

New Smart Noval Approach to Relieve/Reverse Peripheral Vasculo-Neuritis and Stress in Type 2 Diabetes Mellitus Patients

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Abstract

Pathophysiology of peripheral vasculo neuritis are due to narrowing of capillaries and small vessels leads to reduction of blood flow to the feet and nerve fibres. Ultimately skin devoid of enough blood supply and peripheral nerves gets damaged resulting in foot ulcer, numbness, unawareness of slipper and burning sensation that leads to severe stress. Resulting in insulin resistance and become uncontrolled diabetes. Inspite of different modules of approach to treat stress and neuritis by means of pharmacological, diet and exercise but all in vain. This study analysed, effect of Smart Noval Vibration Footwear (based on foot reflexology) to improve the foot sensitivity, Blood flow and stress modulation in type 2 diabetes. The study includes both control and diabetic patients (35 male and 15 female) selected to participate for a month, pt advised to walk with vibrating slipper for 30 minutes daily for a month. All signs of pre and post study reveal blood flow to the skin, neurological sign and symptoms of peripheral neuropathy was significantly relieved/reversed back to normal within a month. Apart from this the Mental Stress relieved. Patient feels well-being, and blood sugar level comes down dramatically. All diabetic and control people also feel pleasure and get good sleep by wearing this noval slipper.

Keywords: Diabetes mellitus • Vibration • Skin blood flow • Micro circulation • Peripheral nerve stimulation • Stress

Introduction

The most commonest and serious complication of diabetics is peripheral neuritis and foot ulcers [1]. Handling diabetes especially with peripheral neuritis apart from healthy lifestyle (nutrition and exercise) along with pharmacological interventions [2,3]. The management requires patient co-operation to implement this treatment programme but inspite of all the management the glycaemic control is yet to achieve normal. Previous studies shows impaired micro-circulation can cause plantar ischaemia and ulcers therefore it is reasonable to find out suitable interventions that can improve the supply of blood flow to foot may reduce the foot complications. Nakagami et al. Shows that applying continuous vibration of 47 Hz to the ear of hairless mice for 50 mins could improve the skin blood flow [4]. This positive effect of vibration leads to release of NO and activation of neural reflex activity induced by mechanical stimulation of vibration [5] with the above study the effect of vibration interventions with increased frequency (130 – 180 HZ) on 5 points of plantar as per foot reflexology chart. In diabetic patient requires complete investigations.

Our study is planning to explore the acute effect of local vibration interventions on the plantar aspect of diabetic and healthy subjects and

assess the clinical improvement. In accordance with findings of [6] 5 minutes vibration applied to the foot. The effect of different vibration pattern that could increase plantar blood flow and potentially clinical improvement and patient complaints.

Methods

Participants

50 Diabetic and 50 healthy subjects were enrolled in this study. Inclusion criteria: Diagnose T2DM, age 40-75 years, history of foot problems like peripheral neuropathy and peripheral arterial disease, no renal disease, no retinal disease, no liver disease, no coronary artery diseases, no cancer, no re-constructive vascular surgery.

Inclusion criteria for healthy subjects: No swelling, normal feet without pathological lesions, no evidence of hypertension, no peripheral neuropathy, no heart disease, no vascular problems. So finally in total of 50 diabetic people and 50 healthy adult met that criteria and participated in this study. The demographic information is shown in Table 1. All subjects gave written consent prior to participation and also conducted with accordance with clinical protocols.

Table 1. Statistics of people participated in the research of vibrating slippers all 50 patients-type 2 diabetes mellitus.

Total number of people participated		
Age	Male	Female
40–50	7	1
50–60	12	4
60–70	10	6
>70	6	4
Total	35	15

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Duration of diabetes		
Age	Male	Female
40–50	3 years	5 years
50–60	8 years	7 years
60–70	>10 years	9 years
>70	>15 years	-
Treatment		
	Male	Female
Regular	90%	75%
Irregular	10%	25%
Peripheral neuritis		
Age	Male	Female
40–50	nil	nil
50–60	nil	10
60–70	40	20
>70	20	-
Comfortable		
Comfortability	Male	Female
Yes	35	15
Vibrating feel		
	Male	Female
Excellent	15	12
Very good	1	2
Good	8	1
Satisfactory	1	0
Not sure	0	0
Comment		
	Male	Female
Extremely good	35	15
Feeling relaxed		
Rate out of 10	Male	Female
10	18	10
9	8	2
8	6	3
7	3	nil
Below 7	nil	nil
Sleep		
	Male	Female
Good	22	8
Better	8	3
As usual	5	4
Cost affordable		
	Male	Female
Affordable	32	13
High	3	2

Study design

A custom designed slipper varying sizes (8-10 sizes) wear fitted with 130-180 hz vibration applied to the both side of the plantar aspect of the toe and heel aspect of the sole of the foot, lateral aspect of the sole of the foot, Ball

of the great toe (Figure 1).

