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Information Booklet

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The VibraFlex® is the only internationally patented, vibration device that functions in the specific one-directional, oscillating pattern based on the concept of a center fulcrum and an alternating right/left, up and down motion. This produces a corresponding teeter-totter motion at the pelvis that forms the basis of human walking or running, providing the body with an active workout. It results in two (2) key actions: one, it simulates the natural, locomotor cross-over pattern so common in rehab, and second, it requires active patient participation in postural stabilization. The vibrations activate the Involuntary Muscle Stretch Reflex (IMSR). We know that when a doctor taps your patella tendon with a little hammer, there is around 20-25 ms afferent and 20-25 ms efferent response for a total reflex response time of some 40-50 ms. This 40-50 ms circuit corresponds to around 24-27 Hz as a frequency. When exercised/trained at this frequency, the IMSR is activated to the tune of around 1,500 contract/relax cycles per minute. The effects on the circulatory system are enhanced due to the rapid 1,500 contract/relax cycles per minute induced by the IMSR. A strong muscle pumping action is responsible for moving a great deal of fresh oxygenated blood to the working muscles, while flushing out lactic acid and metabolic waste products. This frequency range of vibrations stimulates the neuromuscular system and helps to deepen and redevelop the neuromuscular pathways by firing close to 100% of the muscle fibers within the body of the muscle. In summary, the VibraFlex® also:

- Develops explosive power essential in sports such as baseball, basketball, football or hockey;
- Improves muscle power, muscle strength & tone;
- Increases overall muscle performance;
- Increases blood flow warming/cooling the muscle before/after a game;
- Raises testosterone level (7%) which allows fast-twitch white muscle fibers to fully recover at a quicker rate;
- Raises growth hormone level (361%) essential to repairing and regenerating tissue;
- Lowers cortisol level (32%) which helps minimize the effects of stress;
- Eliminates the effects of stress on joints, ligaments and tendons, compared to conventional exercise;
- Reduces acute and chronic lower back pain due to muscle strain;
- Less stress on the cardiovascular system;
- Improves postural reflexes;
- Increases flexibility and range of motion essential in sports such as golf, tennis, baseball or hockey;
- Improves balance & coordination;
- Improves mobility due to the natural locomotor cross-over pattern of vibration;
- Improves leg circulation for people with diabetes;
- Stronger muscles usually means stronger bones;
- Helps fight osteoporosis through exercise;
- Exercises and/or redevelops the postural muscles, joints and reflexes after injury/disease;
- Exercises the perineal muscles of patients with incontinence;
- Reduces the pain and disability associated with osteoarthritis;
- Allows patients with Parkinson's disease to benefit from exercise that can slow the progress of the disease.
The "Galileo" stimulates the whole body by tilting slightly around an axle. The person who stands on the machine tries to keep the head and body steady and upright. All the muscles that keep the body in this position are forced to react to the oscillatory movements provided by Galileo, thus exercising them. This stimulation form is currently known as "Whole Body Vibration" (WBV) training. Many studies show that vibrations at the right dose can lead to faster growth and recovery of all tissues.

Training sessions of only 2-3 minutes twice a week produce measurable effects.

**Muscle power** - The neuromuscular system is activated strongly but in a controlled fashion. As the movements are too fast to react to voluntarily the muscles are activated through a "tonic vibration reflex". This reflex activates especially the fast muscle fibers, that are hard to stimulate and can produce explosive power. As muscles bring forward the highest forces on other tissues they serve as stimulators for a healthy development of these tissues, such as bone and tendons.

*Improvement of muscle power after Galileo training (upper picture, Bosco, in: Clin. Physiol. 1999), improvement of sprint speed, agiligiy and jump height in comparance to explosive weight training (Berschin, in: Leistungssport 2003)*

**Inter- and intra-muscular coordination** - In order to use the muscle power in a functional manner the inter- and intra-muscular coordination should be optimal. Vibrations up to 28 Hz have a positive effect on coordination. Vibrations over this frequency cannot be processed very well.

*Improvement of balance after 1 Galileo session (Torvinen, in: Clin. Physiol. & func im 2002)*

**Effects on Bone**

Bone structure responds according to the Wolffian law of Function, i.e. growth and maintenance of shaft and trabeculae follow the course of the trajectories of strain. A healthy bone - this term also refers to bones with primary osteoporosis - will react to maximum forces, which cause deformation of approximately 1500 microstrain, following a precisely determined biological control circuit. The muscles initiate these deformation forces. Current studies have shown that there is a strict proportional relationship between the cross section of bone and the cross section of muscle. Several studies are showing a positive effect of training with Galileo™ on bone growth.

*Improvement of bone strength (Stress-strain-Index) in bone after Galileo stimulation OSZI and/or hormone replacement HRT (Siegrist, in: Int. J. Sports Med. 2002)*

**The importance of tilting** - The patented tilting vibratory stimulation of the Galileo evokes both horizontal and vertical balance reflexes. Studies show that this stimulation form leads to improvement of power, balance, maneuverability, and improved power in muscles that are responsible for stability, such as adductors, abductors and muscles in the pelvis region.

**Damping** - The Galileo stimulation is based on the walking pattern, where left and right leg alternately are in contact with the ground. The muscles and other tissues of the body dampen these vibrations. The pelvis is tilting synchronous with the plate and functions as an important damper. Vibrations to the head are hereby optimally damped, which is essential within healthy WBV training.
**Dose, variability** - The dose of the stimulation is varied through the amplitude. By changing the position on the plate the amplitude can be varied from 0 up to 13 mm. The use of extra weights further improves the training effect.

**Frequency** - By variation of the frequency different effects can be evoked. At 5-6 Hz (cycles per second) balance and proprioceps are stimulated, 10-15 Hz is used for detonization and mobilization, and 18 Hz and up is used for training.

**Scientific proof**
More than 30 scientific studies have proven the functionality of the Galileo.
- Galileo stimulation induces a **post-activation-potentiation** of the muscles and improves tendon reflex sensitivity.
- Galileo stimulation improves **power and balance** in all people, but especially in low taxable people, neurological patients, and sportsmen who are training at their physical limits.
- Galileo training reduces **low back pain** and improves lumbar power.
- Treatment of **stress incontinence** through physio training in combination with Galileo training leads to a significant extra rise in effectiveness from 50% up to 80%.
- Galileo training improves power balance and coordination in neurological patients.
- Galileo stimulation enhances **blood flow** significantly, especially in peripheral regions.
- The **bone quality** (noted as Stress Strain Index) improves after Galileo training.
- A short Galileo stimulation **prevents loss of tissue** quantity and quality (muscle, bone, tendons), and thus maintains the taxability, for example during an injury rehabilitation period.

**Fields of Application in Sports**
- Increasing readiness before training or competition (scar tissue, poor blood flow, arousal)
- Increasing effectiveness of (weight)training through Post Activation Potentiation.
- Enhancement of recovery after training
- Increasing taxability
- Enhancement of recovery after injury

**Fields of Application in Medicine**
- Rehabilitation of force and power
- Rehabilitation in Neurological patients
- Muscle atrophy
- Poor balance
- Poor proprioceps
- Low Backpain
- Stress-Incontinence
- Osteoporosis
- Blood Flow problems
- Therapeutical applications focussed on metabolism and tissue strengthening and recovery (arthrosis, tendinitis, skin problems).

Many other treatment goals have been noted in clinical practice and are under investigation at this moment.
Examples are treatment of the physical status of women after a breast cancer operation, patients with diabetes type 2, claudicatio, rehabilitation of osteo-arthritis, tendonitis, muscle tears, and general recovery.

**Side effects:**
In many cases, the vibration causes a severe itching in the trained parts of the body. This is evidence of the strong effect on the vegetative system and the blood vessels. With some patients, a too high amplitude or too rapid increase in training intensity can cause circulatory disorders in the form of a fall in blood pressure. This should not be considered an indication of general intolerance but rather a symptom of poor vessel regulation, which can be improved by training with Galileo™.
Table of Contents

I. New Trends in Training Science: The Use of Vibrations for Enhancing Performance

II. Galileo – Vibration Based on Science

III. The Benefits of Vibration - Summary

IV. Publications to Date - Abstracts

V. The Protocol
   A. General Orthopedics
   B. Diabetes
   C. Osteoporosis
   D. Osteoarthritis
   E. Incontinence
   F. Neurological
   G. Sports Medicine

VI. Support Documentation
   A. CPT Coding
   B. Galileo Cost Justification
   C. Leasing Documentation
   D. Galileo vs. Power Plate
   E. Galileo Makes Good Business Sense
NEW TRENDS IN TRAINING SCIENCE: 
THE USE OF VIBRATIONS FOR ENHANCING PERFORMANCE

by Carmelo Bosco, Marco Cardinale, Olga Tsarpela and Elio Locatelli

Introduction

The adaptive responses of the human body to training stimuli have been investigated in depth over the past few years. Thanks to the research carried out in different parts of the world, we know that the adaptation to the training stimulus is related to the modification induced by the repetition of daily exercises, which are specific to the movements executed (Edington and Edgerton, 1976). These adaptations are related to the fact that human skeletal muscle is a specialized tissue, which modifies its overall functional capacity in response to regular exercise with high loads (McDonagh and Davies, 1984).

The above-mentioned findings all suggest that resistance exercise can be an effective means of enhancing muscular performance. In this context it should be noted that changes within the muscle itself constitute the most important adaptation to resistance exercise (Sale, 1988; Behm, 1995).

In fact, strength-training responses have been shown to be mediated by both neurogenic and myogenic factors (Moritani and De Vries, 1979). Neural adaptations have been shown to be the first changes to occur in the muscle, permitting gains in muscle strength and power in the early stages of a resistance exercise program in the absence of an increase in the cross-sectional area of the muscle (Behm, 1995; Costill et al. 1979). It has also been demonstrated that specific adaptations occur depending on the training program implemented (Sale and McDougall, 1981).

Strength training can therefore be considered as a training stimulus, which produces specific adaptations in human skeletal muscles, based upon the protocol, utilized for training. The specificity of training effect from strength work has been underlined by many authors (Sale, 1988; Behm, 1995; Morrisey et al. 1995; Bandy et al. 1990) and the velocity specific effect has been highlighted as the most interesting outcome of resistance exercise programs. However, even if the mechanisms underlining this velocity specific effect have not been clearly defined, most importance has been given to the neural adaptations such as improved co-ordination, increased activation of the prime mover muscles (Moritani and De Vries, 1979), recruitment and synchronization.

The aim of most resistance training programs for elite athletes is to improve the mechanical power output for a given movement, or to enhance speed. In thinking about a boxing punch, a handball throw, a volleyball spike, or a shot putt, these movements involve the exact timing of many muscle groups and are characterized by many coordinative factors. However, boxers, handball and volleyball players and shot putters undergo strength training sessions with the aim of improving their level of performance. Any ideas injected into the development of a training plan for such sporting disciplines must therefore be related to the specificity of each of the movement patterns involved.

An optimal training plan should be developed with some general exercises to improve muscle strength and some specific exercises to improve muscle power and speed. The
The mechanical basis of strength training is thus very simple: overload the biological system in order to determine specific adaptations. Since the environment of our biological system is characterized by the fact that we are all subject to the action of gravity which provides the major portion of the mechanical stimulus responsible for muscle structure in everyday life and training, we need to alter the biological system by increasing the gravitational load in order to enhance strength. It should be remembered that specific programs for strength and explosive power training employ exercises performed with fast, abrupt variations of gravitational acceleration (Bosco, 1992).

