Does Acute Whole Body Vibration Training Improve Physical Performance for People with Knee Osteoarthritis?

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INTRODUCTION

Osteoarthritis (OA), is the most common form of arthritis, and the most prevalent joint disorder worldwide [1]. Abnormal biomechanics in the knee joint may initiate the disease process leading to OA. Additionally, knee pain associated with OA can further alter the mechanics of the lower extremity leading to difficulty in the performance of activities of daily living (ADLs).

Traditional therapies for knee OA consist primarily of pharmacologic and surgical treatments. Each of these presents difficulties, especially when treating the elderly, the main population affected by knee OA. Other forms of managing knee OA, such as exercise, offer numerous advantages. Furthermore, there appears to be a need for additional viable, nonpharmacologic modalities to treat knee OA.

Previous studies have shown whole body vibration (WBV) to be effective in increasing muscle strength and power, improving balance and mobility, improving circulation, and altering certain hormone levels (e.g. growth hormone, IGF-1, cortisol, and testosterone) [2]. Additionally, WBV offers particular advantages as an intervention for special populations.

The purpose of this study was to test the hypothesis that a single session of WBV training (WBVT) would improve the physical performance of individuals with knee OA in three tests designed to simulate ADLs: the Timed-Up-and-Go Test (TUG), a step test, and a 20 meter walk test.

METHODS

Seventeen individuals with symptomatic knee OA, for whom it was safe to perform WBVT, were recruited from orthopedic clinics, fitness centers, care centers, and the community surrounding the university campus.

A Power Plate vibration platform (2004 model Power Plate Personal) was used in all WBV training sessions. Participants stood on the platform with knees slightly flexed and received tri-planar (mostly vertical), sinusoidal WBV at 35 Hz and 4-6 mm displacement, 10 times in 60 second increments with 60 second rest periods in between each bout of WBV. The total exposure time was 10 minutes (Figure 1).

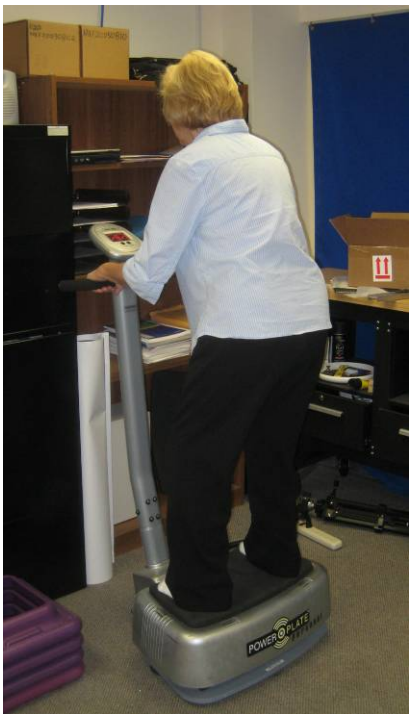

Figure 1: Participants stood on the vibration platform with knees slightly flexed as shown above.

Outcome measures included the time (in seconds) required to complete the following tests: 1) TUG, 2) step test, 3) 20 meter walk test, as well as knee pain levels as measured using a 10 cm visual analog scale (VAS) immediately following each test. The outcome measures were recorded at the following intervals: pre-intervention, five minutes post-intervention, and one hour post-intervention.

Separate one-way ANOVA were performed for each outcome variable across the three testing intervals (α = .05). Pearson correlations were performed to examine the linear correlation of VAS scores on times to complete the three functional tests, respectively.

RESULTS AND DISCUSSION

Main effects were detected for both time to complete the step test ($F(2,28) = 6.243$, $P = .006$) and time to complete the walk test ($F(2,28) = 4.370$, $P = .022$). Post-hoc analyses revealed that the time to compete the step test five minutes after WBVT improved significantly ($P = .042$) from the pre-test, while the improvement from pre-test one hour after WBVT failed to reach significance ($P = .085$). There was no significant change in time to complete the step test from five minutes after WBVT to one hour after WBVT ($P > .05$) (Figure 2). Post-hoc analyses of the times to complete the walk test, however, failed to show any significant changes ($P > .05$). No significant changes following WBVT were found for the TUG, nor for the pain levels following any of the tests ($P > .05$). A moderate correlation ($r = .465$, $P = .001$) was found between the VAS scores and the time to complete the step test across all trials. No other significant correlations were found ($P > .05$).

