



Whole-Body Vibration Therapy for Osteoporosis

FACT SHEET

What is Osteoporosis?

Osteoporosis occurs when bone mineral density and bone mass decrease. This results in bones becoming increasingly fragile and therefore at a higher risk of fracture, even after minor falls. Osteoporosis can affect anyone, even those who are active and eat a healthy diet.

Broken bones are often referred to as 'fragility fractures.' The terms 'fracture' and 'broken bone' mean the same thing. Fractures can occur in various parts of the body, the most common being the wrists, hips, and spine. It is the broken bones that lead to the pain associated with osteoporosis. Additionally, spinal fractures (often undiagnosed) may cause a loss of height, pain, and increased curvature of the spine (e.g., Scoliosis and Kyphosis).

Not everyone with osteoporosis goes on to break a bone. There are ways you can reduce your fracture risk and live well with osteoporosis.

What is Vibration Therapy?

Vibration therapy is a mechanical vibration delivered to the body whilst on a platform. The direction of the vibration can be vertical or oscillatory. As the machine vibrates it transmits energy to your body stimulating your muscles to contract and relax dozens of times each second, with the aim of increasing circulation, muscle strength and flexibility.¹ Research has proven Low-intensity Vibration (LiV) therapy activates the cells in your bones to regenerate.²

There has been significant research into the benefits of vibration therapy. Its use is becoming more common globally.

Low-intensity vibration therapy devices are different from the high-intensity vibration devices often found in gyms used to enhance muscle growth. There are no known contraindications or side effects associated with Low-intensity vibration therapy.³ It is well documented that High-intensity vibration devices can pose a risk to users, especially those with underlying health conditions, such as osteoporosis.⁴

LiV must be differentiated from vibration slimming devices that involve thick rubber bands or belts placed around your middle which shake you up, sometimes quite violently. These are designed specifically for the purpose of weight loss and muscle toning and do carry a health risk.

The History of Vibration Therapy and Bone Health

Low-intensity vibration therapy was initially developed by scientists looking to reduce bone density loss experienced by astronauts whilst in zero gravity. Through continued research, Professor Clinton Rubin (Musculoskeletal Research Laboratory, Stony Brook University) identified that 10 minutes a day of gentle, precise, targeted vibration therapy increases bone mineral density.⁵

This same technology has been refined to help people improve their bone density on Earth. It has long been known that weight-bearing exercise has a positive influence on bone. Vibration therapy works in a similar way by stimulating the stem cells in bone to reproduce.

What Types of Whole-Body Vibration Therapy are there?

Low-intensity vibration therapy and High-intensity vibration therapy are both whole-body vibration therapy, however, it is important not to confuse the two.

There are a variety of vibration devices available in the market based on the direction and size of the vibrations produced. And not all are suitable for use by those with osteoporosis or other underlying health conditions.⁶ If you have osteoporosis in Australia, it is advisable to choose a medical device certified by the Australian Therapeutic Goods Administration (TGA) for its product safety. Marodyne LiV is a Class IIa medical device listed in the TGA (ARTG 317506) for the treatment of osteoporosis or to improve posture, coordination, and balance in clinical and home settings.

Low-intensity whole-body vibration devices, such as the Marodyne LiV, resemble a set of large bathroom scales and emit tiny up and down (vertical) vibrations 30 times per second at 0.4g. These gentle vibrations travel through the feet, up the spine to the jaw.

High-intensity whole-body vibration devices emit a high acceleration, high level vibration, typically over 1.0g. High-intensity whole-body vibration devices can be seriously damaging to those with bone conditions, such as osteoporosis, due to the magnitude of the force exerted on the body. Several high-intensity whole-body vibration devices far exceed what is considered safe for even brief exposure.⁷

Who can use Whole-Body Vibration Therapy?

It is important to check the medical certification of the device you wish to use, and the contra-indications associated with its use.

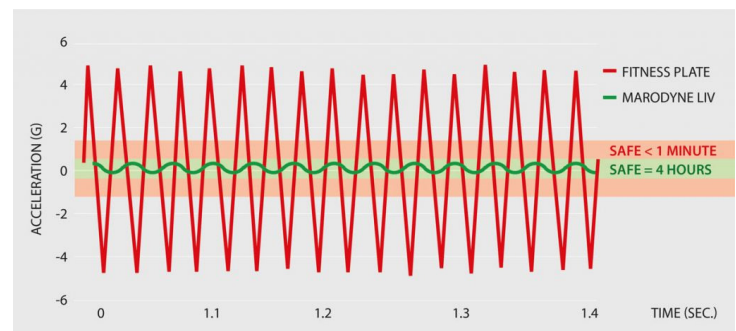
Low-intensity whole-body vibration therapy certified as Class IIa medical devices are designed to mimic the natural way muscles trigger regeneration in our bones, and therefore have no contra-indications or side effects. These devices can be used with confidence by both adult and children.

High-intensity whole-body vibration therapy devices are contra-indicated and therefore unsuitable if you have any of the following conditions^{8,9,10,11}:

- Any current or recent blood clots
- A pacemaker
- Are pregnant
- Dizziness or inner ear problems
- Osteoporosis
- Spinal fractures, injuries, or undiagnosed back pain
- Significant cardiovascular disease (such as heart attacks, angia, arrhythmia, or strokes)
- A recent orthopaedic injury or surgery
- Any recent implants in your body
- Epilepsy or prone to seizures
- Neuropathy
- Acute joint disease, arthritis, or rheumatoid arthritis
- Sever diabetes
- Cancers or tumours
- Retinal conditions
- Kidney or bladder stones
- Migraines
- Acute thrombosis or hernia
- Discopathy and spondylitis
- Recent infections
- Recently placed intrauterine devices

Safety Exposure Limits for Humans

The low-intensity vibration signal provided by Marodyne Liv is categorised as safe by the International Safety Organisation for daily use at a threshold level of up to 4 hours in relation to the human vibration tolerance.



