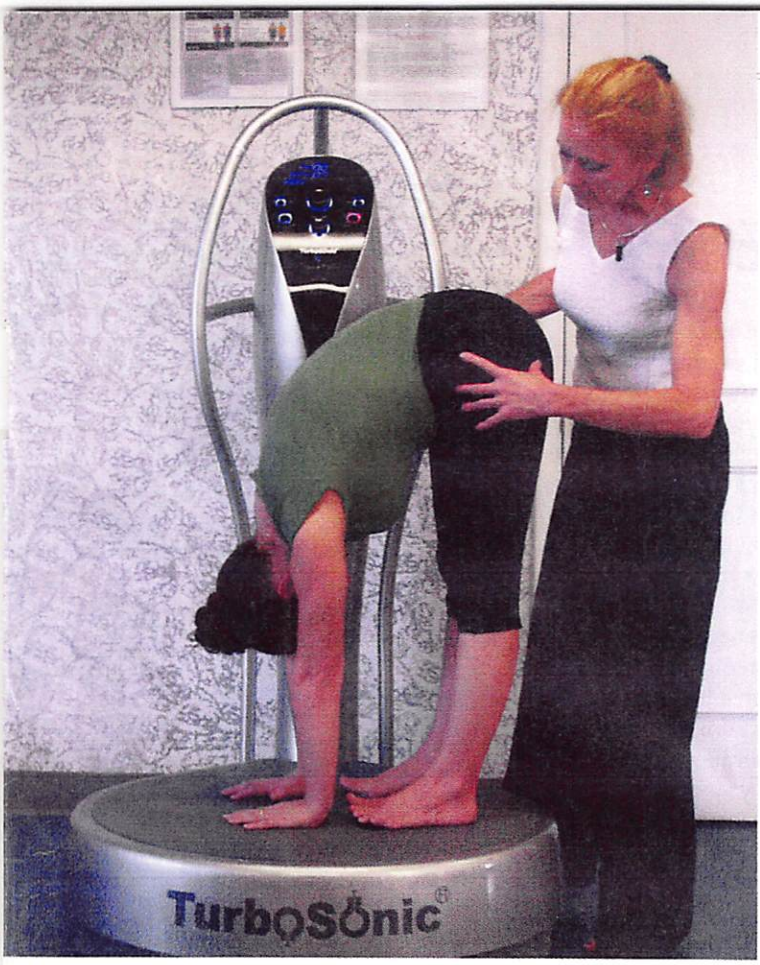

COURTESY PAMELA MORTEMORE

Good Vibrations

Vibration therapy can help heal the body

By Pamela Mortemore, PT

As options for therapeutic technology grow, clinicians are expected to choose the most effective, economical and beneficial treatment regimens for their patients. Whole-body vibration (WBV) training and therapy may help answer these demands. The concept of WBV training was explored by Russian scientist Vladimir Nazarov to increase bone density and slow muscle atrophy during prolonged stays in space.

The technique reduced prolonged muscle atrophy through an involuntary response by stimulating mechanoreceptors (muscle spindles and golgi tendon organs) to contract when excited, and relax when facilitated. WBV exercises primarily rely on the involuntary stretch reflex of mechanoreceptors creating greater communication between the brain and contracting muscles. This concept is important during neuromuscular re-education because the increase in involuntary muscle response creates a jump-start effect on the muscle spindles.

WBV also activates voluntary muscle contractions, as evidenced by an increase in electromyogram activity. When mechanoreceptors in the muscle spindles are stimulated by vibration, messages are sent to the brain to produce a contract-relax response at the rate of current vibration. The response is called a tonic vibration reflex. The reflex amplifies the neuromuscular efficiency by stimulating 100 percent of muscle spindles at the same frequency of the vibration. The main factor that determines this biological effect is the frequency of vibration.

Positive Effects

Current research on WBV reveals promising results for increasing endocrine function, metabolic processes, and for neurological and orthopedic rehabilitation. Studies also confirm that its use has produced successful functional outcomes in people with a spinal cord injury (SCI), and improved postural stability and balance in Parkinson's disease (PD) patients.

WBV offers a low-impact exercise program that burns calories rapidly and increases cardiovascular fitness without the risk of pounding fragile or injured joints or bones. The cardiovascular system responds well to WBV by increasing cardiac output. The increase is due to the rapid contraction and relaxation of muscle spindles. This rapid exchange of blood supply works as a pump on the blood and lymphatic vessels, which improves the exchange of nutrients and toxins, and facilitates the healing process.