We found that WBVT was well-tolerated in nearly all participants, and our results showed that an acute bout of WBVT was effective in improving the ability of individuals with knee OA to perform a step test designed to simulate the task of going up and down stairs. While it is beyond the scope of this study to ascertain the exact mechanism by which physical performance was improved, a review of previous studies [2] and our failure to find an accompanying significant decrease in pain levels suggests that the improved performance is likely due to beneficial effects of WBVT on the neuromuscular system, such as improved balance and increased muscular strength and power. It should be noted, however, that while not reaching significance, we did find that pain levels following the step test decreased on average 28% five minutes after WBVT. Together with the moderate correlation between pain levels and step test performance, there is some evidence that pain reduction may have contributed to improved performance. Overall, our findings suggest that WBVT may be an effective nonpharmacologic modality to treat some knee OA symptoms, although further investigation is needed.

REFERENCES

1. Reginster JY. *Rheumatology (Oxford)* **41**, 3-6, 2002.
2. Prisby RD, et al. *Ageing Res Rev* **7**, 319-329, 2008.

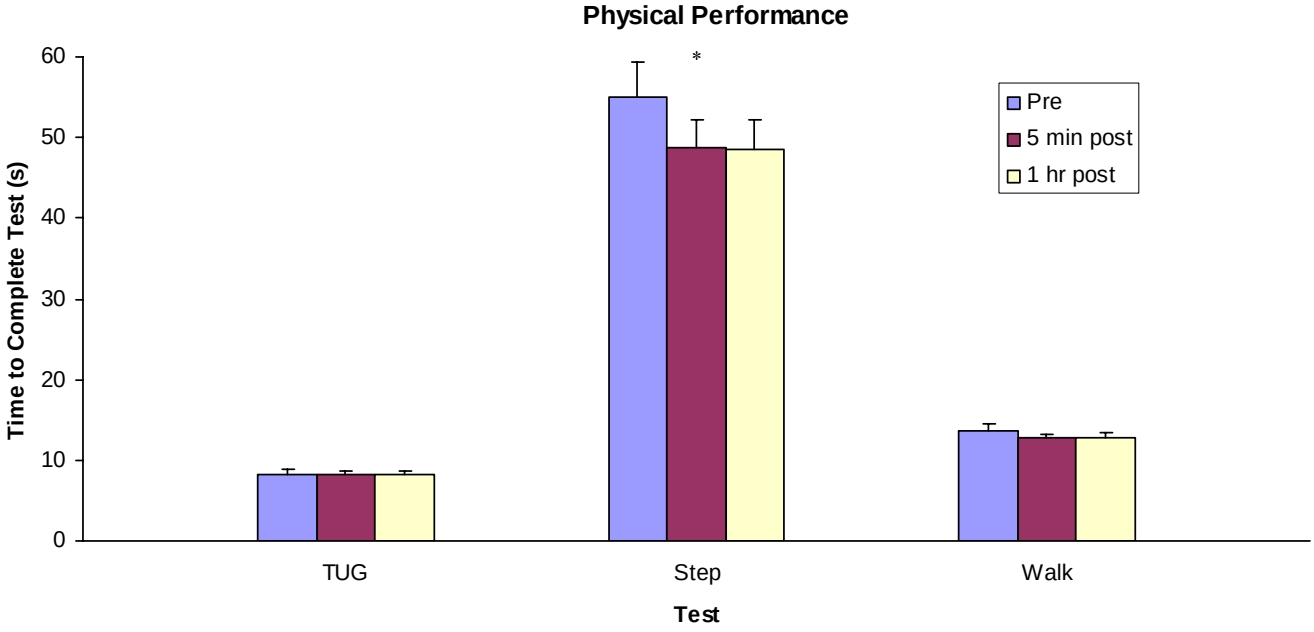

Figure 2: Mean and standard error (SE) before, 5 minutes after, and 1 hour after WBVT for the following tests: TUG, step, and walk. * - 5 min post values are significantly lower than pretest values ($P < .05$).