Efficacy of Low Level Laser Therapy Over Conventional Therapy on Diabetic Peripheral Neuropathy: A Pilot Study

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Abstract

Aim of the study: The study aims to find the effect of low level laser therapy on the diabetic peripheral neuropathy patients. To evaluate the effect of low level laser therapy on the diabetic peripheral neuropathy patients. *Background of the study:* Diabetic peripheral neuropathy is the nerve damage caused by chronically high blood sugar and it leads to numbness, loss of sensation and sometimes pain in the feet,legs or hands. Diabetic Peripheral Neuropathy is a result of injury to the vasa nervosum, axons and atrophy of the axons leading to tissue damage. *Methodology:* Thiswas an experimental study of comparative of pre and post type. 14 patients are selectedselected from the A.C.S College and hospital and they divided into two groups. Group A received low level laser therapy Group B received interferential therapy. Pre and post test measurements taken using Pressure - Mono Filament Method, Vibration – Tuning Fork (128 Hz), Mc GillPain.

Keywords: Diabetic; Laser; Neuropathy.

Introduction

Diabetes mellitus (DM) is characterized by chronic hyperglycemia and impaired carbohydrates, lipids, and proteins metabolism caused by complete or partial insufficiency of insulin secretion and/ or insulin action. There are two primary forms of diabetes, insulin-dependent diabetes mellitus (type 1 diabetes mellitus, T1DM) and non-insulin-dependent diabetes mellitus (type 2 diabetes mellitus, T2DM). T2DM is the most common form of DM, which accounts for 90% to 95% of all diabetic patients[1] and is expected to increase to 439 million by 2030.[2] In China, the latest statistical data show that diabetes and pre-diabetes are prevalent among older people, with the percentages being 15.5% T2DM.[3] Painful DPN is a result of injury to the Vasa nervosum, axons and atrophy of the axons leading to tissue damage. All nerve fibers may be injured, but small myelinated and unmyelinated fibers that transmit pain and temperature are most affected.

In association with injury to the nerves, reduced microcirculation is responsible for the loss of protective sensation and atrophy of intrinsic foot muscles which later leads to development of foot complications like callus, ulcersand infections of skin and bone in T2DM. subjects with long standing diabetes mellitus. In many subjects with diabetic neuropathy, pain develops as a symptom localized to the lower extremities, primarily the soles and toes. In addition, people with T2DM are often accompanied by complications, such

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as cardiovascular diseases, diabetic neuropathy, nephropathy, and retinopathy. Diabetes and its associated complications lower the quality of people's lives and generate enormous economic and social burdens.[6] Diabetic neuropathy has been defined as presence of symptoms and/or signs of peripheral nerve dysfunction in diabetics after exclusion of other causes, which may range from hereditary, traumatic, compressive, metabolic, toxic, nutritional, infectious, immune mediated, neoplastic and secondary to other systemic illnesses. It involves both small and large fibers and has insidious onset. Typically, the most distal parts of the extremities are affected first, resulting in a stocking pattern of sensory loss. As the sensory symptoms advance above the knees, the distal upper limbs. Symptoms are numbness and deadness in the lower limbs with burning pain, altered and uncomfortable temperature perception, paresthesia, shooting, stabbing and lancinating pain, hyperesthesia and allodynia.

The possible causes are hyperglycemia, polyol pathway, non-enzymatic glycation, free radical and oxidative stress. Peripheral nerves have abundant receptors for nerve growth factor (NGF). NGF is responsible for regeneration of nerves. Circulating NGF concentration is reduced in diabetic patients with neuropathy. The diagnosis of DPN in time is very important because effective intervention will be possible only during the subclinical or early phase of dysfunction. Vibration perception threshold (VPT) is usually assessed by 128 Hz tuning fork, Only large fibers are assessed by the test. Vibration perception is usually assessed at the tip of great toe or over lateral malleolus. Among the electrotherapy modalities, low-level laser therapyhas been usedto manage nerve injuries and otherpathologies of the nerve because it holds the potential to induce a biostimulational effect on the nervous system. In addition, low-level laser therapy has also been used in the management of diabetic complications such as foot ulcers. Even though low-level laser therapy is found to be very effective in nerve regeneration, there is a dearth of literature on effect of low-level laser therapy on painful DPN in T2DM population. Therefore the objective of the present study was to evaluate the effect of low-level laser therapy on Type 2 DM subjects with painful DPN.

Materials and Methods

This study was an experimental study with comparative pre and post type. 14 patients were selected randomly from the 30 volunteers. They were then divided into two groups by simple random sampling method (lottery method). Patients are selected from the Out Patient Department of Physiotherapy in A.C.S Medical College and Hospital, Chennai. The duration of the study is 4 weeks (3 days in a week) [from June 2018-Feb. 2019]. This study included type 2 diabetes mellitus with sensory disturbances both male and female patient, patients aged above 50. Excluded those with patient's presence of diabetic ulcers, peripheral vascular disease, significant musculoskeletal disorders in the lower extremities (Including injury, fracture and surgery), rheumatoid arthritis, neuropathies other than diabetic neuropathy. The samples were fully explained about the study and the questionnaire to be filled. They were then asked to fill the Consent form in acceptance to participate in study, which is duly signed by the samples and therapist. Initially demographic details like age, gender, height, weight were collected assuring confidentiality of the same. Pre and post test done with Mc. Gill Pain, MNSI Questionnaire. A total number of 14 patients were divided into two groups. Group A patients undergone low level laser therapy, the treatment procedure and its benefits is well explained by the physiotherapist. Group A samples received A dosage of 3.4 j/cm^2 and power density of 50–150 mw/cm^2 with treatment duration of 5 minutes. The patients were treated 3 days in a week for 4 weeks. Patient was positioned in lying and with the probe laser biostimulation given to the lateral poplitealnerve (neck of fibula). Group B received Interferential therapy given with a treatment duration of 15 minutes. Patient was treated 3 days in a week for 4 weeks. Patient positioned in lying and 4 pole vector method was used (lower compartment of leg).

