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The Effects of Frequencies and Postures on Transmission of Whole Body Vibration in Healthy Young Adults

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Introduction

Whole body vibration (WBV) is a neuromuscular training method that has been widely used for enhancing bone health, muscle strength and proprioception. It is known that the transmissibility of vibration is affected by vibration frequencies, amplitudes and assumed postures on the platform. The vibration signals could be augmented due to resonances or reduced as a result of energy loss during transmission. It has been suggested that excessive resonance effect in any body part should be avoided when using WBV as a training purpose. Therefore, the transmissibility pattern of vibration signals over respective body parts at different combination of vibration frequencies and postures should be evaluated for optimizing the treatment effectiveness and enhance the safety

Objectives

To evaluate the transmissibility pattern of vibration signals over respective body parts at different vibration frequencies and postures

Methodology

Fifteen healthy young adults participated in the study. Subjects were instructed to perform 6 different postures on a vertical-mode vibration platform for 15 seconds. Vibration amplitude of 1 mm and frequencies of 20, 25, 30, 35 and 40 Hz were tested. The order of the testing conditions was randomized. Three minutes of resting period was given between testing. Tri-axial accelerometers were attached to the subjects' ankles, knees, hips, lumbar spine and forehead to capture the accelerations. Transmissibility of WBV was calculated by dividing the acceleration at respective body parts by the acceleration measured at the platform. The main effects of posture and frequency and their interactions were analysed using two-way repeated measure ANOVA. The level of significance was set at 0.05. Ethical approval was obtained from the Hong Kong Polytechnic University.

Result

A significant association of vibration frequencies and postures on the vibration transmissibility was demonstrated ($p<0.001$). Transmissibility increased upon increasing vibration frequency at ankle ($p<0.001$), and decreased upon increasing vibration frequency at other body parts (all $p<0.001$). Tip-toeing posture yielded a significantly lower transmissibility at the ankle, knee and lumbar spine ($p=0.002$ to 0.0047) and erect standing posture generated a significantly higher transmissibility at head region as compared with other testing postures ($p<0.001$).

In the present study, it was found that the transmission of vibration signals was augmented at the ankle in all testing frequencies. Special precaution should be taken for population with ankle pathology when using WBV for training. Erect posture should be avoided as highest vibration transmissibility was noted over the head region disregard the impact of vibration frequency. Training postures with more knee flexion may be more desirable to impose damping effect to minimize transmission to the head.