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Effects of Kinesio Tapping on Diabetic Peripheral Neuropathy Symptoms in Type II Diabetes

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Abstract

Background: Diabetes Mellitus (DM) is a major health concern in the 21st century. Diabetes' most common complication is diabetic peripheral neuropathy (DPN). Physiotherapy and Kinesio tapping help diabetics relieve pain, improve quality of life, and reduce opioid dependency.

Aim of Study: Was to evaluate the effect of Kinesio taping on peripheral neuropathy symptoms in patients with type II diabetes.

Material and Methods: Sixty adult diabetic patients who were diagnosed with peripheral polyneuropathy since 7 years of both sexes (28 male and 32 female) participated in this study. Their age ranged from 50- and 60 years. The participants were selected from The National Institute of Diabetes and Endocrinology in Cairo, Egypt. The practical work was done from May 2021 to January 2022. Patients were randomly distributed into two equal groups in number. Group (A): (Study group) consisted of thirty patients (12 male and 18 female) treated by Kinesio taping in addition to traditional exercise therapy. The 12-week traditional exercise program consisted of 3 sessions per week and Kinesio taping was applied once a week. Group (B): (Control group) consisted of thirty patients (16 male and 14 female) who were treated with traditional exercise therapy of both lower limbs; The programmes were run three times a week for a total of 12 weeks. The evaluation was done by testing muscle tone before and after the treatment and the following questionnaires; visual analog scale for pain (VAS), neuropathy symptom score (NSS), and Neuropathy disability score (NDS), and functional screening.

Results: Group A (study group) was higher the overall improvement for VAS, NSS, NDS and FMS with percentage by 73.07% than group B (control group) by 28.62.

Conclusion: Kinesio tapping is effective when added to the traditional exercise therapy for polyneuropathy diabetic patients.

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Key Words: *Diabetes mellitus – Diabetic peripheral neuropathy – Kinesio taping.*

Introduction

DIABETES is a chronic metabolic disorder caused by inadequate insulin production or function, resulting in poor glycemic control and hyperglycemia [1].

Diabetic peripheral neuropathy (DPN) is one of the most prevalent consequences of diabetes, affecting 30% to 50% of people with type 2 diabetes [2].

Controlling blood glucose levels and managing high blood pressure and cholesterol levels within the desired range is the first step of treatment for people with diabetes. Controlling blood glucose levels can help prevent diabetic neuropathy. Reducing pain and managing some of the symptoms is one of the most significant parts of treatment. Some medicines and kinds of physical therapy, in addition to other treatments, can help alleviate the pain of diabetic neuropathy **[3]**.

Physical therapists play an important role in the diagnosis and treatment of DPN, and rehabilitative intervention is an important part of neuropathic pain management **[4]**.

Exercise has several health advantages, including lowering blood pressure, improving organ perfusion, lowering lipid and protein oxidation, and reducing humoral inflammation. Exercise can assist to relieve neuropathy pain and symptoms **[5]**.

In addition to other physical therapy supervised exercise protocols and the other physical therapy

modalities, Kinesio tapping is used. Muscle mobility has been shown to improve, discomfort has been reduced, muscle fascia and joint misalignments have been corrected, and muscle function has been restored with KT. Kinesio tape promotes dynamic stability by providing sensorimotor stimulation, which can improve muscle activation depending on the direction and tension of the tape, as well as enhance proprioception **[6]**.

Material and Methods

Subjects:

Sixty adult diabetic patients who were diagnosed with peripheral polyneuropathy of both sexes (28 male and 32 female) participated in this study. Their age ranged between 50-60 years. The participants were selectedfrom The National Institute of Diabetes and Endocrinology in Cairo, Egypt.

Ethical consideration:

Ethical considerations: Human use analysis has complied with all applicable national regulations and institutional policies, followed the human use study.

The tenets of the Helsinki Declaration and the acceptance of the ethical declaration physical Therapy Faculty of Committee, Cairo University, Egypt was achieved (No.P.T.REC/012/002441).

All patients had signed a consent form before starting the study with full illustration of the steps and benefits of the study. Confidentiality were assured.

Selection criteria for patients:

Inclusion criteria:

The following criteria were used to select Patients who have diabetes not less than 7 years and diagnosed as diabetic peripheral neuropathy, based on clinical examination and questionnaires. Adult male and female patients participated in the study. Their age ranged from 50-60 years old. Their Hb1Ac was 6.5.BMI less than 34.