Data Analysis

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24. Paired t-test was adopted to find the statistical difference within the groups Independent t-test (Student t-Test) was adopted to find the statistical difference between the groups.

#Group A – Low Level Laser,# Group B – Conventional Therapy

(*- $p > 0.05$)(***- $p \leq 0.001$) The **Table 1** reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom(df) and p-value of the MNSI between

(Group A) and (Group B) in pre test and post test weeks. This table shows that there is no significant difference in pre test values of the MNSI between Group A and Group B (*$p > 0.05$). This table shows that statistically highly significant difference in post test values of the MNSI between Group A and Group B (***- $p ≤ 0.001$)**(Graph 1)**. Both the Groups shows significant decrease in the post test Means but (Group-A) which has the Lower Mean value is more effective than (Group-B).

#*Group A – Low Level Laser,*# *Group B – Conventional Therapy (* $p > 0.05$)*

(***-$p ≤ 0.001$) The **Table 2** reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom(df) and p-value of the Mcgillian pain between (Group A) and (Group B) in pre test and post test weeks. This table shows that there is no significant difference in pre test values of the Mcgillian pain between Group A and Group B (*$p > 0.05$). This table shows that statistically highly significant difference in post test values of the Mcgillian pain between Group A& Group B (***- $p ≤ 0.001$)**(Graph 1)**. Both the Groups shows significant decrease in the post test Means but (Group-A) which has the Lower Mean value is more effective than (Group-B)

#*Group A – Low Level Laser,*# *Group B – Conventional Therapy (*** $p ≤ 0.001$)*

The table 3 reveals the Mean, Standard Deviation (S.D), t-value and p-value of the MNSI between pre-test and post-test within Group – A & Group – BIn MNSI, there is a statistically highly significant difference between the pre test and post test values within Group A and Group B(***- $p ≤ 0.001$). **(Graph 3)**.

Results

The results of the study Group A and Group B have significant differences. On comparing pre test and post test within Group A & Group B on MNSI and Mc Gillian pain questionnaire shows highly significant difference in mean values at $p ≤ 0.001$. On comparing the mean values of Group A and Group B on MNSI And Mc Gill Pain Questionnaire Score, Shows Significant Increase In The Post Test Mean Values of Group A and Group B, Group A –low level laser therapy shows which has the higher mean value is more effective than Group B-convention therapy at $p ≤ 0.001$.

Table 1: Comparison of Mnsi Score Between Group – A and Group - B in Pre and Post Test

#Mnsi	#Group – A		#Group – B		T - Test	DF	Significance
	Mean	S.D	Mean	S.D			
Pre Test	16.4	1.43	16.2	1.68	.254	16	0.805
Post Test	10.1	1.19	13.1	1.66	–4.39	16	0.002

Table 2: Comparison of Mcgillian Pain Score Between Group – A and Group - B in Pre and Post Test

#Mgp	#Group – A		#Group – B		T - Test	DF	Significance
	Mean	S.D	Mean	S.D			
Pre Test	57.6	2.88	53.1	1.83787	3.99	16	0.813
Post Test	43.7	2.95	51.0	1.50	–8.93	16	0.000

Table 3: Comparison of MNSI within Group – A and Group – B Between Pre and Post Test Values

#Mnsi	Pre - Test		Post - Test		T - Test	DF	Significance
	Mean	S.D	Mean	S.D			
Group A	16.4	1.43	10.1	1.19	18.80	8	.000***
Group B	16.2	1.69	13.1	1.66	11.19	8	.000***

Table 4: Comparison of Mcgillian Pain Within Group – A and Group – B Between Pre and Post Test Values

Mcgillian Pain Que	Pre -Test		Post - Test		T - Test	DF	Significance
	Mean	S.D	Mean	S.D			
Group A	57.6	2.88	43.70	2.94	10.96	8	.000***
Group B	51.0	1.85	50.5	1.49	5.16	8	.000***

Discussion

In the present study diabetic peripheral neuropathy patients whose age above 50 were selected. This study was conducted to decrease the pain and improve the sensation. In this study totally 14 patients were selected. The comparison has been done on the effectiveness of low-level laser therapy and interferential therapy for the duration of 10 days.

The result of the study statistically indicates that the described data's such as mean and standard deviation which indicated that improvement in the terms of pain and the sensation at the end of the treatment of both groups. On comparing the results obtained in pre and post test, the result of this study showed that low level laser therapy significant $p \leq 0.001$ improvement than posttest. So, concluded that low level laser therapy is helpful for increasing the sensation. The mean value of MNSI Score in pretest and post test showed a significant difference. The mean value of MCGILL Pain Questionarrie in pretest and post test showed a significant difference.

Conclusion

It was been observed the DPN prevalence of 19.7%. Higher the age, low socioeconomic status, treatment with insulin, longer the duration of diabetes and poor glycemic control were considered to be the risk factors for DPN. Thereby the prevalence of DPN among the elderly population suggest need for early screening and better risk factor management.

Authors Contribution: All authors have contributed equally.

Conflict of Interest: none.

Ethical Considerations: The manuscript is approved by the Institutional Review board of faculty of physiotherapy. All the procedures were performed in accordance with the ethical standards of the responsible ethics committee both (Institutional and national) on human experimentation and the Helsinki Declaration of 1964 (as revised in 2008).

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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