

# Vibration-Based Stimulation to Prevent Bone Loss from Space Travel and Sedentary Behavior

**A lightweight, wearable sleeve provides daily mechanical stimulation to appendages to prevent bone and muscle deterioration in sedentary, bedridden, or microgravity situations while promoting blood circulation.**

When people lead a sedentary lifestyle by choice or due to age or illness for more than 5 to 10 weeks, they often experience significant bone loss and are at high risk for developing osteoporosis and fracturing a bone. When muscles are not used, the muscles atrophy and a loss of muscle strength occurs. Pressure ulcers, also known as bedsores, are a common occurrence for those that are bedridden or sedentary. As our population continues to age, more people will experience such effects.

One challenge of extended space travel is the long-term effects of microgravity on the human body. Approximately 1.5 percent of bone tissue is lost per month of space travel, leading to an increased risk of bone fractures and osteoporosis when astronauts return to earth. Skeletal muscle is no longer required to maintain posture. Given the aforementioned, the unique subset of muscles used in microgravity leads to rapid overall muscle atrophy. In addition, elevated blood calcium levels from bone loss result in dangerous calcification of soft tissues and potential kidney stone formation. It is unknown whether bones ever truly recover completely.

Researchers at Purdue University have developed a device that can provide daily mechanical stimulation to an appendage such as an arm, to prevent the loss of bone density and muscle atrophy in a bedridden environment or in space travel. This device is a comfortable, lightweight sleeve that can be worn every day for 30 minutes to promote bone and muscle health for those that are sedentary, bedridden, or traveling in space. The mechanical stimulation encourages natural blood flow throughout the arm, which is known to stimulate and maintain bone density and muscle tone. This device could be used to prevent bedsores in bedridden patients, fracture healing, osteoporosis prevention, and other ailments related to blood circulation. In

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addition, it could be used after extended space travel.

**Advantages:**

- Prevents loss of bone density and muscle atrophy in bedridden or microgravity situations
- Prevents bedsores
- Osteoporosis prevention
- Increases blood circulation

Potential Applications:

- Aeronautics Engineering/Manufacturing
- Medical/Healthcare

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**Intellectual Property:**

Provisional-Patent, 2010-04-30, United States | Utility Patent, 2011-05-02, United States | CON-Patent, 2014-07-01, United States | CON-Patent, 2015-10-07, United States

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