To give an example, the simulation of hyper-gravity (wearing vests with extra loads) has been utilized for improving explosive muscle power (Bosco et al. 1984; Bosco 1985). The overload or simulation of hyper-gravity is not the only means for changing the gravitational conditions. In fact, mechanical vibrations applied to the body can produce changes in the gravitational conditions and determine specific responses. The studies conducted from our group were aimed to investigate the effects of vibrations applied to the whole body or to part of it in terms of hormonal responses, explosive power, neuromuscular performance and strength. This article aims to present the latest findings on vibrations and some considerations for their use in the athletic setting.

### The effects of vibrations on human performance

The first study carried out by our group was conducted to study the effects of whole body vibrations on the mechanical power of the lower limbs. For this aim, fourteen active subjects involved in team sports training voluntarily participated in the experiment. After being randomly assigned to either an experimental or a control group, they were tested on an Ergojump (MAGICA, Rome, Italy) for assessing vertical jumping ability. The treatment group underwent whole body vibrations at a frequency of 26 Hz (displacement = 10mm, acceleration = 54 mos\(^{-1}\)) for 5 repetitions lasting 90 sec. each and separated by an interval of 40 sec. This procedure was continued for 10 days, the duration of vibration series being extended by 5 sec. every consecutive day up to a total of 2 min. per set.

At the end of the 10-day period the subjects were re-tested. The results showed remarkable and significant (p<.05) enhancement of the height and mechanical power of the best jump during the 5 sec. continuous jumping test (5sCJ) (Bosco-Vittori test, see Bosco, 1992b). The average height of rise of the centre of gravity in the 5sCJ was also significantly improved (p<.01). As expected, no changes were observed in the control group (see Figures 1 and 2).

![Figure 1](image1.png)  ![Figure 2](image2.png)

*Figure 1: Average rise of centre of gravity during 5sCJ measured before and after 10 days of whole body vibrations treatment.*  
*Figure 2: Mechanical power of the best jump performed during 5sCJ measured before and after 10 days of whole body vibrations treatment.*
Considering the fact that the 5sCJ test is a testing protocol characterized by a stretch-shortening cycle (SSC), a small angular displacement and fast stretching speed, it can be considered that since leg extensors muscles experience fast stretching this may elicit a concurrent gamma-dynamic fusimotor input that would enhance primary afferent discharge. Taking this into account, it was argued that the biological mechanism produced by vibrations was similar to the effect produced by explosive power training (Bosco et al. 1998).

After the latter experiment, another study was conducted to observe the behavior of human skeletal muscle following one session of 10 minutes application of whole body vibration treatment. In this case the subjects were six female elite volleyball players. They were tested before and after the treatment while performing a maximal dynamic leg press exercise with increasing loads (70, 90, 110 and 130 kg respectively) with a sensor machine (Muscle Lab. Ergotest, Langesund Norway) able to calculate average velocity, average power and average force corresponding to load displacements (for details see Bosco et al. 1995).

After the control test, one leg was randomly assigned to the experimental treatment consisting of vibrations and the other was considered as a control.

Results showed an alteration of the V-F and P-F relationships after VT lasting only 10 min (see Figure 3; Bosco et al. 1999a). In fact, both relationships were shifted to the right indicating a clear enhancement of performance, which was previously observed only after several weeks of resistance training (i.e. Coyle et al. 1981; Hakkinen and Komi, 1985).

The above-mentioned findings are all related to the effectiveness of vibrations in enhancing performance in the lower limb muscles.

Vibrations applied to the upper limbs have also been found to produce an enhancement of neuromuscular performance. In fact, in a study conducted on 12 national level boxers, vibrations applied to the arm determined an increase in average mechanical power (See Figure 4) during a maximal arm curl with an extra load of 5% body mass. In this study, in which the treatment consisted of five repetitions of vibrations lasting 1 min. each with 1 min. rest interval at a frequency of 30 Hz, EMGrms was collected during the arm curl test and during the treatments. The results showed a significant decrease in the EMGjPower
The hormonal responses to vibrations were studied in handball players who underwent 7 repetitions of 1 min. each of vibrations and a test on vertical jumping performance. In this study, six players of the Italian national team were tested before and after the whole body vibration treatment of 7 min. on aspects such as blood concentration of Testosterone (T), Cortisol (C), growth hormone (GH) and vertical jump performances. The results showed significant decreases in vertical jumping ability and T and C, suggesting that the 7 min. of treatment represented a stressful load leading to an acute under-performance response (Bosco et al. 1999b). These results were similar to the response gained by a single session of heavy resistance exercises. In this context it should be noted that some authors have shown an increase in serum T (i.e. Weiss et al. 1983) after heavy strength training exercises, while others have demonstrated relative strength loss and hormonal decrease during one acute session of exercises (i.e. Hakkinen and Pakarinen, 1985; Bosco et al., in-press).

For further clarification of the hormonal response, another study was carried out with the aim of evaluating a different protocol of administration of the vibration treatment. In this study, fourteen male subjects were exposed to whole body vibrations of 10 repetitions of 60 sec. with 60 sec. rest between each vibration (after 5 reps there was a rest interval of 6 min.). The measurements carried out before and after the treatment were: vertical jumping ability, maximal dynamic leg press with an extra load of 160% of
the subjects' body mass, EMGrms from the vastus medialis and lateralis recorded during leg-press measurement and blood samples for determining T, C, and GH concentration in the blood. The results showed an enhancement of jumping performance (+40/0, p<.001), a marked and significant enhancement of mechanical power output when performing the leg press, a reduction of EMG activity connected to an increase in neuro-muscular efficiency through a decrease in EMG/P ratio. Significant increases in serum T (+7%, p<.03) and GH (+460/0, p<.014) were also found, together with a significant reduction in C concentration.

All the above-mentioned findings suggest that vibrations are without any doubt a useful means for enhancing neuromuscular performance and triggering specific hormonal responses. However, it is important to underline that these responses are very similar to the ones reported in the literature for strength training. It can therefore be stressed that vibrations represent a valid alternative to strength training or can be implemented in a strength training program for further improvement of human performance.

The scientific basis of vibrations

The facilitation of the excitability of the spinal reflex has been elicited through vibration of the quadriceps muscle (Burke et al., 1996). Lebedev and Pelialkov (1991) have also suggested the possibility that vibrations may elicit excitatory inflow through muscle spindle motor neurons connections in the overall motor neuron inflow.

It has been demonstrated that vibration drives alpha-motoneurons via the la loop producing force without decreasing motor drive (Rothmuller and Cafarelli, 1995).

Although it has been suggested that the vibration reflex, like the tendon jerk reflex, operates predominantly or exclusively on alpha motoneurons and does not utilize the same cortically originating efferent pathways as are used when performing voluntary contractions (Burke et al. 1976), it cannot be excluded that vibration treatments can also affect voluntary movements. These suggestions are supported by the present findings.

In fact the EMG recorded in the biceps brachii of the experimental group in the study conducted on boxers showed a significant enhancement (P<0.001) of the neural activity during the treatment period, as compared to normal conditions (Bosco et al. 1999a).

It has been shown that the vibration-induced activation of muscle spindle receptors not only affects the muscle to which vibration is applied, but also affects the neighboring muscles (Kasai et al. 1992). A mechanical vibration (10-200 Hz), applied to the muscle belly or tendon can elicit a reflex contraction (Hagbarth and Eklund, 1965). This response has been named "tonic vibration reflex" (1VR). It is not known whether it can be elicited by low vibration treatment (30 Hz), even if it has been suggested to occur during whole body vibration at frequencies ranging from 1 to 30Hz (Seidel, 1988).

The improvement of the muscle performance after a short period of vibration training has been quoted (Bosco et al. 1998) to be similar to what occurs after several weeks of heavy resistance training (e.g. Coyle et al. 1981, Hakkinen and Komi 1985). In fact the improvement of the muscle functions after resistance training has been attributed to the enhancement of the neuromuscular behavior caused by the increasing activity of the higher motor centre (Milner-Brown et al., 1975). The improvement of muscle performances induced by VT suggests that a neural adaptation has occurred in response to the vibration treatments. In this context, the duration of the stimulus seems to be both...
relevant and important. The adaptive response of human skeletal muscle to simulated hyper-gravity conditions (1.1 g) applied for only three weeks, caused a considerable improvement in the leg extensor muscle behavior (Bosco, 1985). Thus it is likely that both neural adaptation and the length of the stimulus seem to play an important role in the improvement of muscle performances (e.g. Bosco, 1985).

During the VT utilized for the research conducted on the boxers, the elbow flexors were stimulated for a total length of time of 300 seconds. The duration of the treatment was similar to that required to perform an elbow flexion for 600 repetitions with a load similar to 50/0 of the subject's body mass. Such an amount of repetitions would generally otherwise be distributed over 3 sessions a week with 50 repetitions per time, taking one month to complete. The large initial increases noted in muscle strength observed during the earlier weeks of intense strength training can be explained through increases in maximal neural activation (e.g. Moritani and De Vries, 1979).

To explain how the increased neural output may occur is not as simple as how to explain the intrinsic mechanism of neural adaptation. Furthermore, a net excitation of the prime mover motoneurons could result from increased excitatory input, reduced inhibitory input or both (e.g. Sale, 1988). After the VT period the EMG activity was found to be rather lower or to be the same as compared to the pre-treatment conditions even if, during the vibration, period an increment of neural input to the muscle occurred. In this respect the decrease in the ratio between EMG and mechanical power (EMG/P) demonstrated that VT induced an improvement of the neuromuscular efficiency of the muscles involved in the vibration treatment.

Vertical jumping ability has been shown to increase following vibration treatment (Bosco et al. 1998; Bosco et al. In-press). These improvements have been attributed to an enhancement of neural activity in the leg extensor muscles, together with an enhancement of the proprioceptors' feedback. During vibrations, the length of skeletal muscles changes slightly. The facilitation of the excitability of spinal reflexes has been shown to be elicited by vibrations applied to the quadriceps muscle (Burke et al. 1996).

Once again, the influence of vibrations on the neural drive of the la loop can play a crucial part in enhancing jumping performance following vibration treatments. Even if the adaptive responses of neuromuscular performance as measured by vertical jump tests cannot be fully explained, it is important to consider that the effectiveness of the stimulus can have both relevance and importance.

The adaptive response of human skeletal muscle to simulated hyper-gravity conditions (1.1 g), applied for only three weeks, caused a drastic enhancement of the neuromuscular functions of the leg extensor muscles (Bosco, 1985).

The regular use of centrifugal force (2 g) for 3 months has initiated conversion of muscle fiber type (Martin and Romond, 1975). In the experiments conducted, the total length of the WBV application period was not very long (from 7 minutes to 100 minutes), but the disturbance to the gravitational field was quite consistent (5.4 g). An equivalent length and intensity of training stimulus (100 minutes) can only be reached by performing 200 drop jumps from 60 cm, twice a week for 12 months. In fact, the time spent for each drop jump is less than 200 ms, and the acceleration developed can barely reach 3.0 g (Bosco. 1992). This means stimulating the muscles for 2 min per week for a total amount in one year of 108 minutes. In a few words, vibrations can stimulate the biological system of athletes in the same way as strength training or explosive training
and this stimulation can be applied in a much shorter period of time as compared to the
time needed to perform traditional training sessions. It opens a new window in sports
science and gives coaches and scientists new possibilities for studying and enhancing
human performance.

Conclusion

The use of vibrations in an athletic setting offers new possibilities to coaching science.
Resistance training effectiveness has been demonstrated due to the possibility of
enhancing neuromuscular performance, power output, strength and hormonal profile.
However, the time needed for these adaptations to occur is relatively long as compared to
the possibilities offered by vibration treatments. It should be recognized however, that
vibrations need to be viewed not as a substitute tool of resistance exercise, but as a valid
additional means to be implemented in a training routine in association with all the other
traditional methodologies nowadays utilized. New studies need to be conducted to
analyze chronic responses, different treatment protocols and the effects of the association
of vibrations with conventional training means for improving the knowledge in this
interesting and exciting tool of sports science.