Exclusion criteria:

If one of the following criteria was met, the potential participants were ruled out. Presence of malignant disease, Patients with acute infection, Patients with a hemodynamic problem, Uncontrolled diabetes mellitus, Diabetic patient with knee osteoarthritis, Diabetic patient have had a surgical lumberoperation. Allergic reaction to kinesio tapping and Diabetic patient who take peripheral neuropathy medication as analgesics.

Group A: Consisted of 30 diabetic patients of both sexes (12 male and 18 female) who received kinesio tapping in addition to traditional exercise therapy (Hamstring stretch, knee to chest stretch, sciatic nerve glide, calf stretch, ankle range of motion exercises, toe curls, toe splays, bipedal toe and heel raise, uni-pedal toe raises and heel rises, bipedal ankle inversion and eversion, wall slides, uni-pedal balance for time) and Group B: Consisted of 30 diabetic patients of both sexes (16 male and 14 female) receiving traditional exercise therapy for diabetic polyneuropathy. Treatment was carried out at a rate of 3 sessions per week for 12 weeks and kinesio tapping was applied once a week.

Measurement equipment:

All patients were evaluated by: Manual Muscle Testing (MMTs) for hip flexors and extensors, knee flexors and extensors and ankle dorsiflexors, plantar flexors, evertors and invertors and by using questionnaires: Visual Analog Scale for Pain (VAS), Neuropathy Symptom Score (NSS) for knowing level of muscle weakness, sensory disturbance and autonomic symptoms, Neuropathy Disability Score (NDS) for large fibre peripheral neuropathy affection, Functional screening indicates patient's domestic, self-care, behaviour and cognitive functioning.

Instructions for the patient as a home program:

- Each active stretch was done three times for set. Each time for 15 to 20sec holds and 10sec rest in between Two sets per day was done.
- Each exercise was done for 10-15 times repetitions and 2 repetitions on each leg twice a day.

Statistical analysis:

Data were screened, for normality assumption test and homogeneity of variance. Normality test of data using Shapiro-Wilk test was used, that reflect the data was normally distributed ($p>0.05$) after removal outliers that detected by box and whiskers plots. Additionally, Levene's test for testing the homogeneity of variance revealed that there was no significant difference ($p>0.05$). All these findings allowed to conducted parametric and non-parametric analysis. The data is normally distributed and parametric analysis is done. The statistical analysis was conducted by using statistical SPSS Package program version 25 for Windows (SPSS, Inc., Chicago, IL). Quantitative age, weight, height, BMI, VAS, NSS, NDS, and FMS-data are expressed as mean and standard deviation. For qualitative gender and muscle test data are expressed as number and percentage. To compare between both group by independent *t*-test for age

weight, height, and BMI variables and chi-square test for gender and muscle test variables. Multivariate analysis of variance (MANOVA) used to compare the tested major variables of interest at different tested groups and measuring periods. Mixed design 2 x 2 MANOVA-test was used, the first independent variable (between subject factors) was the tested group with 2 levels (group A vs. group B). The second independent variable (within subject factor) was measuring periods with 2 levels (pre- and post-treatment). Bonferroni correction test was used to compare between pairwise within and between groups of the tested variables which F was significant from MANOVA test. All statistical analyses were significant at level of probability ($p \leq 0.05$).

Results

In the current study, a total of 60 diabetes mellitus (Type II) patients from both genders (28 male and 32 female) were distributed randomly into two groups (30 patients/group). The results of patients demographic data (Table 1) showed that no significant differences ($p>0.05$) inage ($p=0.877$), weight ($p=0.337$), height ($p=0.601$), BMI ($p=0.558$), and gender ($p=0.361$) between-kinesio tapping group (Group A) and control group (Group B).

Statistical multiple pairwise comparison tests (time effect) for outcomes variableswithin each group (Table 2) showed that there were significantly ($p<0.05$) decreased in VAS and NDS at post-treatment compared to pre-treatment within group A ($p=0.0001$ and 0.0001, respectively) and group B ($p=0.0001$ and $p=0.016$, respectively). The NSS significantly ($p<0.05$) decreased at post-treatment within group A ($p=0.0001$), but no significant difference ($p>0.05$) was observed in NSS between pre- and post-treatment in group B ($p=0.733$). There was significantly ($p<0.05$) increased in FMS at post-treatment compared to pre-treatment within group A ($p=0.0001$) and group B ($p=0.0001$). These significant decreases in VAS, NSS, and NDS and increase in FMS at post-treatment is favorable of the kinesio tapping group (Group A) than the control group (Group B). Moreover, the kinesio tapping group (Group A) improved higher VAS, NSS, NDS, and FMS (74.58, 65.22, 76.32, and 76.16%, respectively) than control group (21.72, 2.75, 20.85, and 69.15%, respectively).

