

The Galileo System
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The *Galileo System* consists of a vibrating platform for whole body exercise (*Models 2000, 900 and XS*) and a vibrating dumbbell for the exercise of the upper limbs, i.e. forearm, arm and shoulders (*Model 100*).

The patented *Galileo System* has been developed to stimulate muscles in a manner that promotes the rapid development while minimizing the need for conscious exertion and minimizing stress on the musculature, respiratory and cardiovascular systems. Because a muscle's natural involuntary reflexive response time, or stretch time, is typically in the order of 20 milliseconds, many successive activations can be performed in a relatively short period of time, thereby increasing the efficiency of muscle development. Whether activation of the muscle is achieved by oscillatory motion of the body itself (vibrating platform – *Galileo Models 2000, 900 and XS*), or by superimposing oscillatory motions of an external mass on the body (vibrating dumbbell – *Galileo Model 100*), the frequency of activations is set at about 25 Hertz (or 25 activations per second) in order to optimize the stimulation of the muscles' stretch reflexes. The desired amplitude of each oscillation can be adjusted between 2mm and 10mm, depending on the level of exertion desired (the higher the amplitude, the "stronger" the exercise). Typical exercise time is 5 minutes per week.

This unique system is stirring great interest in the health industry and medical community. Independent preliminary clinical investigations in Germany and Italy, using healthy volunteers, have centered on measuring the effects that short and long-term exposure to *Galileo System* have on bone strength and mass as well as on muscle force and power. These studies demonstrate a significant increase in both bone and muscle strength. The exciting outcome of this research suggests that *Galileo System* could be an effective therapeutic modality in bone diseases, neuromuscular conditions and other pathologies. It also has a demonstrated beneficial impact on muscle and bone strength among healthy individuals.

Leading scientists at New York University's School of Medicine and its renowned Rusk Institute of Rehabilitative Medicine are currently conducting clinical studies on the *Galileo 900*, the device that generates a dynamic whole-body stimulation, to gauge and determine the scope of its therapeutic applications.

The Galileo System may affect a host of physiologic mechanisms. It is well known that an important determinant of bone strength is the load that muscles apply on bones. The European studies offer convincing evidence that mechanical vibrations that the *Galileo System* produces enhance the mechanical power of muscles in isometric conditions. Moreover the same studies showed a large increase in neural activities during vibrations indicating stimulation of the neuromuscular system. However, more research is needed

to determine how long the physiologic effect lasts after the cessation of the vibratory stimulus.

The "rat tail model" developed in laboratory research, provided new insight into how repeated stressors elicit a time-dependent "sensitization". That is to say, it triggers a bigger response upon repeated exposure to the same stressor. During this exposure, blood flow to the brain increased. The *Galileo System* may lead to a similar "sensitization" and this calls for further investigation. The influence of vibratory stimulation on the mechanical behavior of skeletal muscle may involve neural and myogenic adaptation through a proprioceptive feedback mechanism via alpha motor-neuron spinal reflex loop and or a cortical reflex.

Although the physiologic mechanism the *Galileo System* impacts needs further characterization, 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.

Reportedly, patients with conditions such as degenerative osteoarthritis and osteoporosis have been successfully treated with the *Galileo System*. If confirmed, these reports indicate that the therapeutic approach to bone disease involves treating the bone-muscle mechanical coupling.

During the first minutes on the *Galileo System – Models 2000, 900 and XS* – individuals experience a drop in blood pressure with a return to baseline. This may be the result of pooling in the lower extremities but could also be, due to lowering of the peripheral vascular resistance (PVR). During exercise, PVR decreases with a simultaneous increase in cardiac output (CO) and blood flow in muscles. The observed increase in blood pressure ($BP=CO \times PVR$) is secondary to the increase in CO. The potential cardiovascular effects of the *Galileo System* on cardiac indices and PVR need further studies to determine whether this device may be indicated in the treatment of hypertension.

If the *Galileo System* generates an increase in blood flow through an effect on the peripheral vascular system, it would be of clear benefit to patients with peripheral vascular diseases, diabetic vasculopathy and neuropathy. A number of potential applications may also include the treatment of muscle spasm, low back pain, tension headache.

The *Galileo System* has convincingly shown a sustained benefit in muscle performance and bone strength in normal healthy individuals and has proven to be of great value to athletes. Exercise stimulates the sympathetic nervous system and this activation increases cardiac output and therefore provides the nutrients to meet the increased

metabolic demands. Vasodilatation occurs at the same time in the exercising muscles counteracting the increase in blood pressure following the rise in cardiac output. The *Galileo System*, by mechanically stimulating skeletal muscles increases their vascularization without an increase in blood pressure and probably has a smaller effect on cardiac output than during exercise. The beneficial effect noted on muscle performance in athletes using the *System* needs further characterization.

Prior to considering potential applications of the *Galileo System* in disease conditions, a comprehensive safety study will be carried out in healthy volunteers.

Contraindications to the use of the *Galileo System* include pregnancy, individuals with implants and prosthesis, epilepsy, bone tumors and fractures, stroke victims in the acute phase prior to recovery. This list is not exhaustive.