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254
Vibration has been used as an exercise and therapeutic tool since the late 1800s. The research of this technology really began in the late 70’s with the development of a vibration system by one of Russia’s key sports scientists Dr. Vladimir Nazarov. He was an active sportsman, a member of the Soviet gymnastics team and occupied a chair for sports biomechanics at the State College in Minsk. He first introduced this technology to competitive sports, ballet and medicine in the former USSR. The Russian Space Program is currently using the technology with their astronauts suffering from considerable bone loss due to weightlessness. In addition, the European Space Agency and NASA are actively using vibration in ongoing studies for the maintenance of muscle strength, mass and bone density.

Since then, and most recently, research into the benefits of segmental and whole body vibration has proliferated. Since most whole body vibration systems were developed in Europe, most of the peer-reviewed publications have come from there. At present there are nearly 100 articles dealing with the effects of and related benefits of whole body vibration (WBV).

The technology has finally crossed the Atlantic and, as of 2002, we have begun to see some aggressive marketing of this technology into U.S. markets. As in any expenditure of capital equipment, buyers need to be cautious. Caveat Emptor, buyer beware.

All Vibration Technology is Not Created Equal

So what are the factors to be considered in the purchase of a WBV system for your clinic or club?

**First, what is the pattern of vibration used?**

Currently there are two patterns of vibration available in the U.S. market, a tri-planar pattern involving all three directional planes, and a very specific one-directional, oscillating pattern based on the concept of a center fulcrum and an alternating right/left, up and down motion.

The tri-planar motion means the platform on which you stand moves forward, backward, left, right, up and down. The whole body is simply “shaken” in multiple directions.
The unique design of the center fulcrum motion means that while the right leg is forced upward and thus reflexively contracting, the left is lowered and relaxed. In this manner, the right and left lower extremities simultaneously contract and relax. In addition, the action provides for the simulation of the natural crossover, locomotor pattern that forms the basis for human walking or running.

This pattern also allows for the stabilization of the spine and head, due to the left-right, natural tilting action of the pelvis, during locomotion. It can be said that this pattern is “vibration with a purpose, based on science.”

Second, what are the acceleration and the amplitude of the platform motion? These two factors will directly influence the “results” the user can expect. Acceleration can be defined as the maximum speed of the platform during the upward motion. Amplitude is the vertical displacement of the platform from the lowest to highest point. With this in mind, it is important for the buyer to understand the following principles:

\[ \text{F} = m \times a \]  
\[ \text{W} = F \times d \]  
\[ \text{P} = \frac{W}{t} \]

where \( F \) = Force, \( m \) = mass, and \( a \) = acceleration  
where \( W \) = work, \( F \) = Force, and \( d \) = distance (amplitude)  
where \( P \) = Power, \( W \) = Work, and \( t \) = time

Further, \( W = F \times d \), so \( P = F \times \frac{d}{t} \)

Further, \( F = m \times a \), so \( P = (m \times a \times d) \div t \)

Since \( (a \times d) \div t = v \), \( P = m \times v \)

**Acceleration and Amplitude are Key**

Let’s first look at the acceleration factor. Based on the first formula above, the amount of force received by the user is directly related to the mass, or body weight of the user, and the acceleration of the platform in the upward motion. Since the weight of the user is constant, the greater the acceleration of the platform upward, the greater the force applied to the user.

Turning to the amplitude factor, we can see from the second formula above that the work done by the user is directly related to the distance, or amplitude, through which the force is applied. The greater the amplitude through which the force is applied, the greater the work done.

So from a buyers perspective, one can see that not only are we concerned with the type of vibration pattern the platform provides, but equally important are the factors of acceleration and amplitude in the vibrating platform. *The greater the*
acceleration and the larger the amplitude, the more work done by the user and the greater and more quickly the results will appear.

Development of Power is Key
The last formula above is probably the most important, whether elderly patient or elite athlete. We all should be paying a much greater attention to the development of power in our training or therapy sessions. Power is directly related to the ability of the individual to move their mass in response to their immediate need. For the elderly patient, it is the ability to react and move quickly to avoid a fall. For the elite athlete, it is to reach the finish line first by powering out of the blocks at the start. In either case, we must focus on the development of power. Since one’s mass is constant, the focus must be on velocity.

If we now look at the two factors of acceleration and amplitude as they relate to the development of Power, it is clear that velocity is directly related to the users ability to accelerate over a distance (amplitude) in as short a period of time as possible. So the buyer interested in the development of power for their patient or athlete need only determine which vibration system provides for the greatest amplitude and acceleration in the motion of the platform. The buyer of this system can expect the greatest and quickest results for their patient or member.

Of the two systems available in the US, only one has the technology, the research and the proven results. That system is the Galileo, from OrthoMetrix, Inc.

Key Questions for Review in the Science of Vibration Training

- What is the vibration pattern of your system? Is it patented?
  The Galileo is the only patented, vibration device that functions in the specific one-directional, oscillating pattern based on the concept of a center fulcrum and an alternating right/left, up and down motion.

- How does that pattern affect my workout or therapy?
  The Galileo is the only vibration device that provides for the application of the natural, crossover pattern, which is the basis for all locomotor activities. The result is a more functional workout or therapy session.
• What is the amplitude through which the platform applies force?
  The Galileo provides the greatest acceleration and amplitude available for a vibration device. As a result, the user can expect greater and quicker results from their sessions.

• What is the acceleration of the platform as force is applied?
  The Galileo platform can accelerate at close to 20 times gravity. Another way to state this is 20 times your body weight. Very effective gains, in strength and power, result from this training.

• Can you provide published research done on your system?
  The Galileo system was the vibration device used for the majority of the original research done in the field of whole body vibration training. A lengthy and substantive bibliography can be provided. Others may point to the vibration literature, however, results from one system cannot be implied to another. Since the parameters of vibration can differ, the research must have been done on the system under evaluation.

• Do you have appropriate FDA classification? Are your marketing claims consistent with that classification?
  The FDA and the appropriate agency individuals reviewed the Galileo claims, regarding its performance. The Deputy Director for Science and Regulatory Policy with the Office for Device Evaluation states that “the … claims that you have identified relate to the intended use specified in the classification regulation. Therefore, these claims do not exceed the limitations to the exemption, related to the intended use of the device…”

The Galileo claims to:
1. Exercises and/or redevelops the postural muscles, joints and reflexes after injury or disease.
2. Improves muscle strength, reflexes and joint motion.
3. Reduces the pain and disability associated with Osteoarthritis.
4. Improves the strength of the perineal muscles, which can reduce incontinence.
5. Improves leg circulation for people with Diabetes.
6. Allows patients with Parkinson’s disease to benefit from exercise, which can slow the progress of the disease.
In summary, there are numerous, published articles on the benefits of WBV for everyone from the very young to our aging seniors. This technology will provide a major contribution to the overall wellness of our country. What buyers and users should be clear about is that all vibration technology is not the same. Ask the right questions, evaluate the answers, and your members and patients will be the beneficiary of your well-founded decision.

Effects of Vibration

The following statements were from an interview with Henk Kraaijenhof, an international performance consultant to individual elite athletes. The interview was given after he had spoken on the fundamentals of vibration training at the US Olympic Training Center, Fall 2002. (Pure Power Magazine, Fall 2002)

Some very good points made in the interview are as follows:

- So what you see is a massive and continuous muscular activity in all muscles.
- Since no tissue escapes vibration, it shows a wide range of effects and has been shown to improve maximum strength, explosive strength, flexibility, circulation (for therapy), and bone density, and it also affects hormones, neurotransmitters, and body composition.
- For strength, one vibration training session repeated 10 times for one minute, with one-minute rest between “sets” shifts the force-velocity curve up and to the right, similarly to what’s expected from high reps in the squat or leg press with relatively heavy loads.
- For explosive strength, 10 days back-to-back of one session a day (10 times one minute vibration training with one-minute rest intervals) increases explosive strength comparable to making 200-drop jumps from 24 inches, twice a week, for a year.
- In the case of hormones, one workout with 14 healthy men increased testosterone by 7%, growth hormone by 460%, while cortisol decreased by 32%.
- Vibration training can have a strong, positive effect on many parameters. But beyond the ones discussed, there’s also no pain or fatigue associated with this approach.
- Actually adding vibration training to a normal workout might prevent over training. First of all, the circulation is improved, “flushing out” breakdown products of ammonia and lactic acid. Second, vibration normalizes muscle tone and stimulates the production of local pain killing substances, which is, I might
Actually adding vibration training to a normal workout might prevent over training. First of all, the circulation is improved, “flushing out” breakdown products of ammonia and lactic acid. Second, vibration normalizes muscle tone and stimulates the production of local pain killing substances, which is, I might add, a well-known application of vibration, in general. Third, the stimulation of hormones prevents over training, since the testosterone/cortisol ratio is a marker for over training… Fourth, vibration itself doesn’t lead to muscle damage or soreness, since there’s no eccentric load.

My practical experience shows that more training load is tolerated, while recovery is enhanced.

It can be used as a warm-up, e.g., 3 to 4 times one minute before weight training or any other workout…. It can also be used as a cooling-down method, e.g., 3 to 4 times one minute after a workout or competition.

But there is nothing against a separate vibration workout.
STUDY DESIGN: A randomized controlled trial with a 6-month follow-up period was conducted. OBJECTIVE: To compare lumbar extension exercise and whole-body vibration exercise for chronic lower back pain. SUMMARY OF BACKGROUND DATA: Chronic lower back pain involves muscular as well as connective and neural systems. Different types of physiotherapy are applied for its treatment. Industrial vibration is regarded as a risk factor. Recently, vibration exercise has been developed as a new type of physiotherapy. It is thought to activate muscles via reflexes. METHODS: In this study, 60 patients with chronic lower back pain devoid of "specific" spine diseases, who had a mean age of 51.7 years and a pain history of 13.1 years, practiced either iso-dynamic lumbar extension or vibration exercise for 3 months. Outcome measures were lumbar extension torque, pain sensation (visual analog scale), and pain-related disability (pain disability index). RESULTS: A significant and comparable reduction in pain sensation and pain-related disability was observed in both groups. Lumbar extension torque increased significantly in the vibration exercise group (+59.2 Nm/kg; SEM 10.2; P < 0.05). No correlation was found between gain in lumbar torque and pain relief or pain-related disability (P > 0.2). CONCLUSIONS: The current data indicate that poor lumbar muscle force probably is not the exclusive cause of chronic lower back pain. Different types of exercise therapy tend to yield comparable results. Interestingly, well-controlled vibration may be the cure rather than the cause of lower back pain.

Vibration exercise (VbX) is a new type of physical training to increase muscle power. The present study was designed to assess the influence of whole-body VbX on metabolic power. Specific oxygen uptake (sVdot;O 2 ) was assessed, testing the hypotheses that sVdot;O 2 increases with the frequency of vibration (tested in 10 males) and with the amplitude (tested in 8 males), and that the VbX-related increase in sVdot;O 2 is enhanced by increased muscle force (tested in 8 males). With a vibration amplitude of 5 mm, a linear increase in sVdot;O 2 was found from frequencies 18 to 34 Hz (p < 0.01). Each vibration cycle evoked an oxygen consumption of approximately 2.5 micro l x kg (-1). At a vibration frequency of 26 Hz, sVdot;O 2 increased more than proportionally with amplitudes from 2.5 to 7.5 mm. With an additional load of 40 % of the lean body mass attached to the waist, sVdot;O 2 likewise increased significantly. A further increase was observed when the load was applied to the shoulders. The present findings indicate that metabolic power in whole-body VbX can be parametrically controlled by frequency and amplitude, and by application of additional loads. These results further substantiate the view that VbX enhances muscular metabolic power, and thus muscle activity.
It seems certain that a positive correlation between training, psychic and physical health exists. A new training device (Galileo900 - 2000) enables people to perform an intensive strength training with additional high-frequency mechanical oscillation (OSZI). We wanted to find out how this new training device influences behavior and psychic and physical health of postmenopausal women.

