Effect of Whole-Body Vibration on Knee Extension ROM & Functional Hop in Healthy Individuals
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Research Question
In college-aged individuals who have sustained a hamstring strain within the past 12 months, is whole-body vibration combined with static stretching more effective at improving knee extension range of motion and functional hop distance when compared to static stretching alone?

Purpose
This is a review of literature to examine the effects of using whole-body vibration (WBV) in conjunction with static exercise to improve knee extension range of motion (ROM) and functional hop distance in healthy individuals.

Background
Hamstring strains are one of the most common types of muscle strains in athletic populations. Individuals that sustain a hamstring strain in the past have a high degree of strain recurrence. They additionally may have decreased ROM and loss of strength as a result of a hamstring strain, thus significantly impacting their lower extremity function. There are several types of interventions that can be used to treat hamstring strains such as inflammation reducing modalities, stretching, and eccentric hamstring strengthening. Vibration therapy involves a mechanical oscillation that transfers energy from the vibration plate to the individual, which when combined with stretching can exert several physiological effects (figure 2). These effects may include the reduction of stiffness in muscles, tendons, and connective tissues.

Literature Review

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<tr>
<th>Title</th>
<th>Subjects</th>
<th>Methods</th>
<th>Results</th>
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<tr>
<td>The effects of a whole-body vibration program on muscle performance and flexibility in female athletes</td>
<td>Twenty-three female athletes</td>
<td>Use Vibration Platform (Nemes LC2-040)</td>
<td>There was a significant difference between the two groups in performance measures. For the CMJ test - statistically significant improvement in the WBV group compared to no statistical improvement found in control. Significant difference between groups at end of 8 weeks.</td>
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<td>Whole body vibration as an adjunct to static stretching</td>
<td>Thirty-four recreationally active college-aged males</td>
<td>Use Galileo 2000 WBV Platform</td>
<td>Remained relatively the same at all points of data collection: SS 66.1° baseline, +8.6° after 4 weeks of stretching. V remained -0.7° below baseline 8 weeks post intervention. V 58.7° baseline, +13.0° after 4 weeks of stretching. V remained +6.4° from baseline 3 weeks post study. Only V group significant increase in ROM (6.4°) from baseline to end of study (p=0059). No statistical significance between SS and V groups at any time.</td>
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<tr>
<td>The acute effects of different training loads of whole-body vibration on flexibility and explosive strength of lower limbs in divers</td>
<td>18 competitive divers. 10 males, 8 females</td>
<td>Use Power Plate Next Generation WBV Platform</td>
<td>There was a significant protocol/time interaction with no effect on squat jump, single leg jump on R. leg with both treatment groups of p=0.01, p=0.04, and p=0.07 respectively. There was no significant protocol/time interaction with no movement improvement in squat jump, or single leg jump on L. leg with either treatment or control groups.</td>
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<td>The effect of dynamic whole-body vibration warm-up on lower extremity performance</td>
<td>14 male physical education students</td>
<td>Use Vibration Platform</td>
<td>There was a significant protocol/time interaction for CMJ. CMJ (p &lt; 0.05) and SR (p &lt; 0.001) remained significantly after 5 min of VBV. No significant changes of MVC. Variables remained unaffected after WBV.</td>
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<tr>
<td>The acute effects of dynamic vibration training on muscle mass, strength, and power</td>
<td>S.S. Colson, R. Roffino, M. Mutin, Carmino, A. Carmino, P.D. Pettit</td>
<td>Use Vibration Platform</td>
<td>Significant protocol/time interaction for CMJ. CMJ (&lt; 0.05) and SR (&lt; 0.001) remained significantly after 5 min of VBV. No significant changes of MVC. Variables remained unaffected after WBV.</td>
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Analysis
Studies chosen to be analyzed here focus on whether WBV may be a beneficial tool to improving hamstring ROM and a functional activity. Functional and hop test the counter movement jump (CMJ) tests were included as they are functional activities with close metrics to evaluate jump performance. Overall, two of the three studies that measured CMI concluded that a statistically significant improvement occurred in the WBV treatment group compared to control. Although not statistically significant for CMI, Dallas et al. found that a statistically significant change in other aspects of jump performance, specifically the single leg functional hop, occurred in the WBV treatment group. Subjects that were treated with WBV benefited from the intervention by demonstrating statistically significant improvements in ROM. When comparing treatment groups, WBV participants were unsuccessful in achieving significant advances in ROM. Finally, all studies that were analyzed reported statistically significant improvements in knee ROM pre- and post-intervention, with three studies reported statistically significant change in knee ROM when compared to a control group.

Limitations
There are some limitations in the existing literature regarding WBV in rehabilitation: 1) no studies on college-aged individuals and athletes that have sustained a hamstring injury; 2) non-standardized vibration frequencies, exercise protocols; and 3) lack of large studies examining the short-term and long-term outcomes to achieve these effects.

Conclusion
The grade of hamstring injury greatly affects an athlete’s performance and return to sport. Normal hamstring range of motion and functional hop are common assessments when determining an athlete's return to sport eligibility. The positive outcomes on healthy tissue shown in this systematic review, lead us to suspect that college-aged individuals and athletes recovering from a hamstring injury may benefit from the use of WBV in conjunction with hamstring rehabilitation methods of physical therapy. Therefore, we have chosen to start a study examining the use of WBV in conjunction with static stretching to improve hamstring extensibility and functional hop in college-aged individuals that have sustained a hamstring injury.

References