Whole Body Vibration Therapy

Prof. Dr. Syed Mohammad Waris
Associate Director at London Academy for Sports and Health Science, UK

Abstract:
Whole-body vibration is commonly used in physical medicine and neuro-rehabilitation as a clinical prevention and rehabilitation tool. WBV has been shown to have an important role in increasing neuromuscular performance, improving muscular strength, balance, gait mechanics, and quality of life. This technique involves standing and holding positions, or performing prescribed exercises, on a platform that is vibrating at a programmed frequency, amplitude, and magnitude of oscillation. During WBV treatment, patients are asked to stand on a device and hold onto a bar while the device vibrates at specific speeds or frequencies. Not only are the skeletal muscles exercised during WBV, but also the ligaments, tendons, lymphatic system, bones, and smooth muscles. The result is a total body exercise which is not possible with conventional exercise equipment.

Keywords: whole-body vibration, vibration therapy, vibration machine.

Concept of Vibration Therapy

Vibration platform for the whole body

The idea originated in space science: BioMechanical Simulation (BMS) by means of whole-body vibration.

In 1856, Russian physican and inventor Gustav Zander developed a series of machines that utilized weights and pulleys to create a sense of vibration. The purpose of apparatus was therapeutic.

Figure 1. The samples of the vibration platform
In 1895, Dr. John Harvey Kellogg implemented vibration therapy in his health practice. With a vibration chair he developed himself, he claimed the therapy was good for circulation and could also alleviate constipation.

During the Russian space programme, Physicians noticed that the returning astronauts suffered from loss of bone mass & bone fractures at a much earlier age than was normal. They began to use whole body vibration device to help strengthen astronaut’s bone mass & muscles.

Today NASA uses VT to help prevent muscle loss in astronauts.

**How does vibration therapy work?**

**Whole body Vibration**

During whole-body vibration therapy, your therapist will ask you to stand, sit, or lay on a machine supported by a vibrating platform. For example, they may ask you to stand in a half-squat position with your knees bent.

**Two types of W-Body Vibration Machines**

**Pivotal**

In Pivotal vibration machines, the platform you stand on tilts around a central pivot point like a see-saw. The left and right sides alternate up and down while the centre remains fixed.

**Lineal**

In an attempt to compete with the successful German vibration platforms, a Dutch company created a vibration machine with a new kind of platform movement called Lineal.

A Lineal vibration platform remains horizontal at all times with the entire platform moving up and down by the same amount.

![Figure 2. Samples of the W-Body Vibration Machines mechanism](image)

**Vertical Vibration (Tri-Planar, Vertical Uniform, Straight)**

How does the platform move? The platform moves straight up and down. Vertical vibration units tend to have platform motion with lower amplitude (about 2 – 4 mm) and often achieve comfortable frequencies (between 20 – 50 Hz).

**Vertical vibration.** What happens inside the body? The vibration stimulus travels straight up through the body. The user’s whole body weight
is being mobilized; lymphatic fluids are being circulated well.

Who is this best for? This is typically the best type of vibration for stronger and more active users. It is excellent for accelerated fitness training along with building and toning muscle. It is also a great help for combating Osteoporosis because it maximizes lymph drainage and promotes the release of osteoblast.

How DC’s apply vertical vibration: DC’s use vertical vibration to enhance muscle building and proprioceptive response in rehabilitation regiments once the patient is out of the acute phase. Many DC’s use vertical vibration to treat osteoporosis because a weight bearing load is placed on the patient’s entire skeletal structure. This type of WBV is also fantastic for lymph drainage and can be used for a pre-adjustment warm up.

**Oscillating Vibration** *(Triangular Oscillating, Vertical Alternate Vibration, Pivotal, Toggle)*

How does the platform move? The motor drives a toggle mechanism that elevates one side of the platform, then the other side, sometimes described as a “teeter-totter” motion. Comparatively, Oscillating units have higher amplitude (up to 10 mm or 1 cm) and lower frequency (5 – 35 Hz).

**Oscillating vibration**

What happens inside the body? Slow motion filming of the thigh, hip and abdominal areas show the incredible wave motion of subcutaneous fat, lending credence to the weight-loss/trimming ability of this modality. It contributes greatly to mobilization and activates the core muscles. Also great for increasing the metabolism and burning calories which aids in weight loss!

Who is this best for? It’s great for patients who suffer from lack of mobility in the lumbar and sacroiliac areas, core muscle weakness or generally have not exercised or been mobile for quite some time. It is the perfect type of vibration for the baby boomer and not-so athletic user who is interested in getting started and wants to feel better quickly.