Based on the results we can conclude that OSZI corresponds with the hitherto results for behavior and psychic and physical health during training.

An intervention oscillating training (amplitude 12 mm, 25-30 Hz) with the help of a new training device, Galileo2000 (NOVOTEC) gave evidence to execute positive effects on neuromuscular excitability and local muscular hemodynamics.

This randomized crossover study was designed to investigate the effects of a 4-min vibration bout on muscle performance and body balance in young, healthy subjects. Sixteen volunteers (eight men, eight women, age 24-33 years) underwent both the 4-min vibration- and sham-interventions in a randomized order on different days. Six performance tests (stability platform, grip strength, isometric extension strength of lower extremities, tandem-walk, vertical jump and shuttle run) were performed 10 min before (baseline), and 2 and 60 min after the intervention. The effect of vibration on the surface electromyography (EMG) of soleus, gastrocnemius and vastus lateralis muscles was also investigated. The vibration-loading, based on a tilting platform, induced a transient (significant at the 2-min test) 2.5% net benefit in the jump height (P = 0.019), 3.2% benefit in the isometric extension strength of lower extremities (P=0.020) and 15.7% improvement in the body balance (P = 0.049). In the other 2-min or in the 60-min tests, there were no statistically significant differences between the vibration- and sham-interventions. Decreased mean power frequency in EMG of all muscles during the vibration indicated evolving muscle fatigue, while the root mean square voltage of EMG signal increased in calf muscles. We have shown in this study that a single bout of whole body vibration transiently improves muscle performance of lower extremities and body balance in young healthy adults.
In this study we investigated metabolic power during whole-body vibration exercise (VbX) compared to mild resistance exercise. Specific oxygen consumption (VO2) and subjectively perceived exertion (rating of perceived exertion, RPE; Borg scale) were assessed in 12 young healthy subjects (8 female and 4 male). The outcome parameters were assessed during the last minute of a 3-min exercise bout, which consisted of either (1) simple standing, (2) squatting in cycles of 6 s to 90 degrees knee flexion, and (3) squatting as before with an additional load of 40% of the subject's body weight (35% in females). Exercise types 1-3 were performed with (VbX+) and without (VbX-) platform vibration at a frequency of 26 Hz and an amplitude of 6 mm. Compared to the VbX-condition, the specific VO2 was increased with vibration by 4.5 ml x min(-1) x kg(-1). Likewise, squatting and the additional load were factors that further increased VO2. Corresponding changes were observed in RPE. There was a correlation between VbX- and VbX+ values for exercise types 1-3 (r = 0.90). The correlation coefficient between squat/no-squat values (r = 0.70 without and r = 0.71 with the additional load) was significantly lower than that for VbX-/VbX+. Variation in specific VO2 was significantly higher in the squatting paradigm than with vibration. It is concluded that the increased metabolic power observed in association with VbX is due to muscular activity. It is likely that this muscular activity is easier to control between individuals than is simple squatting.

...Occupationally used high-frequency vibration is supposed to have negative effects on blood flow and muscle strength. Conversely, low-frequency vibration used as a training tool appears to increase muscle strength, but nothing is known about its effects on peripheral circulation. The aim of this investigation was to quantify alterations in muscle blood volume after whole muscle vibration--after exercising on the training device Galileo 2000 (Novotec GmbH, Pforzheim, Germany). Twenty healthy adults performed a 9-min standing test. They stood with both feet on a platform, producing oscillating mechanical vibrations of 26 Hz. Alterations in muscle blood volume of the quadriceps and gastrocnemius muscles were assessed with power Doppler sonography and arterial blood flow of the popliteal artery with a Doppler ultrasound machine. Measurements were performed before and immediately after exercising. Power Doppler indices indicative of muscular blood circulation in the calf and thigh significantly increased after exercise. The mean blood flow velocity in the popliteal artery increased from 6.5 to 13.0 cm x s(-1) and its resistive index was significantly reduced. The results indicate that low-frequency vibration does not have the negative effects on peripheral circulation known from occupational high-frequency vibration.

We conducted a randomized controlled trial, n=34 (age: mean 67y, range 61-85yr) cross-over design, intervention group 2 month training program three time a week (each session 3x2 minutes), performance tests of all participants every two weeks). The participants reached performance gains in chair rising of 18%, significantly different to the value of the controls. We interpreted the findings as improvements in muscle power of functional relevance by the oscillative muscle stimulation. We observed no serious side effects...
... Vibration exercise (VE) is a new neuromuscular training method that is applied in athletes as well as in prevention and therapy of osteoporosis. The present study explored the physiological mechanisms of fatigue by VE in 37 young healthy subjects. Exercise and cardiovascular data were compared to progressive bicycle ergometry until exhaustion. VE was performed in two sessions, with a 26 Hz vibration on a ground plate, in combination with squatting plus additional load (40% of body weight). After VE, subjectively perceived exertion on Borg's scale was 18, and thus as high as after bicycle ergometry. Heart rate after VE increased to 128 min ±1, blood pressure to 132/52 mmHg, and lactate to 3.5 mM. Oxygen uptake in VE was 48.8% of VO2max in bicycle ergometry. After VE, voluntary force in knee extension was reduced by 9.2%, jump height by 9.1%, and the decrease of EMG median frequency during maximal voluntary contraction was attenuated. The reproducibility in the two VE sessions was quite good: for heart rate, oxygen uptake and reduction in jump height, correlation coefficients of values from session 1 and from session 2 were between 0.67 and 0.7. Thus, VE can be well controlled in terms of these parameters. Surprisingly, an itching erythema was found in about half of the individuals, and an increase in cutaneous blood flow. It follows that exhaustive whole-body VE elicits a mild cardiovascular exertion, and that neural as well as muscular mechanisms of fatigue may play a role.

In many situations of everyday life, vibration load occurs. Here whole body vibration in vehicles, such as boats, cars, helicopters and others as well as hand-transmitted vibration (motor saws etc.) can be named. As vibration is assumed liable to cause various threats to human health, a great number of studies in work science focused on dose-effect relations and concepts for prevention. Although in many sports remarkable vibration load also occurs, there is very little research on the potential dangers and benefits of vibration stimuli, e.g. on whole body vibration and the implications for muscular activity and neuromuscular control in sport. In personal studies the damping behavior and training effects under whole body vibration were investigated. Various research areas have been studied in order to approach the relevant topics: neuromuscular and posture control, energy metabolism in terms of oxygen uptake under whole body vibration and local concentration of phosphates by means of 31P-MRS. Furthermore the effects of strength training under whole body vibration were analyzed. The results underline that vibration is a neglected research topic in sport science from the preventive point of view as well as from the one focusing on the improvement of sport performance.
The aim of this study was to investigate the effects of whole-body vibrations (WBV) on the mechanical behavior of human skeletal muscle. For this purpose, six female volleyball players at national level were recruited voluntarily. They were tested with maximal dynamic leg press exercise on a slide machine with extra loads of 70, 90, 110 and 130 kg. After the testing, one leg was randomly assigned to the control treatment (C) and the other to the experimental treatment (E) consisting of vibrations. The subjects were then retested at the end of the treatment using the leg press. Results showed remarkable and statistically significant enhancement of the experimental treatment in average velocity (AV), average force (AF) and average power (AP) (P < 0.05-0.005). Consequently, the velocity-force and power-force relationship shifted to the right after the treatment. In conclusion, it was affirmed that the enhancement could be caused by neural factors, as athletes were well accustomed to the leg press exercise and the learning effect was minimized.

The aim of this study was to investigate the effects of whole body vibrations on the mechanical behavior of human skeletal muscles... Results showed remarkable and statistically significant enhancement in the EG of the height of the best jump, the mechanical power of the best jump and the average jumping height during 5s Cj. In contrast, no statistically significant variations were noted in the CG. Consequently, it was suggested that the effect of WBV treatment elicit fast biological adaptation connected to neural potentiation.

The results showed statistically significant enhancement of the average power in the arm treated with vibrations. The root mean square electromyogram (EMGs) had not changed following the treatment but, when divided by mechanical power, (P) as an index of neural efficiency, it showed statistically significant increases. It was concluded that mechanical vibrations enhanced muscle P and decreased the related EMG/P relationship in elite athletes. Moreover, the analysis of EMGs recorded before the treatment and during the treatment itself showed an enormous increase in neural activity during vibration up to more than twice the baseline values. This would indicate that this type of treatment is able to stimulate the neuromuscular system more than other treatments used to improve neuromuscular properties.

The aim of this study was to evaluate the influence of vibration on the mechanical properties of arm flexors. ... The results showed statistically significant enhancement of the average power in the arm treated with vibrations. The root mean square electromyogram (EMGs) had not changed following the treatment but, when divided by mechanical power, (P) as an index of neural efficiency, it showed statistically significant increases. It was concluded that mechanical vibrations enhanced muscle P and decreased the related EMG/P relationship in elite athletes. Moreover, the analysis of EMGs recorded before the treatment and during the treatment itself showed an enormous increase in neural activity during vibration up to more than twice the baseline values. This would indicate that this type of treatment is able to stimulate the neuromuscular system more than other treatments used to improve neuromuscular properties.

... The study was performed in order to test the possibility whether a single whole body vibration (WBV) session will produce human skeletal muscle response... In conclusion, the acute effect of a short term WBV on neuromuscular apparatus is expressed by improved movement velocity, muscle force and power in performing leg press exercise with external loads.

Unpublished Vibration Articles & Case Studies:

A. J. Neusy, M.D. Professor of Clinical Medicine (New York School of Medicine): "The Galileo System"

Leading scientists at the New York University's School of Medicine and its renowned Rusk Institute of Rehabilitative Medicine are currently conducting clinical studies on the Galileo900, the device that generates a dynamic Whole Body stimulation, to gauge and determine the scope of its therapeutic applications ... a series of anecdotal reports suggest that it has potential therapeutic benefits for a growing number of medical conditions.

Several spinal cord injury patients are currently receiving experimental treatment with the Galileo system at the Rusk Institute of Rehabilitation Medicine at the New York University School of Medicine. These patients with demonstrated muscle potentials by EMG are experiencing increased muscle strength and improvement in residual functions. The device shows great promises in the treatment of stroke victims and trauma patients with neurological damages.

BONE & STRENGTH: S. Haring, et al (Technical University of Munchen, unpublished data); "Long Term effects of Galileo 2000 - a new training device" (post-menopausal women)

... The polar SSI at 14% (Stress-Strain Index), which was measured by the pQCT, was used as a method to determine bone strength. ... Results indicate that strength training with the Galileo leads to a slight decrease of bone strength after 3 month followed by a strong increase of bone strength after 6 months. The group practicing the conventional strength training showed a tendency towards a decrease of bone strength over the period of 6 months. No changes could be observed in the control group. The 1RM at the leg press was used in order to explore the strength of each person. The training was also able to amplify each test person's 1RM. The strength- training group had an increase of 19.4% and the Galileo group of 27.0%.


