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# Effect of whole-body vibration versus Kinesio tape on nerve conduction in patients with diabetic peripheral neuropathy

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**Abstract:** The goal of this research was the efficacy of whole-body vibration (WBV) versus Kinesio tape on nerve conuction in the elderly with diabetic peripheral neuropathy (DPN). Participants were divided into two groups at random: one for WBV and the other for Kinesio tape.

Methods**:** 60 participants with DPN, divided into two groups of thirty subjects each, were randomly assigned. WBV, balance, and resistance training were given to group A, while Kinesio tape, balance, and strength training were given to group B. The mean ± SD age of groups A and B were 55.33 ± 3.29 and 54.67 ± 3.62 years, respectively. Data on nerve conduction velosity, amplitude and latency for sural and deep peroneal nerve were collected from both groups both prior to and following the therapy regimen.

**Results:** There is no significant improvement in nerve conduction study in both group A and B After six weeks later, post-treatment ($p < 0.05$).

**Conclusion: t**he study found that after six weeks of intervention, there was no significant improvement in nerve conduction velocity, amplitude, or latency in both the whole-body vibration (WBV) group and the Kinesio tape group for participants with diabetic peripheral neuropathy (DPN).

**Keywords. *d****iabetic peripheral neuropathy, kineso tape, whole body vibration, nerve conduction***

**Introduction:**

Globally, the pancreas produces insufficient insulin or does not produce it effectively enough, which results in unstable blood glucose levels. This amounts to about 100 million people, or 6% of the population, suffering from diabetes mellitus (DM). Critical body systems like blood vessels, eyes, kidneys, hearts, and nerves are severely harmed by this illness (1).

Diabetic peripheral neuropathy (DPN) is one of the most common neurological complications associated with diabetes mellitus (DM), and its incidence varies depending on the type, duration, and specific neuropathic manifestations of the disease (2).

One important microvascular consequence of type 2 diabetes mellitus is diabetic neuropathy (DN). Though it typically appears ten years or so after type 1 diabetes mellitus (T1DM) first appears, it can also occasionally be noticed after the first diagnosis of type 2 diabetes mellitus (T2DM). Potential effects of DN include changes to the autonomic nervous system, leading to neurovegetative symptoms across multiple organs due to impaired sympathetic/parasympathetic signaling, and the somatic components of the peripheral nervous system, resulting in sensory and motor abnormalities (3).

Diabetes mellitus (DM)-related peripheral neuropathies frequently cause decreased muscle strength, impaired balance, aberrant gait patterns, and decreased ankle stability. These conditions can also affect hip movements during walking because they weaken the plantar flexor muscles (4).

Physical therapists are essential in the diagnosis and treatment of DPN, and rehabilitation intervention is a critical part of treating balance disturbance and strength. Whole-body vibration (WBV) has emerged as a viable therapy for controlling symptoms of DPN. by subjecting the body to regular mechanical vibrations (5).

Kinesio Tape (KT) has become well-known for its capacity to replicate the characteristics of human skin, support muscle function, ease discomfort, and realign misaligned joints and muscle fascia. When applied in different directions and with different tensions, KT improves sensorimotor stimulation and proprioception, which may lead to increased muscle recruitment and return of normal function.(6,7)

**Material and methods**

Design:

This research was planned as a pre-post, controlled, single-blind, randomized, prospective trial. Prior to the start of the experiment, each patient signed a consent form that comprised a thorough overview of the procedures and advantages of the study along with a confidentiality assurance. Human usage analysis complies with all applicable institutional rules and national standards. Additionally, it complies with the human use study and has been authorized by the ClinicalTrials.gov NO: (P.T.REC/012/005322) and the Ethics Committee of the Physical Therapy Faculty of Cairo University in Egypt (No. P.T.REC/012/005322).

Participants:

This clinical trial was randomized and comprised Thirteen male and twenty-nine female diabetic patients with peripheral polyneuropathy were included in this investigation. They belonged to the 50–60 age range. The participants were selected from the El Mansoura outpatient internal medicine department of the Mansoura University Hospital.

Patient selection criteria: The patients with type 2 diabetes were chosen using the following criteria.(1);(2) who had been diagnosed for at least ten years;(3) controlled blood glucose level measured by glycated hemoglobin

test (hba1c less than 9 and more than 6.5); e of patient will range from 50 to 60 years; Patients had abnormal nerve conduction study. The exclusion criteria were(1)presence of foot ulcers or infections; (2) medical or surgical conditions restricting functional mobility;(3) non-ambulatory status;(4) unwillingness to participate; (5)diagnosis of Type 1 or gestational diabetes;(6) serious illness; (7)history of lower limb fractures or trauma;(8) significant hepatic or renal issues; (9) BMI exceeding 30 kg/m².