How DC’s apply oscillating vibration: DC’s use oscillating vibration equipment for patients who are stiff, lack core strength, and want to get their bodies stimulated, start exercising, and get moving. As society in the United States becomes more aware and conscious about healthy living, DC’s have been using oscillating units in conjunction with weight-loss initiatives in their practice.

**Technical Requirements for VT Platform**

- Frequency: 20-50Hz
- Duration: 0-120s
- Pause time: 0-120s
- Intensity: low – high
- Repetition: 1-20

**Effects I**

**Muscles**

Vibration plate triggers reflexes

Subconscious → Reflexes cannot be controlled

Increased recruitment of muscle fibres:

Vibration Plate: 90-100%

Normal: 60-70%

High performance sports: 80-90%

Example: Muscle Atrophy

(MS, Confinement to bed, Incontinency)

**Tendon / Connectivity Tissue**

Tissues taking on vibrations alternatively

Friction of different tissues against each other → releasing tissue adherences

Improved blood circulation

**Effects II**

**Blood Vessels**

- Improved mobility of blood vessels
- Improved circulation
- Improved metabolic function
• Improved removal of metabolic waste \(\rightarrow\) faster regeneration
• Example: Intermittent Claudication

Hormones
• VT influences the hormonal system positively
• Increased distribution of growth-hormones
• Increase of testosterone
• Increased production of neurotrophin
• Decreased production of cortisol

Effects III
Capsule & Joints
• Balance (Vestibular system)
• Proprioception, the process by which the body can vary muscle contraction in immediate response to incoming information regarding external forces
• Improved neuro muscular connection
• Example: High performance sports

Nervs / Neuro Transmitters
• Activation of Spinal reflexes
• “Tuning” of the Nervous system via mobilisation / sensibilisation
• Increased number of Neurotransmitters (Dopamine / Serotonin) \(\rightarrow\) Increase neuromuscular connections
• Example: M. Parkinson

Effects IV
Bones & Cartilage
• Bones follow the same rules as muscles
• Speed of deformation strengthens the bones \(\rightarrow\) Build up of bones
• Example: Osteoporosis

• Intermittent pressure improves cartilage function \(\rightarrow\) Increased synovial fluids surrounding cartilage (Improved nutrition)
• Skin combination muscle, blood circulation, improved lymphatic transport, connective tissue causes a tightening of the skin

Vibration training as a complement
• VT causes mechanical vibrations which are transferred to the body
• VT is a new and modern form of training because of its positive effects on different systems of the body
• Used as warm-up, Strength training, Coordination training, Balance training, Regeneration, Cool-down
• Excellent alternative to all sports

Vibration training in therapy
• Absolute contra-indications:
  o Cardiac pace maker
  o Pregnancy
  o Cemented joint implants
• Relative Contra-indications:
  o Therapist needs to decide whether VT is indicated or not

Vibration training in sports
• Improved coordination (central/peripheral NS) \(\rightarrow\) Improved learning situation
• Increased recruitment of muscle fibres (Intramuscular coordination) \(\rightarrow\) Increased strength
• Frequency of training: 3 / week
• Eventually combined with strength training (super compensation)
• Warm-up prior to endurance training → immediate ideal effects (increased efficiency)

**Application area**

**Medical Area**
- physical therapists, rehab clinics

**Professional Area**
- sports consultants, sports clubs, training centers, golf clubs, tennis clubs

**Fitness Area**
- fitness studios, wellness hotels

**Application fields**

**Medical application:** incontinence, osteoporosis, MS, rehabilitation following injuries, treatment of pain and stiffness.

**Professional application:** effective exercising method for both hobby and serious athletes, stretches, extends and relaxes the muscles, increasing explosive strength, strength training.

**Fitness application:** improving coordination and movement ability, eases tension.

**Conclusion**

Therapeutic whole-body vibration appears to be a viable and secure treatment and recreational modality for individuals suffering from different health related issues with respect to musculoskeletal, orthopedic, neurological or sports related problems, including osteoporosis. The use of WBVT as an adjunctive component within a multimodal treatment framework for subacute and chronic problems, with an emphasis on pain reduction and enhancement of activities of daily living and physical functions, as well as improvements in postural stability and proprioception, has demonstrated beneficial effects. However, further investigation is necessary, with standardized assessments and interventions to explore optimal protocols, long-term effects, and the potential mechanisms underlying the observed positive outcomes associated with WBVT.

**References**


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