... The results indicate that superimposed VS (Vibratory Stimulation - with Galileo) applied for short periods in recovery breaks allows to keep the Maximal Voluntary Contraction of flexion in the elbow and extension in the knee on a significantly higher level than without VS during the recovery breaks.
Objective: To explore (1) the efficacy of whole body vibration (WBV) in inducing reflex standing and, specifically, (2) the progress of persons with spinal cord dysfunction of 3 differing etiologies. Design: Case series. Setting: Rehabilitation center in a metropolitan area. Patients: Persons with spinal paralysis of various etiologies who were otherwise unable to stand without the use of long-leg braces locked at the knee. Case 1: a 21-year-old man who underwent laminectomy at T2–9 for resection of an intramedullary tumor. Case 2: a 12-year-old boy presented with quadriplegia secondary to transverse myelitis. Case 3: a 24-year-old man with C5 American Spinal Injury Association class A tetraplegia for 5 years secondary to a fall. Interventions: WBV to produce rapid, mechanically delivered repetitive stretches to the lower extremities, thereby resulting in involuntary muscle contraction. Main Outcome Measures: Standing time with and without WBV, degree of volitional movement, trunk, and body control, ability to transfer, and carry over to voluntary standing and walking. Results: All 3 patients were able to stand with minimal assistance and to increase progressively the length of standing time. Eventually, 2 were able to walk independently using various ambulatory aids. Conclusions: WBV represents a promising modality for use in the rehabilitation of persons with motor dysfunction of spinal origin. In our sample, WBV successfully induced reflex standing in all 3 patients and standing was followed by ambulation in 2 cases. Key Words: Rehabilitation; Spinal cord dysfunction; Motor function.

NEURAL REHABILITATION: J. Gianutsos, et al; from the New York School of Medicine at the AAPMR: abstract submission "The effects of Whole Body Vibration on reflex-induced standing in persons with chronic and acute Spinal Cord Injury"

PARKINSON: J. Gianutsos, et al; from the New York School of Medicine presented at the AAPMR: abstract submission "Use of therapeutic ranging/exercise program in the rehabilitation of a person with progressive supranuclear palsy"

GERIATRICS: M. Runge: "The multifactorial etiology of gait disorders, falls, and hip fractures in the elderly"
EFFECT ON MUSCLES OF MECHANICAL VIBRATIONS PRODUCED BY THE GALILEO 2000 IN COMBINATION WITH PHYSICAL THERAPY IN TREATING FEMALE STRESS URINARY INCONTINENCE

**Aims of Study**
A prospective randomized study was performed to determine whether intensive vibration training (1-4) using the Galileo 2000 in combination with physical therapy improves the continence rate in women with urodynamically proven stress urinary incontinence. The influence on the pelvic floor muscles and the therapeutic effect on stress incontinence were investigated.

**Methods**
The Galileo 2000 is a platform with a sagittal axle on which a teeterboard is tilted up and down (5 mm) at a variable frequency of 5 – 30 Hz. This movement produces mechanical oscillations with an average cycle length of about 40 msec, which is the time required to induce a natural monosynaptic stretching reflex in the respective muscle via the muscle spindle during one up and down movement. The neuromuscular system reacts to this stimulation by a chain of rapid muscle contractions which may result in entire-body vibration. Both forms of treatment aim at strengthening the muscles involved in closing the urethra, vibration therapy in a reactive way and physical therapy in an active way.

Twenty-nine patients were examined clinically and urodynamically (including perineal ultrasound and pelvimeter) and assigned to 3 treatment groups. Group A underwent combined physical therapy (PT) and vibration training with the Galileo (Gal) throughout the treatment period. Group B started with physical therapy and switched to vibration training after 12 weeks (PT > Gal), and Group C first had vibration training and then changed to physical therapy (Gal > PT). Weekly training comprised 2 training units with physical therapy of 30 min duration and vibration training of 2 x 4 min. The total length of training was 24 weeks and was followed by a 12-week follow-up period.

**Results**
The patients’ median age at the time of treatment was 50 years (range 34 – 69 years). The objectively determined continence rate was 80% in Group A (combined treatment), 56% in Group B (PT > Gal), and 60% in Group C (Gal > PT). These results were in agreement with the subjective frequency of weekly urine loss. All three groups showed a considerable improvement of mean pelvic floor strength determined pelvimetrically (by 8 µV in Group A, 7 µV in Group B, and 6 µV in Group C). These findings were confirmed by palpation and ultrasound. At the end of the study the average grade of stress urinary incontinence decreased from 1.8 to 0.2 in Group A, from 1.7 to 0.2 in Group B, and from 1.8 to 0.3 in Group C. These results were also reflected by a subjective improvement of complaints in all patients (p < 0.001).

**Conclusions**
Muscle stimulation by vibration training improves the subjective and objective parameters of stress urinary incontinence. The combination of vibration training and physical therapy turned out to be highly effective and thus represents a genuine therapeutic option for patients with stress urinary incontinence.

**References**

The following studies are available in PDF format at
http://www.orthometrix.net/para/articles/galileo_dnlist.php

- Acute and Residual Effects of Vibratory Stimulation on Explosive Strength in Elite and Amateur Athletes
- Acute Changes in Neuromuscular Excitability After Exhaustive Whole Body Exercise as Compared to Exhaustion by Squatting Exercise
- Acute Effects on Whole-Body Vibration on Lower Body Flexibility and Strength
- Acute Effects of Whole-Body Vibration on Soleus H-Reflex
- Acute Physiological Effects of Exhaustive Vibration Exercise in Man
- Adaptive Responses of Human Skeletal Muscle to Vibration Exposure
- Balance Training and Exercise in Geriatric Patients
- Balance Training and Exercise in Geriatric Patients – Systemic Neglect of Geriatric Problems
- Bed Rest Study Started in Berlin
- Controlled Whole Body Vibration to Decrease Fall Risk and Improve Health Related Quality of Life of Nursing Home Residents
- Controlled Whole Body Vibrations to Decrease Fall Risk and Improve Health Related Quality of Life in Elderly Patients
- Effect of a Vibration Exposure on Muscular Performance and Body Balance, Randomized Cross-Over Study
- Effect of Whole Body Vibration Stimulus and Voluntary Contraction on Motoneuron Pool
- Effect of Muscles of Mechanical Vibrations Produced by the Galileo 2000 in Combination with Physical Therapy in Treating Female Stress Urinary Incontinence – Poster Presentation
- Efficacy of Training Program for Ambulatory Competence in Elderly Women
- Estrogen and Bone-Muscle Strength and Mass Relationships
- Good Maintenance of High-Impact Activity-Induced Bone Gain by Voluntary, Unsupervised Exercises: An 8-month Follow Up of a Randomized Control Trial
- High-Frequency Vibration Training Increases Muscle Power in Postmenopausal Women
- Hormonal Responses to Whole Body Vibration in Men
- In Tony Health Clubs, All Shook Up
- Influence of Vibration on Mechanical Power and Electromyogram Activity in Human Arm Flexor Muscles
- Long Term Effects of Galileo 2000 - A New Training Device
- Mechanical Stimulation in the Form of Vibration Prevents Post Monopausal Bone Loss in Ovariectomized Rats
- Metabolic and Cardiovascular Responses During Whole Body Vibration (WBV) Exercise: A Pilot Study
- Metabolic and Cardiovascular Responses During Whole Body Vibration (WBV) Exercise: A Pilot Study – Poster Presentation
- Motor Rehabilitation of Spinal Cord Dysfunction by Means of Whole Body Vibration
- New Insight about Relationship Between Bone Strength and Muscle Strength
- New Trends in Training Science: The Use of Vibrations for Enhancing Performance
- Oxygen Uptake During Whole-Body Vibration Exercise: Comparison With Squatting As A Slow Voluntary Movement
- Oxygen Uptake in Whole-Body Vibration Exercise: Influence of Vibration Frequency, Amplitude, and External Load
- Recovery Effects of Galileo 2000 – A New Device of Training-Intervention
- Short-Term Effects of Whole-Body Vibration on Maximal Voluntary Isometric Knee Extensor Force and Rate of Force Rise
- The Effects of Vibration on Human Performance and Hormonal Profile
- The Effects of Whole Body Vibration on Reflex-Induced Standing in Persons with Chronic and Acute Spinal Cord Injury
- The Galileo System
- The Influence of Whole Body Vibration on Jumping Performance
- Treatment of Chronic Lower Back Pain with Lumbar Extension and Whole-Body Vibration Exercise
- Use of a Therapeutic Ranging / Exercise Program in the Rehabilitation of a Person with Progressive Supranuclear Palsy
- Vibration Therapy Improves Walk, Balance in Elderly
- Whole Body Vibration: A New Exercise Approach
- Whole-Body Vibration Exercise in the Elderly People
- Whole-Body Vibration Exercise Leads to Alterations in Muscle Blood Volume
Vibration therapy improves walk, balance in elderly

Orlando, FL - Controlled whole-body vibrations (CWBV) improve quality of life, walk, balance, and motor capacity in elderly patients, according to a new study reported at the annual meeting of the American College of Rheumatology [1].

"All older patients in nursing homes—except those with any contraindications—could benefit from CWBV," says study researcher Dr Olivier Bruyere (University of Liege, Liege, Belgium). The apparatus costs roughly €8000, and treatment requires just 10 minutes a day.

Precisely how CWBV works is unclear, he says, but it may somehow improve balance or help build bone similar to the way that exercise does, he speculates.

As previously reported by rheumawire, vibration therapy is being investigated as an approach to the prevention and treatment of osteoporosis.

Good vibrations

In the new study, 42 volunteers in a nursing home were randomized to a vibration group or a nontreatment group for 6 weeks. The treatment group underwent 6 weeks of CWBV (4 one-minute series 3 times a week) on a vertical vibrating platform (10 Hz in the first and third series and 27 Hz in the second and fourth ones). The machine used was the Galileo 900® (Orthometrix Inc, White Plains, NY).

After 6 weeks of therapy, patients in the vibrating group showed:

- 143% improvement in physical function.
- 41% improvement in pain.
- 60% increase in vitality.
- 23% improvement in general health.
- 57% improvement in quality of walking as assessed by the Tinetti test (compared with a 2% improvement in control subjects).
- 77% improvement in equilibrium (compared with 1% worsening in controls).
- 39% decrease in time required to get up and go (compared with an increase of 14% among controls).

While it was only a small study, "after just 3 weeks or 9 sessions, we saw a great improvement in get-up-and-go," Bruyere tells rheumawire. "Longer studies are needed," he adds. Patients in the new study also did about 10 minutes a day of classical physical exercise.

Denise Mann

Source


Controlled Whole body vibrations to decrease fall risk and improve health related quality of life in elderly patients.

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Objectives: To investigate the effects of controlled whole body vibrations (CWBV) exercises on global health in elderly patients.

Methods: 42 volunteers patients, resident in a nursing home, were randomized to either a vibration group or control non-treated group. The vibration intervention consists of a 6-week CWBV training (4 x 1 minutes series, 3 times a week) employed by standing on a vertical vibrating (10 Hz in the first and the third series and 27 Hz in the second and fourth ones) platform (Galileo 900®). Different validated tests were performed, at the beginning and at the end of the study, in all patients. Quality of life was assessed by the 9 subscales of the SF-36 questionnaire: physical function (PF), social function (SF), role emotional (RE), role physical (RP), mental health (MH), vitality (V), pain (P), general health (GH) and health change (HC). Quality of walking, as well as the balance were assessed by the Tinetti test. The “get-up-and-go” test was used to assess the motor capacity.

