The effects of whole body vibration on dynamic stability in individuals with anterior cruciate ligament reconstruction

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BACKGROUND

- Individuals with Anterior Cruciate Ligament Reconstruction (ACLR) have an increased risk for secondary ACL injury[6].
- Individuals with ACLR have also displayed quadriceps dysfunction and dynamic postural control deficits[3,7].
- Postural control at the knee can be assessed by time to stabilization (TTS) or the time it takes for the ground reaction forces to become stable after a jump.
- Poor postural control displayed in jump-landing tasks as measured by TTS may be related to increased risk of second ACL injury[2,6].
- Previous research has found TTS to be worse in those with ACLR[7].
- Whole body vibration (WBV) has been associated with an overall increase in neuromuscular function and improved quadriceps function in ACLR individuals[1,4,5].
- It remains unknown how WBV might affect TTS as a measure of postural control in single leg (SL) jump-landing tasks among ACLR individuals to decrease risk of secondary ACL injury.

PURPOSE

Purpose: To analyze the effects of WBV on TTS for SL jump-landing tasks in ACLR individuals.

Hypothesis: WBV will result in decreased TTS in SL jump-landing tasks compared to control.

METHODS

Study Design

- This study consisted of two sessions, at least one week apart, where participants received the control intervention in one session and WBV in the other.
- A counterbalancing scheme determined intervention order.

Participants

- Thirty-four individuals between age of 18 and 35 (20.9 ± 3.5)years and 6 months to 5 years (2.63 ± 1.25) post-unilateral ACLR participated.

Time to Stabilization

- Participants completed 3 SL jump-landing trials for both the involved and uninvolved limbs upon an embedded force plate (Bertec) from a 30 cm high box located half their height away and held their balance for ten seconds upon landing (Figure 1).
- Time to stabilization measures focused on medial-lateral (ML), antero-posterior (AP) (Figures 2 and 3).

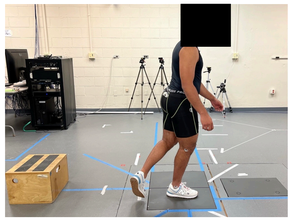

Figure 1. Single leg (SL) jump-landing

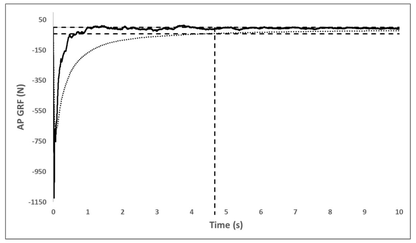

Figure 2.

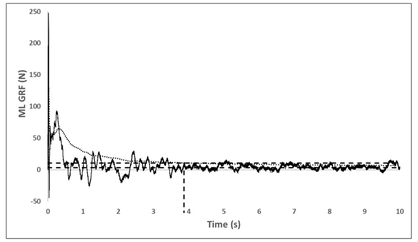

Figure 3.

Figures 2 and 3: Typical waveforms for the anterior/posterior (AP) and medial/lateral (ML) ground reaction forces (GRF) during single-leg landing. Solid lines represent the raw GRF, while dotted lines represent the sequential average GRF. Time to stabilization (dashed vertical line) was identified as the instant at which the sequential average waveform was maintained within ±0.25 standard deviations of the raw waveform mean.

Whole Body Vibration Intervention

- Participants stood in a half-squat on the Power Plate WBV Machine set to 2g acceleration at 30Hz for 60 seconds.
- A two-minute rest period was given after the 60 seconds of WBV and this was repeated six times.

Control Intervention

- Participants were instructed to stand in a mini-squat position on the Power Plate WBV Machine and received no vibration.

Statistics

- Analysis included separate 2x2 (condition x time) repeated measures ANCOVA controlling for time since ACLR to evaluate ML, AP, and DPSI time to stabilization measures with both the involved (INV) and uninvolved (UNINV) limbs.
- The interaction effect was evaluated with SL ML TTS, SL AP TTS for both the INV and UNINV limbs separately.
- Statistical significance was set *a priori* at *P value* ≤ 0.05.

RESULTS

- No significant interaction effects were found for any TTS measures for either limb (P = 0.134 - 0.953)

DISCUSSION

- This study determined that WBV did not influence TTS during SL jump-landing tasks in those with ACLR.
- However, this does not rule out the possible utility of WBV in to decrease risk of second ACL injury as other variables effect this risk.
- This study solely examined the effects of an acute intervention of WBV on one variable, TTS, affecting secondary ACL injury risk.
- Future studies should examine the effect of longitudinal or repeated WBV treatments on TTS as well as other variables affecting secondary injury risk among ACLR individuals.

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