Effects of Whole Body Vibration on Quadriceps Function, Landing Biomechanics, and Performance in Individuals with ACL Reconstruction

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Derek Dewig, PhD, ATC is currently a Research Scientist for the Rockefeller Neuroscience Institute in the Human Performance Innovation Center. He completed his PhD in Human Movement Science at the University of North Carolina at Chapel Hill (UNC), MA in Athletic Training at UNC and BS in Athletic Training at Indiana University. His doctoral work sought to identify biomechanical and neuromuscular consequences following ACL injury and their association with both posttraumatic knee osteoarthritis and secondary injury risk. Additionally, his research is interested in identifying modifiable factors that may predispose individuals to orthopedic injury or associate with poor performance (both from a sport and clinical perspective). Prior to pursing his PhD, Derek held the role of staff athletic trainer for the track and field and cross country teams at Indiana University.

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PRACTICAL SIGNIFICANCE

In those with ACL reconstruction (ACLR), an acute bout of whole body vibration improved knee kinetics during landing in both the surgical and contralateral limbs.

STUDY BACKGROUND

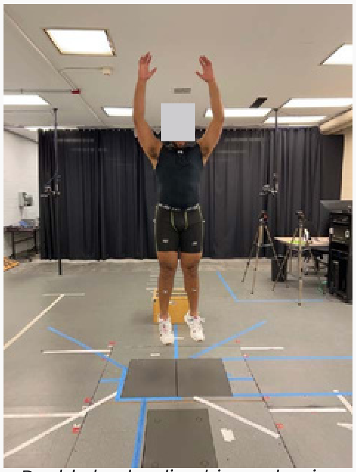
Individuals with ACL reconstruction are at heightened risk of sustaining a second ACL injury and are often unable to return to their preinjury level of activity. These consequences are often driven by quadriceps dysfunction that influences landing biomechanics linked to secondary injury risk and plyometric performance. Whole body vibration (WBV) has been shown to improve quadriceps function following ACLR, but its influence on landing biomechanics and plyometric performance are unknown.

STUDY SUMMARY

Objective: To determine the influence of WBV on landing biomechanics and performance in those with ACLR.
Design & setting: Two session, laboratory study (WBV or Control intervention), repeated measures crossover design with sessions separated by 1-week.
Subjects: 36 individuals with primary, unilateral ACLR.
Measurements: Quadriceps function was assessed pre- and post-intervention via maximal isometric contraction and transcranial magnetic stimulation. Single- and double-leg jump landings were assessed pre- and post-intervention. Repeated measures ANCOVAs for change scores controlling for years post-ACLR and "pre-test" values were used to evaluate landing biomechanics. Partial-Pearson correlations controlling for years post-ACLR were used to evaluate changes in quadriceps function with changes in landing biomechanics post-WBV.
Results: Greater changes in ACLR limb knee-extension moment was noted following WBV compared to Control during double-leg landing (P=0.019). The knee-adduction moment decreased following WBV compared to Control in the uninvolved limb during single-leg landing (P=0.039). Increases in quadriceps rate-of-torque development were associated with increases in single-leg knee-extension moment (P=0.03,r=0.377) and increases in quadriceps torque associated with increases in knee flexion angle at ground contact during double-leg landing (P=0.02,r=0.397).
Conclusions: WBV has the potential to improve landing biomechanics in those with ACLR. Future research should evaluate the repeated effects of WBV.

Whole Body Vibration Intervention

Quadriceps Function Assessment



Double leg landing biomechanics countermovement jump