Results: Baseline characteristics of the two groups (22 patients in the vibration group and 20 in the control group) was not statistically different except for age (84.5 (5.9) years in the treated group and 79.0 (6.9) years in the control group, p=0.008). After 6 weeks of treatment, 7 items (PF, SF, RE, RP, V, P, GH) of the SF-36 improved significantly in the CWBV group compared to the control group, with, for example, 143% of improvement in PF (p=0.0002 between the two groups), 41% in P (p=0.004), 60% in V (p=0.0006), and 23% in GH (p=0.0002). Improvement of 57% in the quality of walking, assessed by the Tinetti test, was also observed in the treated group compared to only 2% in the control group (p=0.0003). For the equilibrium, improvement was 77% in the CWBV group and the worsening was 1% in the control group (p=0.001). Eventually, a decrease of 39% of the time to performed the get-up-and-go test was also observed, after 6 weeks, in the treated group, compared to an increase of 14% in the control group.

Conclusion: Fast and easy exercises, 3 times a week during 6 weeks, using a CWBV apparatus, could improve the quality of life, the walk, the balance and the motor capacity in elderly patients. Longer studies with more patients are needed to assess the impact of such benefits.
The Acclimation Protocol

**Focus:** The focus should be on the following:

1. Patient comfort accomplished through proper acclimation to the Galileo
2. General progression to the 25 Hz frequency, increased duration and intensity.

**Acclimation:** It is imperative that an appropriate acclimation, to the Galileo and the vibration pattern and feel, be provided. If not, the patient may be unreceptive to the Galileo and its inclusion in the therapy program. This will result in a slowing of patient improvement during the given number of visits.

**Basic Start-up Protocol:**

Provide a brief acclimation session (2 minutes – 1:00 on, 1:00 off, 1:00 on):

1. 10 Hz for 30 seconds at foot position 1, close to the center fulcrum.
2. Ramp to 15 Hz for 30 seconds at foot position 1, close to the center fulcrum.
3. Step down and ask them how they feel and if they have any questions. If comfortable with the vibration, have them step back on the unit for a final one minute session
4. 15 Hz for 30 seconds at foot position 1, close to the center fulcrum.
5. Then ramp then to 20 Hz during the final 30 seconds at foot position 1, close to the center fulcrum. Then, have them step down and ask them how they feel. You can explain what is happening to them to enhance their comfort level.
6. If at any time you detect any concern by the patient, have them step off the Galileo. It is imperative that time is taken to adjust them to the feel of the vibration. Getting them to 25 Hz may take a couple of visits. They are still getting the benefits of the vibration and they will feel much better.
Protocol – General Orthopedics

The protocol:

Session 1:  Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2:  2 minutes @ 20 Hz – 1:00 on, 1:00 off, 1:00 on
Session 3:  3 minutes @ 25 Hz - 1:30 on, 1:00 off, 1:30 on
Session 4:  4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 5:  5 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 1:00 on
Session 6:  6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 7:  7 minutes @ 25 Hz – 2:30 on, 1:00 off, 2:30 on, 1:00 off, 2:00 on
Session 8:  8 minutes @ 25 Hz - 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on
Session 9:  8 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 8 minutes at the (2) foot position. There are many other factors to consider. A more severely injured patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning general orthopedic patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.


Protocol – Diabetes

The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 3: 2 minutes @ 20 Hz - 1:00 on, 1:00 off, 1:00 on
Session 4: 3 minutes @ 25 Hz – 1:30 on, 1:00 off, 1:30 on
Session 5: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 6: 5 minutes @ 25 Hz - 2:30 on, 1:00 off, 2:30 on
Session 7: 6 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on
Session 8: 6 minutes @ 25 Hz - 3:00 on, 1:00 off, 3:00 on
Session 9: 6 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 6 minutes at the (2) foot position. There are many other factors to consider. A more severe patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning diabetic patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.


Protocol – Osteoporosis

The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 3: 3 minutes @ 20 Hz - 1:30 on, 1:00 off, 1:30 on
Session 4: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 5: 5 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 1:00 on
Session 6: 6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 7: 6 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 8: 6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 9: 6 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 6 minutes at the (2) foot position. There are many other factors to consider. A more severely osteoporotic patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning osteoporosis patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.

M. Siegrist, et al (Preventive and Rehabilitative Sports Medicine, AG Bone Metabolism at the clinic right of the Isar, Technical University of Munich, Germany); Int. J. Sports Med. vol 23, jul (2002): 154 "Influence of a new form of strength training on health in comparison and in combination with Estradiol and Norethisteron"

G. Wilhelm, et al; Osteoporosis Int. 8 suppl.3 (1998); 121. "Evaluation of long term effects of Galileo2000 in a randomized controlled study"
Protocol – Osteoarthritis

The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 3: 3 minutes @ 20 Hz - 1:30 on, 1:00 off, 1:30 on
Session 4: 3 minutes @ 25 Hz – 2:00 on, 1:00 off, 1:00 on
Session 5: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 6: 5 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 1:00 on
Session 7: 6 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 8: 6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 9: 6 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 6 minutes at the (2) foot position. There are many other factors to consider. A more severely arthritic patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning general osteoarthritis patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.


GERIATRIC STRENGTH & BALANCE: M. Runge, J. Musculoskeletal interactions 2000 (1): 54-58: "Balance training and exercise in geriatric patients "

M.Runge: " The multifactorial etiology of gait disorders, falls, and hip fractures in the elderly "

The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: 2 minutes @ 20 Hz – 1:00 on, 1:00 off, 1:00 on
Session 3: 3 minutes @ 25 Hz - 1:30 on, 1:00 off, 1:30 on
Session 4: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 5: 5 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on, 1:00 on, 1:00 on
Session 6: 6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 7: 7 minutes @ 25 Hz – 2:30 on, 1:00 off, 2:30 on, 1:00 off, 2:00 on
Session 8: 8 minutes @ 25 Hz - 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on
Session 9: 8 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 8 minutes at the (2) foot position. There are many other factors to consider. A more severe patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning general incontinence patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.

C.Bosco, et al; Eur. J. Appl. Physiol. 79 (1999); 306-311 "Influence of vibration on mechanical power and EMG activity in human arm flexor muscles"


Protocol – Neurological

The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 3: 3 minutes @ 25 Hz - 1:30 on, 1:00 off, 1:30 on
Session 4: 3 minutes @ 25 Hz – 2:00 on, 1:00 off, 1:00 on
Session 5: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 6: 5 minutes @ 25 Hz - 2:30 on, 1:00 off, 2:30 on
Session 7: 6 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on
Session 8: 7 minutes @ 25 Hz - 3:30 on, 1:00 off, 3:30 on
Session 9: 8 minutes @ 25 Hz – 4:00 on, 1:00 off, 4:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 8 minutes at the (2) foot position. There are many other factors to consider. A more severely injured patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning neurological patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.


C.Bosco, et al; Eur. J. Appl. Physiol. 79 (1999); 306-311 "Influence of vibration on mechanical power and EMG activity in human arm flexor muscles"

J. Gianutsos, et al; New York School of Medicine, Poster #222 presented at the AAPMR: "Motor Rehabilitation of Spinal Cord Dysfunction by means of Whole Body Vibration"
The protocol:

Session 1: Acclimation for 2 minutes (see Basic Start-up Protocol)
Session 2: 4 minutes @ 25 Hz – 2:00 on, 1:00 off, 2:00 on
Session 3: 6 minutes @ 25 Hz - 2:00 on, 1:00 off, 2:00 on, 1:00 off, 2:00 on
Session 4: 8 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on
Session 5: 8 minutes @ 25 Hz – 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on
Session 6: 8 minutes @ 25 Hz - 3:00 on, 1:00 off, 3:00 on, 1:00 off, 2:00 on
Session 7: 10 minutes @ 25 Hz – 3:00 on, 1:00 off, 4:00 on, 1:00 off, 3:00 on
Session 8: 10 minutes @ 25 Hz - 3:00 on, 1:00 off, 4:00 on, 1:00 off, 3:00 on
Session 9: 10 minutes @ 25 Hz – 3:00 on, 1:00 off, 4:00 on, 1:00 off, 3:00 on

At three times per week, this runs for 3 weeks. While the time/duration is being increased, the therapist can begin to move the foot position to the (2) position. Most patients will not need much more than 10 minutes at the (2) foot position. There are many other factors to consider. A more severely injured patient may require more sessions, depending on insurance reimbursement (many may be willing to pay cash once insurance is used up). A therapist may be more aggressive with a younger, more athletic patient. The above is a guideline for beginning sports medicine patients.

***As always, it is at the discretion of the therapist and the tolerance level of the patient as to how slowly or quickly they might move through the above progression.


Novel Galileo Exercises

Closed Chain Scapular Exercise

Scapular Protraction 10-12 Hz

Dynamic Isometric Gastroc 10-12 Hz

Dynamic Isometric Hold for Quads, Gluts 10-12 Hz

Low Back \ Pelvic
Wide feet, 10 Hz

Isolate SI 10 Hz
CPT Coding

97110  Therapeutic procedure, one or more areas, each 15 minutes; therapeutic exercises to develop strength and endurance, range of motion and flexibility @ $25.00/15 minutes

97112  Neuromuscular reeducation of movement, balance, coordination, kinesthetic sense, posture, and/or proprioception for sitting and/or standing activities @ $25.00/15 minutes

97116  Gait training (includes stair climbing) @ $20.00/15 minutes

97530  Therapeutic activities, direct (one-on-one) patient contact by the provider (use of dynamic activities to improve functional performance), each 15 minutes @ $35.00/15 minutes

97533  Sensory integrative techniques to enhance sensory processing and promote adaptive responses to environmental demands, direct (one-on-one) patient contact by the provider, each 15 minutes @ $25.00/15 minutes
Galileo Cost Justification

Cost:  $11,900

Sample CPT Codes:
- 97110 – Therapeutic Exercise @ $25.00/15 min
- 97112 – Neuro Re-education @ $25.00/15 min
- 97116 – Gait Training @ $20.00/15 min
- 97530 – Improve Function @ $35.00/15 min
- 97533 – Sensory Integration @ $25.00/15 min
* There may be others

Cost:  Lease Options (estimate):
- Standard 36 month: $369.38/month = $4432.56/yr
- Standard 60 month: $241.69/month = $2900.28/yr

Revenues:
- 1 new patient/week = 50 new patients/year
  - 1 Evaluation @ $75
  - 6 Galileo Treatments @ $25/treatment = $150
  - Total Revenue/New Patient = $225
  - 50 new patients x $225 = $11,250/yr

- 2 new patients/week = 100 new patients/year
  - 100 new patients x $225 = $22,500/yr

- 3 new patients/week = 150 new patients/year
  - 150 new patients x $225 = $33,750/yr

- 5 new patients/week = 250 new patients/year
  - 250 new patients x $225 = $56,250/yr

Possible New Markets:

<table>
<thead>
<tr>
<th>Patients</th>
<th>Physicians</th>
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<tbody>
<tr>
<td>Osteoarthritis</td>
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<td>Incontinence</td>
<td>Gynecologist</td>
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<td>Diabetes II</td>
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<td>Multiple Sclerosis</td>
<td>Others….</td>
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<tr>
<td>Spinal Cord Injury</td>
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<tr>
<td>Gait Problems</td>
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</tbody>
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Galileo 2000
Why the Galileo 2000 Makes Good Business Sense

I. CPT Coding
The Galileo can be used with the following CPT Codes...

- 97110 – Therapeutic Exercise
- 97112 – Neuro-muscular Re-education
- 97116 – Gait Training
- 97530 – Therapeutic Activities
- Activities to improve functional performance
- 97533 – Sensory Integrative Techniques

II. Multiple Applications
The Galileo is one of the only rehab devices that can provide multiple benefits to patients. Take the example of a patient receiving right ankle strengthening from the Galileo 2000 versus traditional BAPS.