Randomization:

Each participant signed a formal permission form after being fully informed about the purpose, nature, and benefits of the research, as well as their right to refuse participation at any time and the confidentiality of all information collected. Using sealed opaque envelope techniques and the letters A, B, or C, subjects were randomly assigned to two groups prior to the start of the trial. Numbered envelopes were used to hide the distribution. Randomization was carried out in blocks to ensure an equal number of participants in each group. To ensure anonymity, every piece of data was digitalized. After randomization, there were no dropouts.

Interventions:

Participants in group A received WBV, balance, and resistance exercise program three times per week, for 6 weeks and group B received Kinesio tape, balance, and strength exercise. Therapeutic sessions were conducted three times weekly over a six-week period, with Kinesio tape reapplication occurring every fifth day.

*Balance exercise program*

Each session of exercise comprised 10 min of warm-up, 40min of balance exercise, and 5min of cool down. Warm-up included treadmill walking. Balance exercise comprised two sets of sit to stand, one leg stance, tandem stance and 30 squats. The first set of exercises were performed on a stable surface, where as the second set of exercises was performed on an unstable surface . Each set of each exercise will be performed for 3min, with 1–2min of rest in between the exercises. Cool-down included deep breathing, abdominal breathing, and mild stretching**. (8)**

*Resistive exercise program:*

Resistive exercise were done according to patient's muscle strength. Patient were seated in sitting position and the weight sandbags were applied at the dorsum of the foot. The resistance was set to be around 40%-60% of the 1RM. The patient will performed the exercise for 3 bouts, every bout 10 repetitions. The one repetition maximum (1RM) was established prior to the training period using the following equation: 1 RM = Weight (kg) X (1 + {0.033 X number of repetitions)} **(9)**

Whole-body vibration:

Participants in group A received whole body vibration training were performed under the supervision of a researcher. Subjects were asked to stand barefoot on the vibratory platform with an even distribution of weight on both feet and familiarized with WBV at a lesser frequency and amplitude. Then, they were asked to bend their knee 30º to the vertical; thereafter, to obtain a greater muscular response, WBV training were performed at a frequency

of 30 Hz and an amplitude of 2mm. The exercise comprised five bouts of a 30-sec vibration with a 1-min elapse between the bouts, three times per week, for 6 weeks **(10)**

Kineso tape:

Participants in Group B recived Kineso tape as a therapeutic method that were applied to dorsiflexors for 24 hours a day and was replaced every 5 days for patients were taped as in accordance to Kenzo Kase's Kinesio taping Manual. For taping, each patient's leg were place in a relaxed position while he sits on a taping table. The skin should be free of oils and lotions; to avoid anything that may limits the acrylic adhesive's ability to adhere to the skin. So, the subject's skin was cleaned with alcohol prior to tape application; Tibialis anterior; I tape was measured from the muscle origin to the insertion while the muscle was stretched. The base of the tape was applied to the origin at the lateral condyle and superior 2/3 of anterolateral surface of tibia. Then the subject was asked to stretch the foot into planter flexion and eversion; taping was then finished toward the insertion at the medial and plantar surface of medial cuneiform; base of the first metatarsal. (**9)**

Outcome measures

All outcome measures of nerve conduction velocity study in deep peroneal and sural nerve measured electrophysiological parameter (amplitude, latency and velocity) were evaluated for both groups before and after the 6 -week treatment.

**Statistical analysis**

**Statistical analysis**

Unpaired t-test was conducted for comparison of age between groups and Chi- squared test was used for comparison of sex distribution. Normal distribution of data was checked using the Shapiro-Wilk test. Levene’s test for homogeneity of variances was conducted to test the homogeneity between groups. Two-way mixed MANOVA was performed to compare within and between groups effects on deep peroneal and sural nerves amplitude, latency and NCV. Bonferroni corrections were carried out for subsequent multiple comparison. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social sciences (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

**- Results**

- Subject characteristics:

Table (1) shows the subject characteristics of group A and B. There was no significant difference between groups in age, weight, height, BMI and sex distribution ($p > 0.05$).

