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Whole body vibration therapy for painful diabetic peripheral neuropathy: A pilot study

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Summary The unsatisfactory results associated with conventional treatments for symptoms of diabetic peripheral neuropathy (DPN) demonstrate a need for research into alternative therapies. The purpose of this study was to determine the efficacy of whole body vibration therapy (WBV) as a treatment for pain associated with DPN. Participants ($n = 8$) with painful DPN received three treatment sessions per week for four weeks. Each session consisted of four bouts of 3 min of vibration (frequency 25 Hz, amplitude 5 mm). The primary outcome measures were changes in the visual analog pain scale (VAS) and changes in the neuropathic pain scale (NPS). WBV demonstrated a significant ($p < 0.05$) acute pain reduction in the VAS, and a significant chronic reduction in both the VAS and NPS scales. No side-effects were observed during this study. WBV appears to be an effective, non-invasive treatment for pain associated with DPN.

Introduction

Diabetic Peripheral Neuropathy (DPN) is one of the most prevalent complications of diabetes, with a prevalence of 60–70% in the diabetic population (CDC, 2011). The most common form, peripheral small fiber neuropathy, is characterized by damage to the primary afferent nociceptors due to chronic hyperglycemia (Tolle et al., 2006). This damage causes peripheral sensitization, leading to central neuron hyperexcitability and spontaneous nerve impulse generation, presenting as chronic pain (Tolle et al., 2006; Veves et al., 2009).

Research into treating DPN is scarce due to the complicated nature of neurological pathologies (CDC, 2011; Veves et al., 2009; Mao et al., 2011; Meyer-Rosberg et al., 2001). Currently, the only type of treatment available for DPN is pharmaceutical: tricyclic antidepressants, anticonvulsants, antiarrhythmics, NMDA receptor antagonists, opioid analgesics, and non-prescription NSAID's which are purely

Abbreviations: WBV, Whole body vibration, DPN, Diabetic peripheral neuropathy; NPS, Neuropathic pain scale, VAS, Visual analog scale.

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palliative (Vinik et al., 2008; Veves et al., 2009; Guastella and Mick, 2009; Tolle et al., 2006; Possidente and Tandan, 2009). Furthermore, the efficacy of available phamaceutical intervention is limited, with practitioners reporting 90% of patients requiring two or more medications. Despite a high prescription compliance (75%) only 27% of patients were satisfied with pharmaceutical treatments (Tolle et al., 2006; Possidente and Tandan, 2009). Thus, current pharmaceutical options are not sufficient for the treatment of DPN.

Whole body vibration therapy (WBV) is an experimental modality for pain associated with DPN. WBV uses acoustic energy to generate controlled, vertical oscillation of a platform on which a person can stand. This has been shown to cause reductions in neuropathic pain symptoms while displaying few contraindications. It can easily be made accessible to large populations due to the minimal training required to administer. These qualities indicate that WBV could be an efficacious treatment for DPN.

Currently two published case studies support the efficacy of WBV as a treatment for DPN (Hong et al., in press; Hong, 2010). Both report significant decreases in pain levels measured in the visual analog pain scale (VAS), showing participants experiencing acute and chronic reductions in pain. WBV is the only therapy shown to produce a chronic effect, motivating future research.

The prevalence of DPN and limitations of current pharmaceutical treatments make evident the need for non-pharmaceutical and non-invasive treatments, which are accessible to large populations. WBV has demonstrated potential as a treatment for DPN in preliminary studies and meets these requirements, warranting future research. The purpose of this study was to apply the treatment from previous case studies to a larger participant group, further testing the efficacy of WBV as a treatment for DPN (Hong et al., in press; Hong, 2010).

Methods

Twelve participants diagnosed with type I or II diabetes and peripheral neuropathy were recruited from local hospitals, pain clinics, rehabilitation centers and diabetic support groups. Participants were considered to be neuropathic if they had been diagnosed by a licensed practitioner and had at least one painful episode per week. Eight participants, six males and two females (56.12 $\pm$ 6.78 yrs, 163.43 $\pm$ 8.79 cm and 74.51 $\pm$ 4.29 kg), completed the 4-week treatment cycle. Four participants who were inducted into the study did not return for the treatment period. Participants were excluded who had sustained spinal or lower leg injuries (hip, knee and ankle) in the 12 months preceding the study. Written informed consent was obtained from each participant before the study. This study was approved by the Institutional Review Board at Willamette University.

Participants were instructed to maintain pre-treatment medication and physical activity levels throughout the study, which were recorded at each treatment session, no significant changes were reported. All participants reported taking either gabapentin (Neurontin), opiate analgesics and/or NSAIDs to control their pain symptoms, no participants reported satisfaction from these treatments.

Over the 4-week study, each participant received four, 3-min bouts of whole body vibration, at a frequency of 25 Hz and amplitude of 5 mm, three times per week. For each treatment session, participants stood on the vibration platform with their knees bent at 20° to the vertical with 30 s of rest between bouts.

Changes in pain were assessed using the Neuropathic Pain Scale (NPS), which was tested each week during treatment as well as after the final treatment. Pre and post treatment pain was evaluated using a 0—10 VAS at every treatment session. To further examine the chronic effects of vibration, the participants were asked to report how long (in hours) pain was reduced after each treatment. This was recorded at the following treatment, 42—72 h later.

Statistical analysis

The Normality test (Shapiro—Wilk) was performed on each variable. One way repeated measure analysis of variance (ANOVA) was used to detect whether there was a difference between baseline, midpoint and final. The Holm—Sidak test was used for pairwise comparisons when differences between the tests (baseline, midpoint and final) were found. Alpha was set at 0.05 for significance and Sigmaplot 11 (Systat Software Inc, San Jose, CA) was used for statistical analysis.

Results

The graph in Fig. 1 shows that there was a significant acute decrease in VAS, as well as a chronic decrease following 4 weeks of whole body vibration therapy, both of which were found to be significant ($p = 0.018$ and <0.001 respectively) (Fig. 1) and a significant increase in the duration of pain reduction over the 4 week study period (Fig. 2). There were significant decreases in several variables on the neuropathic pain scale: intense, sharp, hot, sensitive, unpleasant and deep pain (Fig. 3) ($p < 0.05$). No significant difference was observed for the NPS variables dull, cold, itchy and surface pain ($p > 0.05$) Fig. 4.

Discussion

The results of this study indicate WBV caused a significant reduction in both acute and chronic pain in individuals suffering from diabetic peripheral neuropathy. These results are consistent with previous findings (Hong et al., in press; Hong, 2010).

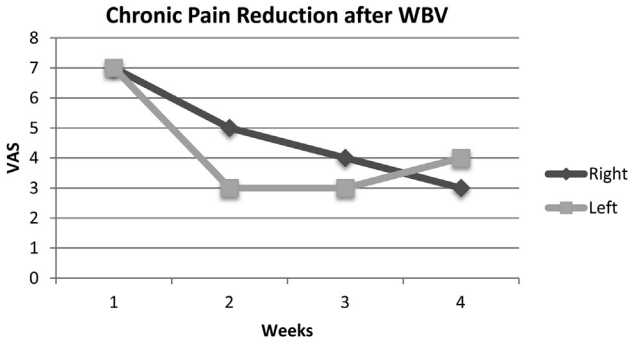

Figure 1 Changes in pain perception before WBV treatment over the study period.