This vibration device consists of a vibration head, a control module, power supply, microchips, with on and off switches. These are designed in well fitted shoes. The force and the vibration generated while individual walks with the slipper (or) shoes. We instructed all subjects are allowed to walk for minimum 30 mins continuously and patient receive continues vibration on the all points. Before the test, all the subjects are asking to rest for 30 mins in room temperature. The same process was repeated for a week.



Figure 1. Foot reflexology chart

Data analysis

The mean value of SBF, temperature of the skin for analysed to both diabetic as well as healthy subjects.

Clinical assessment

Diabetic subjects feels clinical improvement of numbness, and feel warmth of the feet and reduction of burning sensation apart from that patients feels comfortable, the stress level has reduced remarkably the patient feels happier while walking with the slipper or shoes. Neurological test performed over the posterior column as well as pain, touch, temperature, sensation and pulsation of the dorsalis pedis artery before and after in the health as well as diabetic subjects.

Results and Discussion

The characteristic base on gender mostly in 70% of male and remaining 30% of female. Youngest age 45 years and oldest age 70 years and average of 58. Diabetic neuropathy assessed by foot sensitivity and pain and temperature.

The results showed there was a traumatic change the neuropathy score. Pain, touch, temperature almost 50 – 60% recovered. Vibration more than 70% improved. A success of managing T2DM is evaluated from various biochemical parameters HbA1c, fasting blood glucose and postprandial blood glucose and blood pressure, body weight complications also a parameter of the successful management of T2 diabetes mellitus including neuropathy and vascular disease. The result of study indicates the average neuropathy score pain, touch, temperature etc. 4.05 in both legs; these results are in accordance with neuropathic studies [7]. The occurrence of neuropathy is trigger by disorder of glucose metabolism thereby polypol pathway activation increased that leads to more-oxidation, microvascular changes and activation of microglia (c-peptide level is very low is main cause). Neuropathy results from degeneration of thermal cells.

The vibrations produced by the slipper stimulate motor neuron impulses via

mono synaptic and poly synaptic [8-10]. This vibration causes increased ATP level in cells which results in high energy consumption. This vibration causes increasing muscle contraction stimulates osteocytes to secrete osteocalcin thereby increase the insulin secretion and sensitivity that leads to reduction of blood sugar and improvement of HbA1C apart from this neurological effect, this vibration can effect blood circulation in the foot after 30 mins of walking with vibration slipper patients feeling well-being and able to appreciate the foot sensation. After week of walking 80% of the patients the dorsalis pedis pulse has improved, more than 60% from 20% the pulsation of dorsalis pedis artery well felt after walking. Apart from that this slipper improve the psychosocial factor such as stress, comfort level, acceptance level and sleep getting improved in short, patients feels more comfortable within 10 days (Figures 2 and 3).

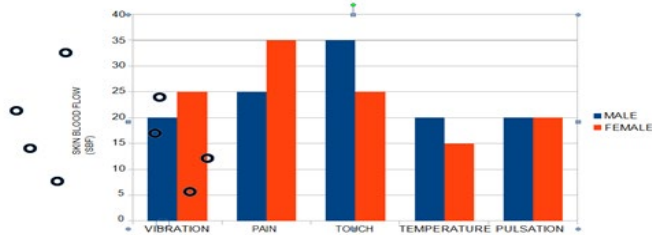


Figure 2. Before vibration

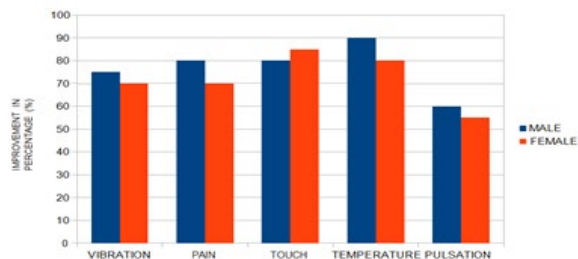


Figure 3. After vibration

Conclusion

This vibration slipper study examined a sample of 50 patients (35 male and 15 female) there was absolute improvement (80%) in diabetic neuropathy and blood circulation of foot restored around 80% with healing sign of foot neuropathy and vasculopathy. Improvement of neuropathy and improvement of vascular changes. Apart from this there is a drastic reduction of mental stress thereby insulin sensitivity improved.

Acknowledgment

It is not applicable.

Conflicts of Interest

No competitive interest exists.

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