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Opinion Article

Whole Body Vibration Therapy for Bone Health

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DESCRIPTION

The piezoelectric theory states that pressure stimulates bone formation in the electrical potential difference, which works as a stimulant of the bone-forming process. The effort made while standing up instead of lying down is a greater osteogenesis stimulator, which explains why vibration therapy is effective. Sarcopenia and osteoporosis are prevented by Whole-Body Vibration (WBV), which raises the levels of growth hormone and testosterone in the blood. Vibration training also improves neuromuscular coordination and muscle strength, which in the case of osteoporosis patients can lower the risk of falls leading in fractured bones. Another component of the ICARO (Innovative Comprehensive Active Rehabilitation of Osteoporosis) plan includes whole-body vibration.

Osteoporosis and poor bone mass afflict more than 53 million persons in the US over the age of 50. When it comes to Bone Mineral Density (BMD), the World Health Organization defines osteoporosis as any number that is more than 2.5 standard deviations below the average for young, healthy females. Osteoporosis is a degenerative bone disease that arises from low BMD and is characterized by increased fracture risk due to loss of bone microarchitecture and bone fragility. Sex Hormone Binding Globulin (SHBG) inhibits oestrogen and testosterone, causing age-related bone tissue deterioration in both men and women. Due to estrogen's diminished ability to defend against osteoporosis after menopause, women over the age of 50 are disproportionately affected. By reducing osteoblast production of osteoprotegerin and increasing bone marrow Receptor Activator of Nuclear factor Kappa-B Ligand (RANKL), the postmenopausal oestrogen drop accelerates bone death. Anti-osteoporotic medicines, hormones, and vitamins have been used in effective pharmacological therapy, however there are long-term side effects, astronomical drug prices, and difficulties with medication adherence.

BMD can be used to evaluate the quality of bone microarchitecture and fracture risk, and bone biomarkers may be used in addition to BMD to help predict fractures. Dual-energy X-ray Absorptiometry (DXA) is the current gold standard for BMD diagnostics. Blood biomarkers can be used to measure both bone growth and resorption. Bone formation is commonly evaluated using Procollagen type 1 N-terminal Propeptides (P1NP), a by-product of collagen synthesis. Other biomarkers to evaluate the osteoblastic activity of bones include Osteocalcin (OC), Bone Specific Alkaline Phosphatase (BSAP), and Procollagen type 1 C-terminal Propeptide (P1CP). The C-terminal Telopeptide of type 1 collagen (CTX1), a collagen degradation product, is typically used to evaluate bone resorption. N-terminal Telopeptide (NTX), hydroxyproline, pyridinoline, and Tartrate-Resistant Acid Phosphatase type 5b (TRAP5b) are further markers of osteoclastic bone tissue destruction.

Exercise has been shown to stimulate bone formation by modifying the architecture of bone tissue, increasing peak bone mass, reducing the risk of fracture, and delaying the onset of osteoporosis. As a result, non-pharmacological methods including exercise and physical activity are frequently advised to slow the loss of BMD. Physical activity-induced mechanical stress is crucial for maintaining and enhancing bone function. Applying unusually high-strain mechanical forces could encourage osteogenesis. In postmenopausal women, high frequency, low magnitude mechanical stressors also significantly improve bone density and structure.

The mechanical stress on bone structures is increased by Whole-Body Vibration (WBV), a passively produced, non-invasive mechanical stimulation technique that produces strain and modifies muscular force contractions. It has been shown that WBV increases bone density. Function and muscle architecture. However, according to some studies, there is no appreciable effect on BMD. With a shift toward bone production, WBV in young, healthy people showed an increase in P1NP and CTX1, but in contrast, a decrease in CTX in other research.

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