasures for Bone Demineralization Using a Bedrest Analog." The study is expected to move to the NASA Flight Analogs Facility at the University of Texas Medical Branch in Galveston in June 2009. Cavanagh will collaborate with fellow scientists at NASA until the anticipated completion of the study in early 2011. He will discuss the relevance of knowledge gained in space for life on Earth in a keynote address at the International Symposium on Osteoporosis in Washington, DC on April 2, 2009.

For more than 40 years, scientists have known that spaceflight has a detrimental effect on bone, but to date, none of the countermeasures have been 100% effective.

"This study takes us another step closer to learning how to maintain bone health during and after these space missions," Cavanagh said. "This week's launch of the Space Shuttle Discovery serves as a timely reminder that space exploration continues and, with it, our research agenda must keep pace to ensure the musculoskeletal health of our first interplanetary explorers -- as well as the rest us back here at home."

Provided by University of Washington (news : web)