**BAPS Value:**
1. Strengthening of the ankle muscles. Only those muscle fibers that the patient can consciously recruit will get stronger.

**Galileo Value:**
1. Strengthening of nearly all ankle muscle fibers due to the enhanced recruitment via the involuntary muscle stretch reflex.
2. Improved circulation due to strong muscle pumping action. The result is improved healing and reduction in muscle soreness.
3. Enhanced flexibility and range of motion using PNF.
4. All lower extremity compensatory problems are addressed and dealt with while on the Galileo. Right ankle issues may result in left hip problems. The Galileo addresses this issue while still focusing on the right ankle strengthening.
5. Enhanced neurological re-wiring. As a result of the Galileo, the inter- and intra-muscular communication is improved. The result is improved reciprocal inhibition, providing for better neuromuscular coordination and reduced re-injury.
III. **Increased Patient Throughput**  
As a result of the Galileo, more can be done toward overall patient improvement per visit. With a limited number of visits, the patient can leave the clinic stronger and with less chance of re-injury. Also, with increased patient throughput, more visits can be scheduled per day, resulting in increased revenues.

IV. **Increased Physician Referral Base**  
The challenge most physical therapists have is building their business. At some point, they have tapped most of the referring Orthopods and settle in to a somewhat “fixed” revenue number. The Galileo allows for the marketing of physical therapy services to patients rarely tapped by the PT, such as: diabetes, incontinence, neurological, osteoporosis, osteoarthritis, geriatric, spinal cord injury, developmentally disabled, and others.

The Galileo provides for the strong and successful rehabilitation of numerous patient populations, beyond the traditional orthopedic patient referral, resulting in the building of a larger physician referral base. The result is a strong, growing practice with increased revenues and more dollars in your pocket.
Galileo™ Contra-Indications

- Acute Inflammations in the Pelvis and/or Lower Extremities
- Acute Thrombosis
- Bone Tumors
- Fresh Fracture
- Fresh Implants
- Gallstones
- Kidney or Bladder Stones
- Neoplastic Disease of the Spine (i.e. multiple myeloma and invasion of the spine, metastasis to the spine, osteosarcoma of a long bone, etc...)
- Pregnancy
Frequently Asked Questions

Q. Is Vibration a new phenomenon in the fitness and rehabilitation world?

A. Vibration has been used as an exercise and therapeutic tool since the 1800’s. The research of this technology really began in the late 70’s with the development of a vibration system by one of Russia’s key sports scientists Dr. Vladimir Nararov. He was an active sportsman, a member of the Soviet gymnastics team and occupied a chair for sports biomechanics at the State College in Minsk. He first introduced this technology to competitive sports, ballet and medicine in the former USSR. The Russian Space Program is currently using the technology with their astronauts suffering from considerable bone loss due to weightlessness. In addition, the European Space Agency and NASA are actively using vibration in ongoing studies for the maintenance of muscle strength, mass and bone density.

Since then, and most recently, research into the benefits of segmental and whole body vibration has proliferated. Since most whole body vibration systems were developed in Europe, most of the peer-reviewed publications have come from there. At the present time there are nearly 100 articles dealing with the effects of and related benefits of whole body vibration (WBV).

Q. How does whole body vibration affect the body?

A. The platform vibrates in a teeter-totter” fashion. This produces a corresponding teeter-totter motion at the pelvis resulting in two (2) key actions: one, it simulates the natural, locomotor crossover pattern so common in rehab, and second, it requires active patient participation in postural stabilization. The vibrations activate the involuntary muscle stretch reflex (IMSR). We know that when a doctor taps your patella tendon with a little hammer, there is around 20-25 ms afferent and 20-25 ms efferent response for a total reflex response time of some 40-50 ms. This 40-50 ms circuit corresponds to around 25-27Hz frequency. When exercised/trained at this frequency, the IMSR is activated to the tune of around 1,500 contract/relax cycles per minute. The effects on the circulatory system are enhanced due to the rapid 1,500 contract/relax cycles per minute induced by the IMSR. A strong muscle pumping action is responsible for moving a great deal of fresh oxygenated blood to the working muscles, while flushing our all lactic acid and metabolic waste products. See below for additional benefits.

Q. How does that pattern affect my workout of therapy?

A. The Galileo is the only vibration device that provides for the application of the natural, locomotor, crossover pattern, which is the basis for all functional ambulatory activities, such as walking and running. The result is a more functional workout or therapy session.

Q. What are the advantages to the Galileo’s vibration pattern?

A. Simulates the natural locomotor, crossover pattern.
   Provides for improved neuromuscular communication
   Provides for better stabilization of the head and spine, resulting in less vibration
   Provides for increased use of postural muscles
   Properly re-wires the neural pathways
   Provides for larger amplitudes and forces resulting in greater work done, per unit of time

Q. What is the amplitude through which the platform applies force?

A. The Galileo provides the greatest acceleration and amplitude available for a vibration device. At either end of the platform, there is a displacement of 10 mm, form the lowest to the highest point. As a result, the user can expect greater and quicker results from their sessions.
Q. What is the acceleration of the platform as force is applied?

A. Acceleration is a function of frequency, therefore, the higher the frequency, the greater the acceleration. At the highest frequency of 30 Hz, the Galileo platform can accelerate at very close to 20 times gravity. Another way to state this is 20 times your body weight. Very effective gains, in strength and power, result from this training.

Q. What does 25 Hz really mean?

A. Hertz is a unit of frequency, equivalent to cycle per second. Depending on your frequency (i.e. Galileo & VibraFlex:25Hz) the targeted muscles are given 25 impulses per second, causing these muscles to contract and relax by natural reflex, 25 times per second.

Q. Can we provide published research on our system?

A. The Galileo system was the vibration device used for the majority of the original research done in the field of whole body vibration training. A lengthy and substantive bibliography can be provided. Others may point to vibration literature, however, results from one system cannot be implied to another. Since the parameters of vibration can differ, the research must have been done on the system under evaluation.

Q. What is the appropriate setting for beginner to advanced?

A. It is most important that the user be acclimated slowly. Beginners should stay at the lower frequencies, i.e. 5-15 Hz. Once comfortable with the Galileo, the frequencies can be increased to the optimal 25-27 Hz frequency. At this time, the user can increase their duration, or time of the Galileo. Advanced users, such as athletes, can increase the strength training effects by adding additional weight, in the form of a weight vest, or dumbbells.

Q. How often should I use the Galileo? What is the optimal frequency?

A. Training sessions of only 5-10 minutes, twice per week produce measurable results. 25-27 Hz is optimal.

Q. How can I increase the intensity of my workout?

A. To increase the intensity of your workout, adjust your amplitude and acceleration. The greater the acceleration and the larger the amplitude, the more work is done by the user. To vary the amplitude, simply widen your stance anywhere from foot position 0 to foot position 4. This increases your amplitude form 0-5.1mm. To vary acceleration, simply increase your frequency range anywhere from 0-30Hz. This will increase the number of impulses per second, causing the muscles to contract and relax by natural reflex at a higher rate. Weight can be added to further increase the workout.

Q. How can I further develop power for my patients or athletes?

A. Power is directly related to the ability of the individual to move their mass in response to their immediate need. For elderly patients, it is the ability to react and move quickly to avoid a fall. For the elite athlete, it is to reach the finish line first by powering out of the blocks at the start. In either case, we must focus on the development of power. Power is developed by the increased muscle fiber recruitment as a result of the vibration device evoking the involuntary muscle stretch reflex. Through neurological means, nearly all the muscle fibers in the body of the muscle are fired/contracted resulting in the development of new neuromuscular pathways to fibers not normally trained. The individual now has a greater number of muscle fibers to recruit when needed. To further develop power, the user can use additional weights such as dumbbells and/or weight vest to alter his/her mass.

Q. Can I change my frequency levels during my vibration training program?

A. Yes, you may program your vibration training session and change the level of frequency as you see fit.
Q. Do the arms undergo training while exercising on the Galileo whole body vibration system?

A. Yes, the whole body undergoes vibration training. Various positions from our Galileo Challenge exercise poster target certain muscle groups. When performing a certain position, the vibrations are concentrated on the targeted muscle groups, but also vibrate in near by muscles, joints and tendons. However, to achieve optional benefits of vibration in the upper body (neck, shoulder, arm, elbow, forearm, wrist and hand), we suggest training with the Galileo 100 (Mini-VibraFlex). The Galileo 100 was tested with excellent results in sports and fitness centers, tennis and golf clubs, and physical therapy.

Q. After exercising on the Galileo my legs and calves feel itchy and have reddened. Is this normal?

A. Users commonly report itching erythema, due to enhanced blood flow, following the use of the Galileo exercise system. This effect usually subsides in minutes, as blood flow returns to normal. This effect is a positive benefit of the Galileo as circulation to the lower extremities is improved.

Q. Can I use the Galileo as a warm up and/or cool down?

A. Yes, by adjusting the amplitude and frequency, you can accommodate the level of vibration training to your needs. Whether training with the Galileo or simply using it to warm up and/or cool down, the vibrations of the Galileo warm up the muscles as they contract and relax due to natural reflex. There is an increase in blood circulation and oxygenation flushing out the metabolic waste products of ammonia and lactic acid. The Galileo is you personal trainer. You program it according to your needs.

Q. What are the training benefits of training on the Galileo?

A. Increases flexibility and range of motion
   Eliminates the effects of stress on joints, ligaments and tendons, compared to conventional exercise
   Improves balance & coordination leading to less falls hence fewer fractures
   Improves mobility
   Improves postural balance
   Less stress on the cardiovascular system
   Stimulates the neuromuscular system
   Improves leg circulation for people with diabetes
   Increases oxygenation in the blood
   Flushes out breakdown products of ammonia & lactic acid
   Raises testosterone (7%) and growth hormone (361%) levels
   Lowers cortisol (32%) level
   Increases overall muscular performance
   Improves muscle power (explosive strength), muscle strength & tone
   Stronger muscles means stronger bones
   Helps fight osteoporosis through exercise
   Exercises and/or redevelops the postural muscles, joints and reflexes after injury/disease
   Exercises the perineal muscles of patients with incontinence
   Reduces the pain and disability associated with osteoarthritis
   Allows patients with Parkinson’s disease to benefit from exercise that can slow the progress of the disease
Benefits of Vibration

The following statements were from an interview with Henk Kraaijenhof, an international performance consultant to individual elite athletes. The interview was given after he had spoken on the fundamentals of vibration training at the US Olympic Training Center, Fall 2002.

Some very good points made in the interview are as follows:

- So what you see is a massive and continuous muscular activity in all muscles.

- Since no tissue escapes vibration, it shows a wide range of effects and has been shown to improve maximum strength, explosive strength, flexibility, circulation (for therapy), and bone density, and it also affects hormones, neurotransmitters, and body composition.

- For strength, one vibration training session repeated 10 times for one minute, with one-minute rest between “sets” shifts the force-velocity curve up and to the right, similarly to what’s expected from high reps in the squat or leg press with relatively heavy loads.

- For explosive strength, 10 days back-to-back of one session a day (10 times one minute vibration training with one-minute rest intervals) increases explosive strength comparable to making 200-drop jumps from 24 inches, twice a week, for a year.

- In the case of hormones, one workout with 14 healthy men increased testosterone by 7%, growth hormone by 460%, while cortisol decreased by 32%.

