WHOLE BODY MECHANICAL VIBRATION (WBV) REDUCES TORQUE VARIABILITY INDEPENDENT OF AGE

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SUMMARY

Mechanical vibration increases the excitability of the Ia afferent fibers and thus provides an increased input to motor units. The present study examined the short-term effects of WBV on the ability to reduce the variability in voluntary torque in healthy young and old adults. The results showed that WBV transiently reduced the variability in torque production and this reduction was independent of age and the level of torque and persisted beyond the treatment period.

INTRODUCTION

Mechanical vibration of tendons and muscles provides a potent stimulus to sensory receptors. Through rapid stretch-shortening cycles, WBV at 20-50 Hz and 2-4 mm amplitude activates muscle fibers in lower extremity muscles (1). It has been extensively documented that WBV can improve neuromechanical output under a variety of conditions (3, 10). Weak muscles are particularly responsive to WBV (3, 7) and WBV has thus a potential to evoke favorable neuromechanical responses in old adults (2, 4) and other populations with muscle weakness (6, 9).

Here we examined the possibility that WBV has a positive acute effect on the ability of healthy young and old adults to produce voluntary torque steadily. It is well established that old compared with young adults have a reduced ability to produce voluntary torque steadily (5, 8). Because WBV is particularly effective in exciting peripheral sensory receptors in old adults’ weak muscles (2, 4) and the ability of producing voluntary torque steadily is associated with motor unit control (8), we hypothesized that WBV will reduce torque variability more in old compared with young adults.

METHODS

Young and old adults were instructed to produce knee extensor eccentric and concentric torque as steadily and accurately as possible by matching the torque production with a target displayed on a large computer monitor. The present abstract only focuses on the torque variability data pooled across age, the 5 bouts of WBV and this effect increased to 39% (p = 0.001) and similarly (p = 0.123) at the two torque levels over the 5 bouts of WBV and this effect increased to 50% (p = 0.024) over an 8-minute follow-up. Table 1 presents the torque variability data pooled across age, the 5 observations made over the 5 bouts of WBV, and the 4 observations made over the follow-up period. None of the Age by Time interactions was significant and there were no significant changes in torque variability under any of the sham conditions.

RESULTS AND DISCUSSION

Old compared with young adults produced 31% (p = 0.001) lower maximal eccentric voluntary torque. Before WBV, old compared with young adults had 64% (p = 0.001) more variability in torque during efforts at 10% and 40% of maximal eccentric torque. WBV reduced torque variability to similar levels over the 5 bouts of WBV and this effect increased to 39% (p = 0.001) and similarly (p = 0.123) at the two torque levels over the 5 bouts of WBV and this effect increased to 50% (p = 0.024) over an 8-minute follow-up. Table 1 presents the torque variability data pooled across age, the 5 observations made over the 5 bouts of WBV, and the 4 observations made over the follow-up period. None of the Age by Time interactions was significant and there were no significant changes in torque variability under any of the sham conditions.

CONCLUSIONS

WBV reduced torque variability but these reductions were independent of torque level, and against our hypothesis, were also independent of age. The data suggest that WBV may have effects on neuromuscular function, including fine control of torque by postural muscles that persist beyond the period of the WBV intervention. None of the subjects reported adverse effects or sensations during or after WBV. A limitation of the present study is that it is unclear if age- and torque level-dependent effects may appear after WBV delivered at higher frequencies than 35 Hz. The use of longer follow-up periods is also warranted in future studies.

ACKNOWLEDGEMENTS

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REFERENCES


2. Bogaerts AC, Delecluse C, Claessens AL, Troosters T, Boonen S, and Verschueren SM. Effects of whole body vibration training on cardiorespiratory fitness and...


Table 1. Torque variability at baseline, during real WBV, and after WBV in absolute units of torque (top panel, Nm) and expressed as a coefficient of variation (% lower panel). Data for the sham group are not shown.

<table>
<thead>
<tr>
<th>Target</th>
<th>Baseline</th>
<th>WBV</th>
<th>Follow-up</th>
</tr>
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<tbody>
<tr>
<td>10% MVC</td>
<td>6.9 ± 0.75</td>
<td>4.5 ± 0.95</td>
<td>3.9 ± 0.74</td>
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<tr>
<td>40% MVC</td>
<td>11.5 ± 3.01</td>
<td>6.4 ± 1.70</td>
<td>9.2 ± 2.37</td>
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</table>

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<th>Target</th>
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</tr>
</thead>
<tbody>
<tr>
<td>10% MVC</td>
<td>29.5 ± 2.42</td>
<td>21.6 ± 2.37</td>
<td>21.4 ± 2.92</td>
</tr>
<tr>
<td>40% MVC</td>
<td>20.3 ± 0.85</td>
<td>16.1 ± 1.56</td>
<td>14.2 ± 1.25</td>
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</tbody>
</table>

Data are pooled across young and old adults and across 5 bouts of WBV and the 4 measures of follow-up.