Even more compelling is the direct effect of WBV on the central nervous system (CNS). According to past and present research, the benefit of exercise to the brain is clearly documented and is responsible for enhancing memory and cognitive function. Research confirms that exercise increases spatial learning and memory in mice by employing a brain-derived neurotrophic factor (BDNF) to enhance cognitive function and synaptic plasticity, with possible increases in the release of neurotransmitters.[1,2]

BDNF also modulates synaptic plasticity and regulates axonal and dendritic branching and remodeling in the adult brain, giving rise to synaptogenesis in the arborizing of axon terminals, which assist in the efficacy of the synaptic transmission.[1]

Aerobic exercise such as running can create exercise-induced formation of BDNF in the human hippocampus.[1-3] BDNF is responsible for the survival, growth and maintenance of neurons during development.[1] The proliferation, migration and differentiation of neurons is defined as neurogenesis.[2]

Consistent research supports that voluntary exercise increases neurogenesis in the adult hippocampus and improves spatial learning ability.[4] Neurogenesis is found only in the adult brain's olfactory bulb and hippocampus areas where learning and memory formation occurs, making a possible crossover effect in learning occur secondary to the location.[1,2,4]

Research in the 1970s led to numerous studies that concur with the belief that axons of neurons in the brain and spinal cord can regrow to some degree after trauma. This research has encouraged universities and rehabilitation centers across the world to study the effects of WBV in the CNS.

Benefits to SCI Patients

The Miami Project to Cure Paralysis at the University of Miami's Miller School of Medicine conducted a recent study that supports the fact that a change in motor learning and an increase in strength occur during WBV training in SCI populations. The main purpose of the study was to determine if repeated use of WBV would show improvements in gait function of SCI patients.

The study consisted of 17 subjects with chronic, motor-incomplete SCI. Gait function was assessed via 3-D motion capture before and after 12 sessions, three times a week for four weeks, with walking speed as a primary outcome measure. The results showed a statistically significant

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($p<0.001$) improvement in walking speed. According to the study's final results, WBV may be useful to improve walking function, with effects that may persist for some time following the intervention.[5]

Benefits to PD Patients

Parkinson's disease is a motor system disorder marked by stiffness or rigidity, tremors, slowed movements, and balance and coordination issues. Two studies that support the theory of decreasing unwanted motor symptoms and improving postural stability in PD patients using WBV come from Johann Wolfgang Goethe University in Frankfurt, Germany.

The first study assessed the effects of random WBV on motor symptoms using the Unified Parkinson's Disease Rating Scale (UPDRS) in 68 people with PD. After a series of WBV treatment sessions, tremor and rigidity scores improved 24 to 25 percent.[6] The second study evaluated the effects of random WBV on postural control in 52 people with PD. The subjects were tested pre- and post-therapy using narrow standing and tandem standing. Following WBV training, spontaneous postural stability increased balance in the patients.[7]

Today, clinicians are using WBV to strengthen or fatigue muscles with unwanted muscle tone from abnormal CNS activity. Current research supports WBV for its positive biological effects, and some research suggests that motor learning can occur after WBV therapy. If patients can develop motor learning that's comparable to an hour of conventional resistance training after only 10 to 15 minutes on a vibrational plate, it stands to reason that WBV therapy should be regarded as a positive treatment option. ■

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by providing a therapeutic effect in the software category of dysfunction. The tactile stimulation of tape on the skin results in improved muscle activation, restoring functional joint stabilization through the activation of inhibited muscles via mechanisms involved with sensory gating and neuroplasticity.

Fully designed and ready-to-apply kinesiology tape is available specifically for the ankle. It can be applied easily by following the instructions and worn for multiple days continuously by the patient. The ability to withstand continuous wear during bathing and exercise differentiates kinesiology tape from other traditional taping methods and is also a large component of how this form of tape achieves its therapeutic potency.

Structural-based kinesiology taping applications are intended to improve postures as well as prevent potentially harmful ranges of motion.

Plantar Flexion With Inversion

In the case of chronic ankle instability, the range of motion we are trying to limit is plantar flexion with inversion. This is the most common motion involved in the mechanism of injury.

The portion of tape over the plantar fascia is applied using a "neurosensory" method of application to enhance muscle activation, which was negatively affected due to the initial trauma and subsequently has not resolved, contributing to the presentation of chronic ankle instability.

Since the changes associated with muscle activation following an ankle sprain and chronic ankle instability have been shown to result from neural mechanisms and not actual strength of the muscle, it is plausible that treatments that act by engaging neural mechanisms should be utilized in order to achieve the clinical results you are looking for.

This article has touched on building an understanding of the sequence of problems and limitations that can occur in the clinical presentation of chronic ankle instability.

It has also discussed the therapeutic use of kinesiology taping as an important consideration for treatment of ankle sprains to prevent a cycle of recurrent injury often associated with this type of injury. The tape essentially becomes the treatment for the software, or neural component of dysfunction associated with chronic ankle instabilities.

Kinesiology taping is beneficial, not only in the treatment of ankle problems, but also in the prevention and therapeutic intervention for most musculoskeletal conditions.

It is important to note that use of kinesiology taping is a synergistic therapy and should be combined with effective conditioning and neuromuscular training exercises to achieve the greatest outcomes. ■

Kevin D. Jardine is a practicing chiropractor, working mainly in the field of sports therapy and performance treating and consulting with numerous athletes and teams. He is the creator of SpiderTech™, pre-designed and ready-to-apply kinesiology taping applications engineered to reduce pain and improve strength while protecting against further injury. Dr. Jardine is the Chief Medical Officer of Nucap Medical Inc. and owner of The Urban Athlete, a multidisciplinary treatment and training facility in Toronto, Canada, and is an expert in the field of kinesiology taping along with integrative manual and rehabilitative therapy.