- Vibration training can have a strong, positive effect on many parameters. But beyond the ones discussed, there’s also no pain or fatigue associated with this approach.

- Actually adding vibration training to a normal workout might prevent over training. First of all, the circulation is improved, “flushing out” breakdown products of ammonia and lactic acid. Second, vibration normalizes muscle tone and stimulates the production of local pain killing substances, which is, I might add, a well-known application of vibration, in general. Third, the stimulation of hormones prevents over training, since the testosterone/cortisol ratio is a marker for over training… Fourth, vibration itself doesn’t lead to muscle damage or soreness, since there’s no eccentric load.

- My practical experience shows that more training load is tolerated, while recovery is enhanced.

- It can be used as a warm-up, e.g., 3 to 4 times one minute before weight training or any other workout…. It can also be used as a cooling-down method, e.g., 3 to 4 times one minute after a workout or competition.

- But there is nothing against a separate vibration workout.

Interview with John Gianutsos

Which Galileo models do you currently use at the Rusk Institute?
Galileo 2000, Galileo 900, and Galileo100

When and how did you first become aware of the Galileo?
I tried it and immediately saw the possibilities.

Do you find the Galileo easy to use?
Yes

How do your patients respond on the Galileo?
Very well.

Specifically, how have your patients responded to the Galileo?
It helps back pain, increases strength and mobility.

Have you published and studies performed using the Galileo?
Several have been presented at various professional meetings.

Are you currently working on any case studies with the Galileo?
Yes. I am attempting to see whether the device can help persons with Parkinson’s Disease or spinal cord injury to improve their tone and mobility.

What was the most remarkable result you experienced with your patients using the Galileo?
That it further confirmed my hypothesis that reflex standing can be accomplished and in some cases evolve into voluntary standing and sometimes walking.

In your opinion, what has the Galileo brought to your patients?
A new and sometimes essential modality.

I understand you created a presentation on the “History of Vibration”. What gave you the idea to do it?
I was surprised to discover that others, notably Charcot, were using similar methods over one hundred years ago.

Are people misinformed about vibration?
Yes. I think people need to be further informed about its possibilities.

Is your Galileo easy to maintain?
The 2000 is very easy to maintain.

Given your experiences with the Galileo, which clinical conditions do you feel are best treated with the help of the Galileo?
Parkinsonism, paralysis of spinal origin, spasticity, and pain.

Overall, what are your thoughts on the Galileo?
Its possibilities are exciting.

Specifically, what “exciting possibilities” do you see with the Galileo?
The device can increase the scope of rehabilitative medicine. It has possibilities for inducing standing in paralyzed patients, and for use in cardiac rehabilitation to name a few.
STRENGTH & CONDITIONING PROFILE #3 - Matt Jordan

Every month CB ATHLETICS will be featuring a new strength coach and an insight into their conditioning philosophies. There are many great coaches out there that are unrecognized and that may even live in the same city as you or an athlete you know that is looking for advanced instruction.

Canadian Strength Coach Matt Jordan is fresh from the Olympic games in Salt Lake City. It was an event that he says is "truly a different environment than any other sporting event you can imagine."

CB: Head Strength and Conditioning Coach! That is amazing. What is your education and professional education background?

MJ: My undergraduate degree is in Kinesiology and I am completing a Masters of Science in Exercise Physiology. My main research area is the effect of whole-body vibrations on skeletal muscle. In addition, I am a Certified Strength and Conditioning Specialist (CSCS) through the NSCA, and a certified Level II Weightlifting Coach through the NCCP.

CB: We've discussed vibration training a little in the past, can you describe it at a general level, with respect to skeletal muscle adaptations and where you see this fitting in the future of athlete training?

MJ: Vibration training is a very interesting training modality. Vibration training causes a large increase in muscle activity due to reflex muscle contractions and the resonance properties of muscle tissue. I believe vibration training also has a positive effect on the hormonal status - increases in GH and testosterone can be observed after vibration training. Vibration training can also lead to substantial improvements in explosiveness.

The best way of describing this in simple terms is a quote from a physiologist in Holland: "Vibration training re-wires the nervous system". This is obviously not a scientific explanation but it does give an idea of the potential of vibration training. Vibration training can also help with recovery and can be used as a warm up tool prior to programs designed to improve explosiveness. My research is designed to evaluate the acute effects of vibration training on muscle. Hopefully I will have a better explanation of how vibration training makes us more explosive after I conclude my research in the summer.
Galileo Users

**Bauman Physical Therapy  859-219-2233  Barb Bauman  Margot is “vibration specialist”**

“We have had a great result with neurological patients. A MS patient can now feel wiggle her toes and can feel them. We are having great results with plantar fasciitis and fibromyalgia.”

**Michael Hoorn  810-299-8558**

Michael reports he is billing about 35 units extra per month generating additional revenue of approximately $1050.00 per month. He will have paid for the unit in less than 12 months with the additional revenue. He is billing using code 97112, and receiving $25 from Medicare and $32 from Blue Cross Blue Shield.

The vast majority of his patients like and benefit from the Galileo.

**Diamond Physical Therapy  630-837-2705  Prasad Rhogaraju**

“Jim, I love the Galileo. I received a call from a clinic in Portland, Oregon regarding this product. He did not leave me his telephone #. Please tell him to call me back. I’ll tell him how great it is!”

**Chicago White Sox  312-674-1000  Herman Schneider, Head Trainer**

“We love it. It’s one of the best things we have. Our guys love it. We use it a great deal for both lower and upper body. It’s as durable as a son-of-a –gun”. They have had their Galileo for 4-5 years.

**Well Foot and Ankle  847-344-7441  Lowell Weil, DPM**

Dr. Weil has had his unit for 3-4 years. Among other things, “we use it for diabetic neuropathy. It is effective in treating any neuropathy, even drug induced.” We allow our patients to use the Galileo at no charge after they are discharged, and “it amazes me that people will drive 45 minutes each way 2 times per week to get on the Galileo for 5 minutes!”.

**Rehab Connections  708-478-6996  Sheryl Poremba, PT  Shelly O'Donnell, PT**

Shelly states “we love the Galileo 2000. And the health club members (they are located in a fitness center) like it also. We are keeping a log of all our users and their response to the Galileo. It is very positive. A number of the fitness members are starting to utilize the Galileo as part of their exercise program. We charge them $1 per minute. We really like the Galileo”

**Comprehensive Care  219-977-2090  Dave Newbolds, PT  Michael Foreit, DO  Frank Messana, DO**

Dave states everyone, clinicians and patients just love the VibraFlex. It has speeded up their ability to provide treatment a great deal. They also use it with a bicycle team, as well as other athletes with very good results.
Physicians Group  847-984-6562  Gordon Husby, PT

This is a multi-disciplinary facility. Gordie states he and the doctors really are impressed by the VibraFlex. They hope to integrate it into some of the women’s health areas. “We have treated a lady with Parkinson’s with very good results. We also have had wonderful results with severe osteoarthritis. It’s amazing what happens when you can recruit those smaller muscles you normally can’t get to.”

Primal Fitness  630-443-0446  Bob Tomlinson C.S.C.E.

Bob was on the verge of purchasing a Power Plate which he had used, but was concerned that all the research tauted by Power Plate was conducted on the Galileo. He asked for whether there was a difference, and I offered that the differences would be obvious in minutes. He tried the VibraFlex for 2 minutes. He purchased the VibraFlex.

Baptist Rehab  270-534-1200  Tony Bohannon  P. T.

3-8-06 “Jim, I already have a success story. I have a pt who has arthritis and tremendous stiffness in his LB and hips. I've been working for 2 months to stretch him out including aquatics and stretching in the hot tub. The best he was ever able to do was forward bend to touch his knee joint line and rotate his trunk right 60 degrees and left 40 degrees.

I put him on the Vibraflex a total of about 5 minutes having him stand with his knees locked and forward bent over the arm rests with his feet spread apart to maximum at 10 Hz. Immediately after this, he was able to forward bend to 2" below his tibial tuberosity and rotate his trunk to the right 80 degrees and 65 degrees to the left.

We were both amazed. This is a pt I was close to discharging because of lack of progress.

3-22-06 “Got another one...I eval'd a pt a couple of days ago with a head injury from 2 1/2 years ago. He hasn't walked since and was a max asst for transfers to the w/c. He also has flexion contractures in both hips and knees.

He was able to stand unsupported for 3 minutes on the Vibraflex unsupported. He and his help from his house were amazed”.

12-5-06 “We've used the fire out of the Vibraflex on just about any pt that it's not contraindicated for. We've had several referrals specifically for "Vibraflex Therapy". It's been a great tool for us.”

Back in Balance  847-644-9870  Carole Oser P. T.

Carole has found the VibraFlex very instrumental in treating her Parkinson’s patients.
VibraFlex Restores Strength, Balance

For patients with arthritic knees or those scheduled for orthopedic surgery or procedures, new technology at Baptist Rehab Center can help alleviate pain and stiffness.

Tony Bohannon, physical therapist, said that Baptist Rehab is the only facility in the region to offer VibraFlex technology.

"After just a few minutes on the VibraFlex machine, a patient who has endured years of low back pain and hip stiffness experienced increased flexibility and less pain," said Bohannon. "This is exciting technology that has the potential to help many people in need."

VibraFlex emits varying degrees of vibration through patients’ legs. Typically, patients stand on the platform five to 10 minutes, three times a week. The vibration hyperstimulates nerves and increases blood flow to the feet and legs, giving patients increased strength, balance and reflex sensation.

To learn more, visit our Web site at westernbaptist.com or phone (270) 534-1200.
Good vibrations
Before the big night, stars are literally trembling in their sneakers, thanks to the latest Hollywood craze: vibrating platforms that look like large scales and shake 25 to 30 times per second. “Your body has to counter the unstable surface,” says Jennifer Lopez’s trainer, Gunnar Peterson, who has a Vibraflex machine (below) at his gym in Beverly Hills, California. That means muscles work harder, so you get firmer. You can also do three reps of his drill on a BOSU ball: Squat and hold for 30 seconds.

Shake it up
Lopez’s trainer loves this lean machine for a fit lower body.
Galileo Users: Sport

- Sven Hannawald
  (Olympic Ski Jump Winner in Salt Lake City 2002)
- Martin Schmitt
  (Olympic Ski Jump Winner in Salt Lake City 2002)
- Michael Uhrmann
  (Team World Championships 2000/2001
  Larthi, Olympic Ski Jump Winner in Salt Lake City 2002)
- Lance Armstrong
- Astrid Kumbernuss
  (Shotput European Champion 2003, World Champion 1999)
- Christoph Langen
  (Bobsled World Champion 2003, Team Salt Lake City)

- German National Volleyball Team (Men)
- Herm Schneider, Head Athletic Trainer, Chicago White Sox
- Stelian Moculescu, Coach, German National Volleyball Team
- Gregor Haslberger, Coach, German National Kart Team
- Jürgen Wolf, Coach, German National Ski Touring Team

- National Volleyball Team (Men) in:
  Frankfurt, Germany
  SC Charlottenburg Berlin, Germany
  VfB Friedrichshafen, Germany
  SV Bayer Wuppertal, Germany
  SC Schwerin, Germany
- AC Milan - National Soccer Team, Milan, Italy
- Chicago White Sox - Major League Baseball Team
  Illinois, USA

- German National Olympic Training Center in:
  Rhein-Neckar in Heidelberg
  Stuttgart
  Potsdam
  Berlin
  Schifferstadt
  Saarbrücken
  Neubrandenburg
  Munich
  Warendorf

- German National Ski Union Training Center in:
  Eberbach
  Winterberg
  Hinterzarten
  Rastbüchl-Breitenberg

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