Table 1. Comparison of subject characteristics between study and control groups:

| | **Group A** | **Group B** | **p-value** |
|---|---|---|---|
| **Age (years)** | 55.33 ± 3.29 | 54.67 ± 3.62 | 0.46 |
| **Sex, n (%)** | | | |
| Females | 14 (47%) | 15 (50%) | 0.79 |
| Males | 16 (53%) | 15 (50%) | |

SD, Standard deviation; t, unpaired t value; $\chi^2$, Chi squared value; p value, Level of significance.

Effect of treatment on deep peroneal and sural nerves amplitude, latency and NCV:

Two-way mixed MANOVA revealed that there was no significant interaction of treatment and time ($F = 0.51$, $p = 0.90$). There was no significant main effect of time ($F = 1.54$, $p = 0.15$). There was no significant main effect of treatment ($F = 0.87$, $p = 0.59$).

**Within group comparison**

There was no significant change in right and left deep peroneal and sural nerves amplitude, latency and NCV of group A and B between pre and post treatment ($p > 0.05$). (Table 2-3).

**Between group comparison**

There was no significant difference between groups pre treatment ($p > 0.05$). There was no significant difference in right and left deep peroneal and sural nerves amplitude, latency and NCV between group A and B post treatment ($p > 0.05$). (Table 2-3)

Table 2. Mean right and left deep peroneal amplitude, latency and NCV pre and post treatment of group A and B:

| | **Pre treatment** | **Post treatment** | | | |
|---|---|---|---|---|---|
| | **Mean ±SD** | **Mean ±SD** | **MD** | **% of change** | **p value** |
| **Right deep peroneal amplitude (uV)** | | | | | |
| **Group A** | 2.96 ± 0.31 | 2.97 ± 0.32 | -0.01 | 0.34 | 0.31 |
| **Group B** | 2.97 ± 0.32 | 2.99 ± 0.31 | -0.02 | 0.67 | 0.10 |
| **MD** | -0.01 | -0.02 | | | |

| | | | | | |
|---|---|---|---|---|---|
| | ***p = 0.91*** | ***p = 0.86*** | | | |
| **Left deep peroneal amplitude (uV)** | | | | | |
| **Group A** | 2.93 ± 0.41 | 2.94 ± 0.41 | -0.01 | 0.34 | 0.18 |
| **Group B** | 2.96 ± 0.32 | 2.97 ± 0.31 | -0.01 | 0.34 | 0.25 |
| **MD** | -0.03 | -0.03 | | | |
| | ***p = 0.74*** | ***p = 0.74*** | | | |
| **Right deep peroneal latency (msec)** | | | | | |
| **Group A** | 5.49 ± 0.48 | 5.50 ± 0.50 | -0.01 | 0.18 | 0.16 |
| **Group B** | 5.34 ± 0.44 | 5.36 ± 0.42 | -0.02 | 0.37 | 0.12 |
| **MD** | 0.15 | 0.14 | | | |
| | ***p = 0.22*** | ***p = 0.21*** | | | |
| **Left deep peroneal latency (msec)** | | | | | |
| **Group A** | 5.40 ± 0.77 | 5.42 ± 0.76 | -0.02 | 0.37 | 0.14 |
| **Group B** | 5.42 ± 0.68 | 5.43 ± 0.71 | -0.01 | 0.18 | 0.47 |
| **MD** | -0.02 | -0.01 | | | |
| | ***p = 0.90*** | ***p = 0.94*** | | | |
| **Right deep peroneal NCV (m/sec)** | | | | | |
| **Group A** | 36.09 ± 5.57 | 36.18 ± 5.40 | -0.09 | 0.25 | 0.43 |
| **Group B** | 37.82 ± 4.69 | 37.98 ± 4.58 | -0.16 | 0.42 | 0.15 |
| **MD** | -1.73 | -1.8 | | | |
| | ***p = 0.20*** | ***p = 0.17*** | | | |
| **Left deep peroneal NCV (m/sec)** | | | | | |
| **Group A** | 35.72 ± 5.42 | 35.81 ± 5.34 | -0.09 | 0.25 | 0.58 |
| **Group B** | 36.30 ± 5.51 | 36.47 ± 5.58 | -0.17 | 0.47 | 0.26 |
| **MD** | -0.58 | -0.66 | | | |
| | ***p = 0.68*** | ***p = 0.64*** | | | |

