The Effects of Whole Body Vibration on Landing Biomechanics Linked to Secondary Injury Risk in Individuals With Anterior Cruciate Ligament Reconstruction

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BACKGROUND
Anterior Cruciate Ligament (ACL) ruptures are very common injuries. Individuals who have ruptured their ACL have demonstrated poor quadriceps function, marked by reductions in strength and activation. Quadriceps dysfunction may lead to aberrant jump landing biomechanics as the quadriiceps is crucial for attenuating force during a jump landing. Averrant jump landing biomechanics have been linked to an increased risk of lower extremity injury.1 Studies have demonstrated that whole body vibration (WBV) improves quadriceps function2 and gait mechanics. However, the effects of WBV on landing biomechanics are unknown.

PURPOSE
To compare jump landing biomechanics in individuals with anterior cruciate ligament reconstruction (ACLR) before and after whole body vibration.

METHODS
Participants
- 34 individuals between the age of 18 and 35 (20.9 ± 3.5) years and between 6 months and 5 (2.63 ± 1.25) years post-unilateral ACLR with no neurological disorders or recent lower extremity injuries.

Procedures
- Intervention protocol
  - This study consisted of two data collection sessions, at least a week apart, where participants would receive a control intervention in one session and the WBV intervention in the other.
  - A counterbalancing scheme determined the intervention order as well as the jumping task order.

Landing Biomechanics Assessment
- Three-dimensional kinematics and kinetics were obtained via 3D motion capture system (Vicon) interfaced with two in-ground force plates (Bertec) sampled at 200Hz and 2,000 Hz respectively.
- Single leg (SL) and Double leg (DL) jumping tasks were completed from a 30 cm box half their high away from the imbedded ground force plates.

Intervention
- WBV: For 1 minute participants performed a half squat on the Power Plate vibration platform receiving a 30Hz stimulus, then rested for 2 minutes. This cycle was repeated 6 times.
- Control: Participants completed the same intervention as WBV, but no stimulus was applied.

RESULTS

Statistical Analyses
- A 2 (condition: WBV, Control) x 2 (time: Pre, Post) ANCOVA controlling for time post-ACLR was used to evaluate all outcomes for involved/ACLR (INV) and uninvolved (UNINV) limbs separately (α = 0.05).
- Significant interaction effects were further evaluated via Bonferroni corrected pairwise comparisons between time points and conditions (α = 0.0125).

DISCUSSION

• WBV acutely reduces uninvolved limb vGRF during single leg jump landing tasks.
• Decreasing vGRF using WBV presents clinical implications as lower vGRF may be associated with a reduced risk of ACL injury1.
• This study only investigates the acute effects of WBV, thus future studies should investigate the effects of repeated WBV on landing biomechanics longitudinally.

REFERENCES


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