Statistical multiple pairwise comparison tests (group effect) for outcomes variables between both groups (Table 2) indicated no significant differences ($p>0.05$) at pre-treatment of VAS ($p=0.119$), NSS ($p=0.177$), NDS ($p=0.331$), and FMS ($p=0.660$) between group A and group B. However, there were significant differences ($p<0.05$) at post-treatment in VAS ($p=0.0001$), NSS ($p=0.0001$), and NDS ($p=0.0001$), but no significant difference ($p>0.05$) in FMS between group A and group B at post-treatment ($p=0.208$).

The comparative between pre- and post-treatment muscle test (right and left sides) within each group are presented in Table (3). The statistical analysis revealed that there was significant difference ($p<0.05$) in the muscle test distribution for right side within group A ($p=0.005$) and group B ($p=0.0001$). Moreover, muscle test distribution for left side significantly ($p<0.05$) affected by time effect within group A ($p=0.002$) and group B ($p=0.0001$).

The comparative between both groups at pre- and post-treatment muscle test (right and left sides) are presented in Table (4). The statistical analysis showed that the muscle test distribution not differ significantly ($p>0.05$) between group A and group B at pre-treatment in right side ($p=0.058$) and left side ($p=0.061$). However, there were significant differences ($p<0.05$) in the muscle test distribution between group A and group B at post-treatment in right side ($p=0.0001$) and left side ($p=0.0001$).

Table (1): Comparison of general characteristics between groups A and B.

Items	Groups		*p*-value
	Group A (n=30)	Group B (n=30)	
Age (year)	54.83±3.92	55.13±2.99	0.877
Weight (kg)	86.38±13.06	92.55±13.70	0.337
Height (cm)	165.38±7.68	167.45±8.87	0.601
BMI (kg/m^2)	31.61±4.81	33.16±6.09	0.558
Gender (males : females)	12 (40.00%) : 18 (60.00%)	16 (53.33%) : 14 (46.67%)	0.361

- Quantitative data (age, weight, height, and BMI) are expressed as mean ± standard deviation and compared by t-independent test.
- Qualitative data (gender) are expressed as number (percentage) and compared by chi-square test.
p-value: Probability value. NS: Non-significant.

Table (2): Mixed MANOVA within and between groups comparison for outcomes variables.

Variables	Items	Groups (Mean ± SD)		Change	*p*-value
		Group A (n=30)	Group B (n=30)		
VAS	Pre-treatment	8.38±1.59	7.55±0.82	0.83	0.119
	Post-treatment	2.13±0.35	5.91±1.30	3.78	0.0001*
	Change	6.25	1.64		
	Improvement %	74.58%	21.72%		
	p-value	0.0001*	0.002*		
NSS	Pre-treatment	5.75±1.58	6.55±0.93	0.80	0.177
	Post-treatment	2.00±0.92	6.73±1.42	4.73	0.0001*
	Change	3.75	0.18		
	Improvement %	65.22%	2.75%		
	p-value	0.0001*	0.733		
NDS	Pre-treatment	9.50±1.41	8.73±1.79	0.77	0.331
	Post-treatment	2.25±0.70	6.91±2.16	4.66	0.0001*
	Change	7.25	1.82		
	Improvement %	76.32%	20.85%		
	p-value	0.0001*	0.016*		
FMS	Pre-treatment	6.88±2.03	6.45±1.36	0.43	0.660
	Post-treatment	12.12±2.69	10.91±2.07	1.21	0.208
	Change	5.26	4.46		
	Improvement %	76.16%	69.15%		
	p-value	0.0001*	0.0001*		

VAS: Visual analogue scale for pain.
NSS: Neuropathy symptom score.
NDS: Neuropathy disability score.
FMS: Functional screening.
Data are expressed as mean ± standard deviation (SD).
p-value: Probability value.
*Significant ($p<0.05$).

Table (3): Comparison between pre- and post-treatment muscle test (right and left sides) within each group.

Items	Muscle test				
	Grade	Right side (n=30/group)		Left side (n=30/group)	
		Group A	Group B	Group A	Group B
Pre-treatment	3	22 (73.33%)	30 (100%)	26 (86.67%)	30 (100%)
	3+	8 (26.67%)	0 (0.00%)	4 (13.33%)	0 (0.00%)
	4	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Post-treatment	3	0 (0.00%)	5 (16.67%)	0 (0.00%)	5 (16.67%)
	3+	15 (50.00%)	20 (66.66%)	15 (50.00%)	25 (83.33%)
	4	15 (50.00%)	5 (16.67%)	15 (50.00%)	0 (0.00%)
p-value		0.005*	0.0001*	0.002*	0.0001*

Data are expressed as number (percentage). *p*-value: Probability value. S: Significant. *Significant ($p<0.05$).

