WHOLE LOT OF SHAKING GOING ON!

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I have no financial relationships to disclose

PRIMARY/CLINICAL QUESTION
Does Whole Body Vibration exercise (WBV) prevent musculoskeletal injury or improve healing or fitness in physically active participants?
TODAY’S GOALS

At the end of this presentation, you should be able to:
1. Summarize the research on physiological and clinical effects of WBV
2. Identify potential risks and understand populations that may benefit from WBV training
3. Evaluate if WBV would be effective in your current population to augment training, rehabilitation, and treatment protocols to produce improved outcomes

What Is WBV?

• WBV is a general term
• Vibrations are mechanical oscillations
  - Number of cycles completed in 1 second = frequency (Hz)
  - Amplitude = distance moved on either side of the stationary position
  - Acceleration = how quickly the speed changes direction with time (m/s^2)
• Vibrations can be a bad thing
  - Regulated in ISO 2631-1:1997
  - High frequency (> 50 Hz)
  - Power tools – jackhammer
  - Low frequency can lead to motion sickness
• Much research focused on problems

Therapeutic WBV

• Good machines are expensive to purchase, but relatively low cost to maintain
• Easy to use, non-invasive, requiring AT supervision but not direct involvement after initial training
Therapeutic WBV

Types
- Side alternating (pivotal, top)
  - Larger amplitude (up to 6 mm)
  - Frequency range of 5-40 Hz
  - More closely mimic human gait
- Linear (vertical, bottom)
  - Lower amplitudes (1-2 mm)
  - Higher frequency (20-50 Hz)
  - More vibration transferred to the head
  - May be easier to do some exercises

What Does WBV Do?
Side alternating (pivotal) causes alternating contralateral activation of muscles

Very low acceleration acting on the center of gravity compared to vertical plates

Video
What Does WBV Do?

- Linear (vertical) vibration stimulates reflex and stretch responses
- Body experiences gravity and ground reaction forces
- Many muscles respond to each vibration cycle
- 25 Hz for 3 min = 4500 muscle contractions

EFFECTS OF WBV: what do we know?

- WBV does not replace regular exercise for health/fitness in healthy, active populations
- Use in combination with exercise/rehab
- In general, WBV may improve neuromuscular performance, muscular strength, balance, bone density, gait mechanics in non-active or pathological populations.

• 5-12 Hz - Brain Dominant. Voluntary muscle contract/relax cycle
  - Proprioception, balance, mobilization and relaxation
• 12-20 Hz - Spine Dominant. Involuntary muscle contract/relax
  - Muscle function, stretching, flexibility, relaxation
• 18 Hz (or less) for warm up, ROM, stretching
• 20-36 Hz - Maximum contraction. Involuntary continuous muscle contraction
  - Increases muscle power and muscle mass

Do not train at transition frequencies, go 2 Hz above or below.
STRENGTH AND POWER

- Resistance training is the most effective intervention to improve strength and physical performance.
- Research quality is variable.
- Acute WBV improved concentric strength/power.
- WBV applied to the chest area improved bench press training results.
- WBV improved vertical jump.
- Addition of WBV to squat improved split training in well-trained youth and ice hockey performance.
- Addition to core training may improve more than without WBV.

EXAMPLE OF GOOD GUIDANCE:

"High vibration frequencies can lead to enhanced exercise benefits within an appropriate frequency range, and different exercises have diverse effects on various muscles."

Effects of Whole-Body Vibration on Lumbar-Abdominal Muscles Activation in Healthy Young Adults: A Pilot Study – Chen, 2019

BALANCE AND MOVEMENT

- Lower limb training + WBV improved vertical jump, muscle strength, and balance in athletic throwers.
- WBV improved balance in athletes with and without CAI.
- WBV improve balance and flexibility in rhythmic gymnasts.
- Another study found no effect of a 4-month WBV program on static or functional balance.
- When added to stretching – may improve results.
- Desensitizes muscles spindles, like dynamic stretching.
PERFORMANCE

- Elite athletes may respond differently than amateur or non-athletes
- Shown to be a good warm-up
- Some work also shows WBV after hard training can speed recovery
  - One study found no clear affect on training adolescent swimmers
  - A small study found multiple improved performance measures (torque)
  - WBV + extra load training, 4 week increased muscle strength speed in elite male track athletes
  - Dual frequency training WD+V jumps and change of direction ability in rugby players

REHABILITATION

- Most work in this area is with spinal cord injury and other traumatic injuries
- More work needed
  - WBV improved balance in CAI compared to standard rehab (6 wks)
  - If WBV can be added to current rehabilitation without detriment, consider trying it

MUSCULOSKELETAL PAIN

- High adherence rate and safety
- Initial studies suggest there may be a benefit to long durations of WBV
  - May not be more effective than current fx
  - Stochastic resonance WBV shown to reduce pain in healthy young individuals
  - Shown to decrease pain for 3 hrs or more after fx
  - Increases in flexibility may also lead to decreased pain
  - Some success for low back pain
PHYSIOLOGICAL RESPONSE

- Affects related to type of vibration, settings, population, and intervention
- Neuromuscular adaptations specifically tied to vibration frequency
- Influences nervous system response
- Changes in reflexes
- Increase in peripheral blood flow
- Recent research in our lab indicates side-to-side and vertical WBV produce increases in muscle oxygenation and blood flow
- Time and activity on the platform important

OF INTEREST

- Improved body composition in specific populations (non-athletic)
- Improve physical performance in older people and those with disabilities
- Improved strength and body composition in children with disabilities
- Has been shown as a useful intervention for a variety of issues in pathological populations

CONTRAINDICATIONS

- Pregnancy, gallstones or epilepsy, tumors, diabetes or kidney stones
- Prior (recent or serious) concussion
- Frequent migraines or headaches
- Recent implants or surgery
- Congestive, pulmonary, liver or kidney disease
- Blood clots
- Joint disorders/arthroses
- Acute injury or infection
- Heart rhythmic/valve disorders
- A few reports of retinal tears with high force training (Older?)

http://www.mayoclinic.org/diseases-conditions/concussion/symptoms-20355594
TAKING HOME POINTS

- Studies that do not report specific WBV parameters are in question.
- Specific settings are important for specific results.
- Different populations may respond differently.
- WBV is an adjunct – not a replacement for
  training.
- Form and specific training activity critical for success.
- We still have a lot to learn.
- We must be careful of contraindications and how
  athletes respond. Some simply do not like it.
- We still don’t have direct research on injury prevention.

WBV MIGHT HELP MY
ATHLETES IF:

- Athlete has limited ROM/mobility
- Injury prevents adding weight to resistance training
- Elite athletes want to take training to the next level
- Painful conditions
- Preventing overtraining – a different type of training
- Need a new challenge to improve functional balance
- Decrease DOMS, speed recovery
- Getting over training plateau
- Limited # of AT’s to administer modalities

REFERENCES