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from September
2014

©Journal of Sports Science and Medicine (2011) 10 , 19 - 30

Research article

The Potential Neural Mechanisms of Acute Indirect Vibration

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ABSTRACT

There is strong evidence to suggest that acute indirect vibration acts on muscle to enhance force, power, flexibility, balance and proprioception suggesting neural enhancement. Nevertheless, the neural mechanism(s) of vibration and its potentiating effect have received little attention. One proposal suggests that spinal reflexes enhance muscle contraction through a reflex activity known as tonic vibration stretch reflex (TVR), which increases muscle activation. However, TVR is based on direct, brief, and high frequency vibration (>100 Hz) which differs to indirect vibration, which is applied to the whole body or body parts at lower vibration frequency (5-45 Hz). Likewise, muscle tuning and neuromuscular aspects are other candidate mechanisms used to explain the vibration phenomenon. But there is much debate in terms of identifying which neural mechanism(s) are responsible for acute vibration; due to a number of studies using various vibration testing protocols. These protocols include: different methods of application, vibration variables, training duration, exercise types and a range of population groups. Therefore, the neural mechanism of acute vibration remain equivocal, but spinal reflexes, muscle tuning and neuromuscular aspects are all viable factors that may contribute in different ways to increasing muscular performance. Additional research is encouraged to determine which neural mechanism(s) and their contributions are responsible for acute vibration. Testing variables and vibration applications need to be standardised before reaching a consensus on which neural mechanism(s) occur during and post-vibration.

Key words: Spinal reflexes, muscle tuning, motor unit firing frequency, motor unit synchronisation, inter-muscular co-ordination

Key Points

- There is strong evidence to suggest that acute indirect vibration acts on muscle to enhance force, power, flexibility, balance and proprioception, but little attention has been given to the neural mechanism(s) of acute indirect vibration.
- Current findings suggest that acute vibration exposure may cause a neural response, but there is little consensus on identifying which neural mechanism(s) are specifically responsible. This is due to a number of studies using various vibration testing protocols (i.e. varying frequencies, amplitudes, durations, and methods of application).
- Spinal reflexes, muscle tuning and neuromuscular aspects and central motor command are all viable neuromechanical factors that may contribute at different stages to transiently increasing muscular performance.
- Additional research is encouraged to determine when (pre, during and post) the different neural mechanism(s) respond to direct and indirect vibration stimuli.

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