Table (4): Comparison between both groups at pre- and post-treatment muscle test (right and left sides).

Items	Muscle test				
	Grade	Right side (n=30/group)		Left side (n=30/group)	
		Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Group A	3	22 (73.33%)	0 (0.00%)	26 (86.67%)	0 (0.00%)
	3+	8 (26.67%)	15 (50.00%)	4 (13.33%)	15 (50.00%)
	4	0 (0.00%)	15 (50.00%)	0 (0.00%)	15 (50.00%)
Group B	3	30 (100%)	5 (16.67%)	30 (100%)	5 (16.67%)
	3+	0 (0.00%)	20 (66.66%)	0 (0.00%)	25 (83.33%)
	4	0 (0.00%)	5 (16.67%)	0 (0.00%)	0 (0.00%)
p-value		0.058	0.0001*	0.061	0.0001*

Data are expressed as number (percentage). *p*-value: Probability value. S: Significant. *Significant ($p<0.05$).

Discussion

The main objective of the study is to evaluate the effect of kinesio taping on the symptoms of peripheral neuropathy in patients with type II diabetes.

A study done by Park et al., **[7]** to determine the effect of kinesio taping on ankle strength, movement and function in patients with common peroneal nerve paralysis stated thatafter kinesio taping application in PNP patients for 8 weeks, MMT (tibialis anterior, peroneus longus muscles) Active ROM (dorsiflexion, eversion), PPT (fibular head), and one-leg standing significantly increased. VAS decreased significantly also as the results of this work.

In a study conducted by Oğuz et al., **[8]** that support this study results in 22 patients diagnosed with knee osteoarthritis to compare the effect of exercise alone and in combination with kinesiotaping on pain and function in knee osteoarthritis. The patients in both groups (control group and experimental group) performed walking exercises for 6 weeks. In addition to physical training, the experimental group used KT with kinesiotape for 6 weeks. Patients' pain and functional status were assessed at rest before and after the procedure using the Visual Analogue Scale (VAS) and the Western Ontario McMasters Osteoarthritis Index (WOMaC). In both groups, post-procedure pain and function scores improved significantly (p<0.05), concluding that kinesiology taping improved pain and physical function and should be added to physiotherapy treatment protocols.

In Kluding et al., **[9,17]** subjects diagnosed with DPN participated in a study conducted to investigate the effect of a supervised moderate-intensity strength and aerobic exercise program on subjects with DPN. Measure pain (visual analog scale), Michigan Neuropathy Screening Instrument (MNSI) questionnaire on neuropathic symptoms, nerve function, and intraepidermal nerve fiber (IENF) density and skin biopsies of distal and proximal lower extremity. Pain was significantly reduced in (p=0.05) and neuropathic symptoms reduced (p=0.01) and increased intraepidermal nerve fiber branching was observed from a proximal skin biopsy after the procedure (p=0.008).

Ahmed et al., **[6]** applied kinsiotaping to 40 patients with DM and mild polyneuropathies to compare its effect with the effect of resistance exercise in type 2 DM. Muscle strength was assessed using a portable dynamometer which called hand-held dynamometer and the functional performance using the 6-minute walk test. Both kinesio tape and resistance exercise improve dorsiflexors muscles and functional performance without significant differences between them in dorsiflexor strength and functional performance in patients with diabetic polyneuropathy.

Consistent with the results of the study, a case report study by Gupta et al., **[10]** applied kinsiotaping in two cases of patients with chemotherapy-induced peripheral neuropathy (CIPN)-induced foot pain during hospitalization. Kinsiotaping was applied to each patient on the plantar surface of both feet up to the ankle with 0% stretch on the tape for 24-96 hours. Pain scores were reduced by >50% in both patients within 24 hours of use. This reflects a substantial improvement in pain with the ET intervention. This allowed for better tolerance when participating in functional mobility with an improvement in distances traveled.

Białoszewski et al., **[11]** studied 24 patients who underwent the Ilizarov procedure for lower limb lengthening and had thigh edema. They were divided into two groups. Both groups received normal physical therapy for 10 days, and the experimental group received additional KT treatment. They found a statistically significant decrease in thigh and leg circumference in both groups (p=0.02, p=0.03), with the experimental group showing greater significance than the control group, which received only regular lymphatic massages. However, they did not provide statistical data for comparative studies between the groups.

A case of meralgia paresthetica with symptoms of numbness, paresthesias, and pain in the anterolateral thigh was documented by Kalichman et al., **[12]**. Symptoms and quality of life were greatly improved after four weeks of adopting the KT technique.

