The Acute Effects of Whole Body Vibration on Isometric Mid-Thigh Pull Performance

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Introduction

Acute exposure to vibration has been suggested to produce transient increases in muscular strength (1,2,3), vertical jump displacement (4,5, and power output (6,7) recorded while performing various tasks. It has been hypothesized that the reported acute vibration induced increases in performance occur as a result of alterations in neuromuscular stimulation (1,3,4). Specifically, most studies have ascribed the observed improvements to the thickness of Whole Body Vibration (WBV) in producing a "tonic vibration reflex" (TVR) in which the primary nerve endings of the la afferents of the muscle spindle are activated. This is thought to result in the excitation of the alpha-motor neuron and activation of the stretch reflex (4) which likely leads to a greater synchronization of motor units as a result of homonymous motor unit contractions. However, not all investigations report improvements in muscular strength (4), vertical jump (7), and power production in response to acute vibration (4).

While the current body of scientific knowledge offers conflicting evidence on the effectiveness of WBV in augmenting neuromuscular performance it is possible that WBV may result in alterations to specific aspects of the force-time curve during the performance of a maximal isometric contraction. Therefore, the primary purpose of this investigation was to examine the effects of WBV performed using 30 Hz frequency and 2.4 mm amplitude on the force-time curves of an isometric mid-thigh pull.

Methods

Subjects:

Eleven (4 women and 7 men) recreationally trained individuals served as subjects in the present investigation which was approved by the East Tennessee State University Institutional Review Board (IRB). All subjects read and signed informed consent documents in accord with the East Tennessee State IRB.

The first testing session was used to perform all preliminary testing. This testing included the collection of the subject's physical characteristics. A summary of the subject characteristics is presented in Table 1. Additionally during this session each subject was familiarized with the WBV protocol (Figure 1) and the isometric mid-thigh pull testing protocol (Figure 2). Seven days after the completion of the familiarization session and 48 hours after their last exercise bout, the subjects performed one of the three randomly assigned treatment conditions. A summary of the testing protocol is presented in Figure 3.

Results

• There were no statistically significant differences between any of the treatment groups for force-time curve parameters analyzed in the present investigation.

• There were no significant differences (p ≥ 0.05) for the percent differences between the sham and vibration conditions for any of the force-time variables analyzed in the present investigation.

• The results of the coefficient of variance, intraclass correlation, and interclass correlation analyses between performed using the sham and treatment conditions (T1 vs. T2; T1 vs. T3) are presented in Table 2.

• The percent difference scores between the T1 vs. T2 and T1 vs. T3 are presented in Figures 4 and 5.

• There were only trend to small variations between body mass and the percent difference in power for prepeak force at 50 ms (T1 vs. T2; r = -0.29; T1 vs. T3; r = -0.29, 90 ms (T1 vs. T2; r = -0.46; T1 vs. T3; r = 0.02), 200 ms (T1 vs. T2; r = -0.39; T1 vs. T3; r = -0.39), and 250 ms (T1 vs. T2; r = -0.46; T1 vs. T3; r = -0.11).

• Similar results were found when looking at the RFD results at 50 ms (T1 vs. T2; r = 0.23; T1 vs. T3; r = 0.23), 90 ms (T1 vs. T2; r = -0.36; T1 vs. T3; r = -0.40), 200 ms (T1 vs. T2; r = -0.41; T1 vs. T3; r = 0.14), and 250 ms (T1 vs. T2; r = -0.36; T1 vs. T3; r = 0.36).

• It was found that there was a significant increase in power when comparing the WBV protocol with the sham protocol. Figure 6: Percent Change for Peak Force between Sham and Vibration Treatments

Results

Table 2: Coefficient of Variance, Intraclass Correlation, and Interclass Correlations between Treatment Conditions

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Coefficient of Variance</th>
<th>Intraclass Correlation</th>
<th>Interclass Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 vs. T2</td>
<td>CV = 0.99; IC = 0.99</td>
<td>IC = 0.99; IC = 0.99</td>
<td>IC = 0.99; IC = 0.99</td>
</tr>
<tr>
<td>T1 vs. T3</td>
<td>CV = 0.99; IC = 0.99</td>
<td>IC = 0.99; IC = 0.99</td>
<td>IC = 0.99; IC = 0.99</td>
</tr>
</tbody>
</table>

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References