The above graph is from ISO 2631 Mechanical vibration and shock – evaluation of human exposure to whole-body vibration, and highlights the potential dangers of WBV when compared to the gentle and safe LiV.

How does Low-Intensity Whole-Body Vibration Therapy Improve Bone Health?

Mesenchymal stem cells produce either bone, cartilage, or fat cells. Ageing and other underlying health conditions cause our cells to produce less bone and more fat. This gradually reduces bone density and increases our risk of developing osteoporosis.

Low-intensity Vibration therapy counteracts this process by using precisely targeted, low-intensity vibrations to gently stimulate the body's bone building (osteoblast) cells to work.¹² It is a safe, natural, and gentle way to increase bone density.

I am fit, very active and don't have Osteoporosis. Will Low-intensity Vibration therapy strengthen my bones?

Extensive research supports the use of Low-intensity vibration plates by people with osteoporosis. Devices emit gentle vibrations to increase bone mineral density and encourage bone growth, reducing fracture risk. Evidence shows Low-intensity Vibration therapy reduces your risk of falls as it improves muscle strength.¹⁵ Any reduction in falls will reduce the risk of broken bones.

As with any treatment, we are all unique and results may vary. Some people may benefit more from vibration therapy than others.

Before using a device, make sure you know the intensity of its vibrations. Devices that vibrate rapidly at high levels have contraindications and cannot be deemed to be safe, especially if you have osteoporosis. Care must be taken when stepping on and off the machines. If you have any concerns about using a vibration plate, discuss it with your doctor or physiotherapist.

References

- 1 Judex S, Rubin CT. Is bone formation induced by high-frequency mechanical signals modulated by muscle activity?. *J Musculoskeletal Neuronal Interact.* 2010;10(1):3-11.
- 2 Pagnotti GM, Styner M, Uzer G, et al. Combating osteoporosis and obesity with exercise: leveraging cell mechanosensitivity. *Nat Rev Endocrinol.* 2019;15(6):339-355. doi:10.1038/s41574-019-0170-1

- 3 Muir J, Kiel DP, Rubin CT. Safety and severity of accelerations delivered from whole body vibration exercise devices to standing adults. *J Sci Med Sport.* 2013;16(6):526-531. doi:10.1016/j.jsams.2013.01.004

- 4 Muir J, Kiel DP, Rubin CT. Safety and severity of accelerations delivered from whole body vibration exercise devices to standing adults. *J Sci Med Sport.* 2013;16(6):526-531. doi:10.1016/j.jsams.2013.01.004

- 5 Gilsanz V, Wren TA, Sanchez M, Dorey F, Judex S, Rubin C. Low-level, high-frequency mechanical signals enhance musculoskeletal development of young women with low BMD. *J Bone Miner Res.* 2006;21(9):1464-1474. doi:10.1359/jbmr.060612

- 6 Muir J, Keil D, Rubin C. Safety and severity of accelerations delivered from whole body vibration exercise devices to standing adults. *J Sci Med Sport.* 2013 Nov;16(6):526-31. doi:10.1016/j.jsams.2013.01.004.

- 7 Muir J, Kiel DP, Rubin CT. Safety and severity of accelerations delivered from whole body vibration exercise devices to standing adults. *J Sci Med Sport.* 2013;16(6):526-531. doi:10.1016/j.jsams.2013.01.004

- 8 Alfio Albasini, et al. *Using Whole Body Vibration in Physical Therapy and Sport : Clinical Practice and Treatment Exercises.* Edinburgh, Churchill Livingstone, 2010.

- 9 Kiiski, Juha et al. "Transmission of vertical whole body vibration to the human body." *Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research* vol. 23,8 (2008): 1318-25. doi:10.1359/jbmr.080315

- 10 Maggiano, J., Yu, MC.M., Chen, S. et al. Retinal tear formation after whole-body vibration training exercise. *BMC Ophthalmology* 20, 37 (2020). <https://doi.org/10.1186/s12886-019-1291-y>

- 11 Wong, M.L., Widerstrom-Noga, E. & Field-Fote, E.C. Effects of whole-body vibration on neuropathic pain and the relationship between pain and spasticity in persons with spinal cord injury. *Spinal Cord* (2022). <https://doi.org/10.1038/s41393-022-00806-w>

- 12 Pagnotti GM, Styner M, Uzer G, et al. Combating osteoporosis and obesity with exercise: leveraging cell mechanosensitivity. *Nat Rev Endocrinol.* 2019;15(6):339-355. doi:10.1038/s41574-019-0170-1

- 13 Sun, Yuyang et al. "Mechanical Stimulation on Mesenchymal Stem Cells and Surrounding Microenvironments in Bone Regeneration: Regulations and Applications." *Frontiers in cell and developmental biology* vol. 10 808303. 21 Jan. 2022, doi:10.3389/fcell.2022.808303

- 14 Games KE, Sefton JM, Wilson AE. Whole-body vibration and blood flow and muscle oxygenation: a meta-analysis. *J Athl Train.* 2015;50(5):542-549. doi:10.4085/1062-6050-50.2.09

- 15 Leung, K S et al. "Effects of 18-month low-magnitude high-frequency vibration on fall rate and fracture risks in 710 community elderly--a cluster-randomized controlled trial." *Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA* vol. 25,6 (2014): 1785-95. doi:10.1007/s00198-014-2693-6

