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Variations in Neuromuscular Activity of Thigh Muscles During Whole-Body Vibration in Consideration of Different Biomechanical Variables

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ABSTRACT

The intention of this study was to systematically analyze the impact of biomechanical variables in terms of different vibration frequencies, amplitudes and knee angles on quadriceps femoris and hamstring activity during exposure to whole-body vibration (WBV). 51 healthy men and women (age 55 ± 8 years) voluntary participated in the study and were randomly allocated to five different vibration-frequency groups. Each subject performed 9 static squat positions (3 amplitudes x 3 knee angles) on a side alternating vibration platform. Surface electromyography (EMG) was used to record the neuromuscular activity of the quadriceps femoris and hamstring muscles. Maximal voluntary contractions (MVCs) were performed prior to the measurements to normalize the EMG signals. A three-way mixed ANOVA was performed to analyze the different effects of the biomechanical variables on muscle activity. Depending on the biomechanical variables, EMG muscle activity ranged between 18.2 and 74.1 % MVC in the quadriceps femoris and between 5.2 and 27. 3 % MVC in the hamstrings during WBV. The highest levels of muscle activation were found at high frequencies and large amplitudes. Especially in the quadriceps femoris muscle, a WBV frequency of 30 Hz led to a significant increase in muscle activity compared to the other tested frequencies. However, it seems that knee angle is only relevant for the quadriceps femoris muscle. The results of this study should give more information for developing individual training protocols for WBV treatment in different practical applications.

Key words: Vibration training, surface electromyography, muscle strength, muscle tuning

Key Points

- WBV leads to a higher muscle activity of the quadriceps femoris than of the hamstrings.
- The maximum levels of muscle activity were significantly reached at high amplitude and high frequency.