

# **SHAKE, RATTLE AND GROW**

## **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.

## 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

## USER FRIENDLY

- Professional sports teams
  - NFL (Oakland Raiders, Tampa Bay Buccaneers, Tennessee Titans)
  - NBA (Dallas Mavericks, Houston Rockets)
  - MLB (Chicago Cubs, NY Mets, Pittsburgh Pirates)
  - NHL (Anaheim Mighty Ducks, Dallas Stars)
  - Athletes' Performance (Tempe, AZ) – renowned professional training facility
- University testing
  - Stanford University (Donald Chu); University of Nebraska; Ohio State; UC – Davis; University of Louisville; University of Clearlake (NASA)
- Medical Field
  - Health South – largest rehabilitation and recovery network U.S.
  - Kronos Clinics – longevity/antiaging
  - Healthy Inspirations – national chain weight loss and lifestyle clinics

- Fitness Industry
  - 24 Hour Fitness; Spectrum Club

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#### FUTURE FITNESS

- Certification program
- Power Up Centers
- Complementary training tools
  - Co2ntrol – determines lactic acid threshold
  - Mino2xy – hand held high altitude simulator
  - Perfection line – nutritional supplements
  - Oxy + - oxygen workout bench
  - M2Max system

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