**SD, Standard deviation; MD, Mean difference; p value, Probability value.**

**Table 3. Mean right and left sural amplitude, latency and NCV pre and post treatment of group A and B:**

| | **Pre treatment** | **Post treatment** | | | |
|---|---|---|---|---|---|
| | **Mean ±SD** | **Mean ±SD** | **MD** | **% of change** | **p value** |
| **Right sural amplitude (uV)** | | | | | |
| **Group A** | 2.09 ± 0.24 | 2.13 ± 0.26 | -0.04 | 1.91 | 0.21 |

| | | | | | |
|---|---|---|---|---|---|
| **Group B** | 2.07 ± 0.30 | 2.09 ± 0.24 | -0.02 | 0.97 | 0.43 |
| **MD** | 0.02 | 0.04 | | | |
| | ***p = 0.74*** | ***p = 0.55*** | | | |
| **Left sural amplitude (uV)** | | | | | |
| **Group A** | 2.05 ± 0.16 | 2.08 ± 0.22 | -0.03 | 1.46 | 0.25 |
| **Group B** | 2.07 ± 0.21 | 2.11 ± 0.23 | -0.04 | 1.93 | 0.24 |
| **MD** | -0.02 | -0.03 | | | |
| | ***p = 0.58*** | ***p = 0.64*** | | | |
| **Right sural latency (msec)** | | | | | |
| **Group A** | 4.94 ± 0.23 | 4.96 ± 0.25 | -0.02 | 0.40 | 0.35 |
| **Group B** | 4.98 ± 0.25 | 4.97 ± 0.29 | 0.01 | 0.20 | 0.78 |
| **MD** | -0.04 | -0.01 | | | |
| | ***p = 0.55*** | ***p = 0.86*** | | | |
| **Left sural latency (msec)** | | | | | |
| **Group A** | 4.96 ± 0.31 | 4.98 ± 0.33 | -0.02 | 0.40 | 0.51 |
| **Group B** | 4.95 ± 0.27 | 4.96 ± 0.29 | -0.01 | 0.20 | 0.78 |
| **MD** | 0.01 | 0.02 | | | |
| | ***p = 0.93*** | ***p = 0.82*** | | | |
| **Right sural NCV (m/sec)** | | | | | |
| **Group A** | 38.60 ± 1.90 | 38.67 ± 2.01 | -0.07 | 0.18 | 0.30 |
| **Group B** | 38.70 ± 1.75 | 38.78 ± 1.88 | -0.08 | 0.21 | 0.23 |
| **MD** | -0.1 | -0.11 | | | |
| | ***p = 0.83*** | ***p = 0.82*** | | | |
| **Left sural NCV (m/sec)** | | | | | |
| **Group A** | 38.28 ± 1.22 | 38.42 ± 1.43 | -0.14 | 0.37 | 0.50 |
| **Group B** | 38.81 ± 1.90 | 38.50 ± 1.47 | 0.31 | 0.80 | 0.12 |
| **MD** | -0.53 | -0.08 | | | |
| | ***p = 0.21*** | ***p = 0.84*** | | | |

**SD, Standard deviation; MD, Mean difference; p value, Probability value.**

## Discussion

The main objective of the study is to evaluate the effects of kinesio taping versus WBV on nerve conduction in patient with peripheral neuropathy. The results of this investigation show that this non signficant improvement occur in kineso tape group and whole body vibration group for older patients with DPN and also there no signficant diffrence between two groups A&B

This study confirmed with Games et al. (2013), who investigated the impact of whole body vibration on the neurological and circulatory systems of the lower extremities and reported that there was no significant difference in sural sensory nerve conduction velocity. There was a non-significant improvement in nerve conduction in whole body vibration group (A). (14)

The results of this investigation showed that KT tactile stimulation of the skin has no effect at all on the conduction velocities of motor neurons. The kineso tape group (B) showed a non-significant improvement in nerve conduction. This study was supported by Lee et al., (2011), who studied Kinesio Taping's Effect on the Velocity of Motor Neuron Conduction and stated that the motor nerve conduction velocity, amplitude, and latency did not significantly alter with or without KT.(15)

Still, there were certain limition with the study. Due to the study's limited participant size, the findings may not be as applicable to the greater number of people with diabetic peripheral neuropathy.The study only included a six-week follow-up period. Since DPN is a chronic illness, the short-term effects of WBV and KT cannot fully be represented. This makes it more difficult to evaluate long-term advantages or potential side effects that could develop later on, such as neuropathy and Patients with varied durations of diabetes and severity of DPN were included in the study population.It's possible that this heterogeneity threw off the results, making it challenging to identify which patients would gain the most from each intervention.

