Daily vibration may help aging bones stay healthy

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Dr. Karl H. Wenger is a biomedical engineer in the MCG Schools of Graduate Studies and Medicine. Credit: Phil Jones, Campus Photographer

A daily dose of whole body vibration may help reduce the usual bone density loss that occurs with age, Medical College of Georgia researchers report.

Twelve weeks of daily, 30-minute sessions in 18-month old male mice – which equate to 55- to 65-year-old humans – appear to forestall the expected annual loss that can result in fractures, disability and death. Dr. Karl H. Wenger, biomedical engineer in the MCG Schools of Graduate Studies and Medicine, reported the findings with his colleagues in the journal *Bone*.

Researchers found vibration improved density around the hip joint with a shift toward higher density in the femur, the long bone of the leg, as well. Hip fractures are a major cause of disability and death among the elderly.

They also found a reduction in a biomarker that indicates bone breakdown and an increase in the surface area involved in bone formation in the vibrating group.

The findings provide more scientific evidence that the technique, which dates back to the 1800s and is now showing up in homes, gyms and rehabilitation clinics, has bone benefit, particularly as a low-risk option for injured individuals with limited mobility, Wenger said.

The scientists theorize that the rhythmic movement, which produces a sensation similar to that of a vibrating cell phone but on a larger scale, exercises cells so they work better. Vibration prompts movement of the cell nucleus, which is suspended by numerous threadlike fibers called filaments. "The filaments get all deformed like springs and then they spring back," Wenger said.

All the movement releases transcription factors that spur new osteoblasts, the cells that make bone. With age, the balance of bone production and destruction – by osteoclasts – tips to the loss side.

In the case of an injury, vibration acts on stem cells, the master controllers of the healing process. "We think that in fracture healing, you get a more dramatic response. We don't know exactly why it affects the biology differently but it's likely because of the extent to which stem cells invade the injured area," Wenger said. They have found that vibration slows stem cell proliferation, which may sound counterintuitive, but likely means more stem cells differentiate into bone cells rather than continuing to just make more generic stem cells. With

age, stem cells have difficulty differentiating.

To see if their findings translate to the trauma clinic, they are evaluating vibration tolerance in patients with lower-limb fractures and finding, surprisingly, that even two weeks after injury the subtle vibration is soothing, rather than painful, to most.

The bone group, based in the MCG Department of Orthopaedic Surgery, also is working with Georgia Prevention Institute scientists to explore vibration's potential to improve glucose uptake – to see if vibration results in more insulin production or aids glucose clearance in some other way – and whether, like exercise, it can reduce fatty liver disease in chunky, pre-diabetic children.

In related studies, postmenopausal women at the peak age of bone decline, experienced results similar to those of Wenger's aging mice. Wenger's studies used only male mice to mitigate the impact of fluctuating hormones and focus on aging. In the human study, led by Dr. Clinton T. Rubin at the State University of New York at Stony Brook, the women receiving daily whole body vibration didn't gain appreciable bone but they did not lose it either.

While vibration lacks the same cardiovascular benefit of exercise, animal and human studies also have shown it can improve muscle strength and weight loss.

Provided by Medical College of Georgia