

The Science and Application of Vibration Training

Jim Stoppani, Ph.D.

INTRODUCTION

- What is “Vibration Training”?
 - Vibration means "a recurrent change of position."
 - Vibrations are movements where the recurrent changes of position occurring at equal intervals of time give them the character of waves whose amplitude is very small.
 - Today’s vibration machine
 - Platform (32” × 20”) that oscillates.
 - Control panel (~ chest height) to manipulate magnitude of vibration.
 - Stand, Sit, Kneel, Lay, Place hands on it and do static or dynamic movements
 - Multitude of benefits

HISTORY OF VIBRATION

- Ancient Method
 - The Greeks used saw wrapped in cotton fabric to transmit mechanical vibration to the part requiring treatment.
 - Dr. John Harvey Kellogg – late 1800’s/early 1900’s was among the noted pioneers in the induction of mechanical vibration with the vibrating chair, platform, and bar and. These were the fore-runners of modern vibrators.
 - 1960 Prof. Biermann of former East Germany developed RNS, the technique that is the forerunner of today’s vibration methodology.
 - Russian scientists utilized this technology to help their cosmonauts combat the degenerative effects of micro gravity
 - 1970’s Soviet Union Olympic Athletes were introduced to vibration training – maybe it wasn’t all steroids.
 - Late 1990’s Guus van der Meer, Dutch Olympic team trainer – was first to recognize the benefits of vibration in healthy populations, and developed Power Plate.
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THE SCIENCE OF VIBRATION

- The Physics
 - Amplitude = distance (2-4 mm)
 - Frequency = number of vibrations per second (30 – 50 Hz)
 - Time = exposure unit (30 – 60 sec); total time of exposure (\leq 20 min)
 - Vibration imposes hypergravity activity due to fast and short changes in muscle length
 - Muscle activity (contraction) attempts to dampen the vibratory waves

The Physiology

- Tonic Vibration Reflex
 - Vibration stimulates afferent fibers (muscle spindle)
 - Creates reflexive contraction of muscle – \uparrow tone; \uparrow potential strength
 - EMG activity is significantly higher with vibration than voluntary contractions against a load (weight).
 - Greater synchronization of motor units
 - Enhanced excitatory state of the somatosensory area.
 - Inhibits antagonist muscle activity
 - Stimulates collaterals of the central motor command – travel to hypothalamus
 - Endocrine activation – \uparrow GH, IGF-I, Testosterone, \downarrow Cortisol
 - The Research
 - \uparrow Leg extension strength; \uparrow jumping ability > weight training (*Delecluse et al 2003*)
 - Leg extension strength \uparrow 15% (*Warman et al. 2002*)
 - Biceps curl strength \uparrow 10% (*Issurin et al. 1999*)
 - GH \uparrow 361%; Testosterone \uparrow 7%; Cortisol \downarrow 32% (*Bosco et al. 2002*)
 - Blood flow \uparrow 100% (*Kersch-Schindl et al. 2001*)
 - Lower-back pain \downarrow 66% (*Rittwejer et al. 2002*)
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VIBRATION TRAINING

- Muscle Strengthening
 - Warm-up – enhanced blood flow and hormone release
 - ↑ Muscle strength/power
 - acutely – enhanced neural drive
 - chronically – motor unit recruitment; muscle fiber microtrauma; metabolic perturbations; hormone release
 - Functional training/balance/stability/sport specific
 - Cool down and recovery – blood flow and hormone response
 - Stretching
 - Duration stretching/contracting antagonist
 - Repeated stretching
 - Alternate contraction-relaxation
 - Rehabilitation
 - Enhance recover of sport injuries
 - ↑ BMD
 - ↓ Chronic back pain
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