Conclusion:

This study aimed to compare the effects of whole-body vibration (WBV) and Kinesio tape (KT) on nerve conduction in elderly individuals with diabetic peripheral neuropathy (DPN). After six weeks of intervention, no significant improvement was observed in nerve conduction velocity, amplitude, or latency in either the WBV group or the KT group. Additionally, no significant differences were found between the two groups. These findings suggest that neither WBV nor KT, when combined with balance and strength training, significantly improve nerve conduction in DPN patients over a short-term period. Further studies with larger sample sizes and longer follow-up durations are needed to assess the potential long-term effects of these interventions.

**Reference**

1- Aruoah MK, Al-Jowari SA. The effects of zinc and vitamin C supplementation on the glycemic profile in type 2 diabetic patients. Iraqi Journal of Science. 2022 Jan 30:70-6.

2- Ullah S, Hunain Al Arabia D, Rathore FA. Multi-disciplinary rehabilitation for management of diabetes mellitus related neurological and musculoskeletal complications. JPMA. The Journal of the Pakistan Medical Association. 2022 Feb 1;72(2):380-2.

3- Galiero R, Caturano A, Vetrano E, et al. Peripheral neuropathy in diabetes mellitus: pathogenetic mechanisms and diagnostic options. International Journal of Molecular Sciences. 2023 Feb 10;24(4):3554.

4-du Plessis R, Dembskey N, Bassett SH. Effects of an isometric exercise training program on muscular strength, ankle mobility, and balance in patients with diabetic peripheral neuropathy in the lower legs in South Africa. International Journal of Diabetes in Developing Countries. 2023 Apr;43(2):252-7.

5-Kessler NJ, Lockard MM, Fischer J. Whole body vibration improves symptoms of diabetic peripheral neuropathy. Journal of Bodywork and Movement Therapies. 2020 Apr 1;24(2):1-3.

6-AHMED AE, MOHAMED NI, MARIAM EM, Ahmed M. Effect of kinesiotape versus resistive exercise on dorsiflexors functional performance in diabetic peripheral neuropathy. The Medical Journal of Cairo University. 2020 Sep 1;88(September):1777-82.

7-Lazarus C. The Use of Kinesio® Tape for the Treatment of Foot Drop in a Patient with (Doctoral dissertation. Florida Gulf Coast University. 2013..

8-Waheed A, Azharuddin M, Ahmad I, Noohu MM. Whole-body vibration, in addition to balance exercise, shows positive effects for strength and functional ability in patients with diabetic peripheral neuropathy: A single-blind randomized controlled trial. Journal of Diabetology. 2021 Oct 1;12(4):456-63.

9- Giri HS, Borkar P. Effects of sensory stimulation on balance and postural control in diabetic neuropathy: systematic review. International Journal of Research in Medical Sciences. 2021 Jul;9(7):2090.

10- Yoosefinejad AK, Shadmehr A, Olyaei G, et al . The effectiveness of a single session of Whole-Body Vibration in improving the balance and the strength in type 2 diabetic patients with mild to moderate degree of peripheral neuropathy: a pilot study. Journal of bodywork and movement therapies. 2014 Jan 1;18(1):82-6.

11-Khanal P, He L, Stebbings GK, Onambele-Pearson GL, et al . Static one-leg standing balance test as a screening tool for low muscle mass in healthy elderly women. Aging clinical and experimental research. 2021 Jul;33:1831-9.

12- Neuls PD, Clark TL, Van Heuklon NC, Proctor JE, et al . Usefulness of the Berg Balance Scale to predict falls in the elderly. Journal of geriatric physical therapy. 2011 Jan 1;34(1):3-10.

13- Greene BR, McManus K, Ader LG, Caulfield B. Unsupervised assessment of balance and falls risk using a smartphone and machine learning. Sensors. 2021 Jul 13;21(14):4770.

14- Games KE, Sefton JM. Whole-body vibration influences lower extremity circulatory and neurological function. Scandinavian journal of medicine & science in sports. 2013 Aug;23(4):516-23.

15-Lee MH, Lee CR, Park JS, Lee SY, Jeong TG, Son GS, Lee JY, Kim EC, Kim YK. Influence of kinesio taping on the motor neuron conduction velocity. Journal of Physical Therapy Science. 2011;23(2):313-5.