The results of this study also agreed with Aktürk et al., **[13]** who compare the effectiveness of splints and kinesio (KT) tapes as treatment modalities for patients with mild to moderate idiopathic carpal tunnel syndrome (CTS) by assessing symptoms and measuring functional scope and electrophysiological findings. A significant improvement was observed in the KT group compared to the splint group in terms of electrophysiological changes and the functional status of the core.

In comparison of low-power laser therapy (LPLT) and kinesiotaping for the treatment of carpal tunnel syndrome, VAS and electroneuromyography were measured before and after treatment in a study by Akgol et al., **[14]**. Both groups im-

proved significantly in VAS pain, however, the LPLT group had significantly better VAS pain than the KT group. While median nerve distal motor latency and median nerve sensory conduction velocity were significantly improved by treatment in both groups, the improvement in the LPLT group was significantly better than that of the KT group.

In contrast, research published in 2004 by Halseth et al., **[15]** found that using Kinesio tape does not improve muscular power, proprioception, or functional performance in healthy people. Measurements of plantar flexion and inversion with 20 degrees of plantar flexion reproduction of joint position sense (RJPS) were performed using an ankle RJPS apparatus.

Conclusion:

Kinesio tapping is effective when added to the traditional exercise therapy for polyneuropathy diabetic patients.

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تأثير الكاينزيو تايبنج على أعراض التهاب الأعصاب الطرفية لمرضى الكسرى النوع الثانى

خطة الدراسة : تم تطبيق هذه الدراسة على ستين مريضاً من الذكور والإناث البالغين الذين يعانون من التهاب الأعصاب الطرفية المصاحب لمرض السكرى النوع الثانى. تراوحت أعمارهم من ٥٠ إلى ٦٠عام. تم اختيار المشاركين من تم اختيار المشاركين من المعهد القومى لأمراض السكر والغدد الصماء، القاهرة، مصر، تم توزيعهم عشوائياً على مجموعتين متساويتين فى العدد (المجموعة أ، المجموعة ب). المجموعة الأولى شملت ٣٠ مريضاً تم علاجهم بواسطة الشرائط الطبية الكاينزيو تايبنج إلى جانب تمارين علاجية للاطراف السفلية. المجموعة الثانية شملت ٣٠ مريضاً تم علاجهم بواسطة تمارين علاجية للاطراف السفلية فقط نفس ما تم للمجموعة (أ). استمر العلاج لمدة أسبوع بمعدل ٣ جلسات فى كل أسبوع وتطبيق الكاينزيو تايبنج مرة أسبوعياً.

وقد خضع الأشخاص فى كلتا المجموعتين للفحوصات التالية: إختبار قوة العضلات وإستبيانات تشمل مقياس الألم النظرى ومقياس أعراض إلتهاب الأعصاب الطرفية ومقياس درجة الإعاقة المصاحبة لإلتهاب الأعصاب الطرفية ومقياس للوظائف.

نتائج الدراسة : تم تحليل النتائج إحصائياً حيث أفادت الدراسة الحالية أنه بالنسبة للاستبيانات الزربعة المستخدمة كان هناك إنخفاض بفارق ذى دلالة إحصائية فى استبيان مقياس الألم النظرى واستبيان مقياس أعراض إلتهاب الأعصاب الطرفية واستبيان مقياس درجة الإعاقة المصاحبة لإلتهاب الأعصاب الطرفية ووجود فارق ذى دلالة إحصائية فى اختبار قوة العضلات فى مرحلة ما بعد العلاج مقارنة لما قبل العلاج فى صالح المجموعة (أ) مقارنة بالمجموعة (ب). بينما لم تكن هناك تغيرات ذى دلالة إحصائية بعد العلاج بالنسبة لاستبيان مقياس الوظائف مقارنة بما قبل العلاج فى المجموعتين (أ) و (ب).

وفقاً للنتائج الإحصائية السابقة التى تم الحصول عليها من الدراسة الحالية نستنتج أن الكاينزيو تايبنج هو تقنية آمنة للتطبيق يجب إضافتها إلى بروتوكولات علاج اعتلال الأعصاب الطرفية بمرض السكرى لأن له تأثير جيد جداً فى الحد من آلام التهاب الأعصاب وأيضاً له تأثير كبير على تحسين أعراض الاعتلال العصبى السكرى والوظائف الحركية بالجسم. إضافته تعد مساعدة فى التخطيط لنظام علاجى مثالى لعلاج مرض السكرى واعتلال الأعصاب الطرفى المتعدد.