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ORIGINAL ARTICLE

A COMPARATIVE STUDY OF FUNCTIONAL STRENGTH TRAINING AND PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION ON BALANCE AND GAIT IN DIABETIC PERIPHERAL NEUROPATHY	Search engine: **www.ijmaes.org**

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ABSTRACT

Background and Purpose: Diabetic peripheral neuropathy is the nerve damage that is mainly caused by diabetes. It most often damages the nerves in the legs and feet. The main purpose of the study is to compare the functional strength training and proprioceptive neuromuscular facilitation on balance and gait in diabetic peripheral neuropathy. The aim of the study is to compare the functional strength training and proprioceptive neuromuscular facilitation on balance and gait in diabetic peripheral neuropathy. **Method:** it is a quasi experimental study with 30 subjects of age group 50 to 70 years of both sexes are selected from the outpatient department of JKK Munirajah Medical Research Foundation, College of Physiotherapy, Komarapalayam. Group A of 15 subjects receives Functional strength training; Group B of 15 subjects receives Proprioceptive neuromuscular facilitation. Pre and post intervention were assessed by Berg balance scale and Dynamic gait index scale. **Result:** Group A diabetic neuropathy patient included in the study completed the 15 sessions of functional strength training were re-evaluated at the five month follow-up. The two-tailed P value is less than 0.0001, by conventional method; this result shows that it is extremely statistically significant. **Conclusion:** This study concludes that the functional strength training has improvement of the body's balance and gait during treatment.

Keywords: Functional strength training, Proprioceptive neuromuscular facilitation, Berg balance scale, Dynamic gait index.

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INTRODUCTION

Diabetes mellitus is a group of metabolic disease characterized by the high level of blood glucose level (hyperglycemias) performing from deficiency of insulin or resistance to insulin or both[1].

Insulin is the hormone Secrets by beta cells of the pancreas, which is demanded to use glucose from digested food as an energy source. Macro vascular complaint leads to an increased prevalence of coronary artery disease, peripheral vascular disease and stroke. Micro vascular complaint leads to nephropathy, diabetic retinopathy and diabetic neuropathy. Around 37.3 million people in United States have diabetes which is about 11 among the population[2]. Type 2 diabetes is the most common form, representing 90 to 95 of all diabetes cases. About 537 million People across the world have diabetes. Experts also predict this number will rise to 643 million by 2030 and 783 million by 2045.

One of the main complications of diabetes mellitus is Diabetic peripheral neuropathy (DPN) is defined as the dysfunction and damage in the peripheral nerve in people with diabetes[3]. Neuropathies are characterised by the progressive loss of nerve fibre function. It's estimated that 60 to 70 of diabetes have mild to severe form of nervous system damage. Diabetic peripheral neuropathy is one of the serious given micro vascular complications of both Type 1 and Type 2 diabetes mellitus have been diagnosed in 20-50 of the diabetes population[4].

The main prevalence of developing diabetic peripheral neuropathy increase the regularity of the conditions and poor glycemic control also balance affliction is set up in 16 diabetics who may increase up to 30 to 50 with increases the disease[5].

Peripheral neuropathy occurs when the nerves that are located outside of the brain and spinal cord are damaged. It also causes weakness, numbness and pain, usually in the hands and feet. About 50 of cases may witness symptoms like burning pain, electrical or stabbing sensations, paraesthesia, hyperesthesia and deep aching pain.

Sensory disturbance in diabetes leads to loss of vibration, pressure, temperature and pain. It also contributes to drop in proprioception and increase reflex reaction time. In addition, as numerous as 30 of people with DPN experience muscle weakness, loss of ankle reflexes and drop balance, coordination and gait control[6]. All these risk factors limit walking and other activities and increase the prevalence of fall.

Sensory loss can be confined to the toes, it can extend over to the bases or spread over the lower leg or cross the knee position fully depending on how intense the peripheral nerve lesions are, and subsequently it may progress to upper extremities and trunk. With increased severity of Diabetic peripheral neuropathy, a positive Romberg's sign and ataxia may be set up due to the weakness in the ankle plantar flexors and dorsiflexors. This instability in the muscles leads to difficulty in maintaining the balance and it eventually affect the gait.

Balance is defined as the capacity to maintain or return the body's centre of gravity with the base of support within the limit of stability[7].

Postural control is the control of the body's postion in space for the purpose of balance and orientation. Balance is concerned primarily with preserving, attaining or restoring the center of mass in relation to the limits of stability within a given base of support and plays a important part in mobility as well as stability.

The peripheral nervous system controls the complex series of events in gait through somatic and autonomic functions, precisely balancing of eccentric and concentric muscle contraction and reliance on the sensory information received from plantar surface[8]. So to lower these complications and improve the function of the cases with diabetic neuropathy, various exercise intervention have been used, such as strength training, endurance training, balance training, Swiss ball exercise etc.

Functional strength training for diabetic neuropathy cases tends to improve balance and coordination. Functional strength training involves repetitive functional movements to improve the capability of the body to perform everyday activities. The functional strength training includes sit to stand from stool, walking up and down a ramp, stair climbing, toe standing.

Proprioceptive Neuromuscular Facilitation is one similar treatment approach by using the proprioceptive stimulants.

Proprioceptive Neuromuscular Facilitation (PNF) is a system that uses diagonal and spiral movements, intended at facilitating, strengthening, gaining control and coordinating movements to activate proprioceptors that are located in the joint, tendons and muscles accordingly improves the motor functions[9].

METHODOLOGY

The study will be conducted at Maruthi Medical Center -Erode and JKKMMRF College of Physiotherapy-Outpatient Department. 30 samples will be selected by convenient sampling techniques which consist of both male and female each group consists of 15 persons.

GROUP A: Functional strength training

GROUP B: Proprioceptive neuromuscular facilitation

Parameters: Berg balance scale; Dynamic gait index

Inclusion criteria:

- Patient with confirmed diabetes mellitus more than 5 years with controlled hypertension
- Age 50 to 70 years
- Sex both male and female
- Patient lower extremity symptoms should be consistent with peripheral neuropathy
- Neuropathy disability score ,more than 2 and less than 5
- MRC grade of ankle 3

Exclusion criteria:

- CNS dysfunction
- Musculoskeletal deformity
- Vestibular dysfunction
- Complete sensory loss
- Angina pectoris
- Lower extremity arthritis
- Peripheral vascular disease

Procedure and protocols: Group A was treated with Functional strength training

Group A (Functional Strength Training)

Functional strength training is a type o f exercise that focuses on training the body for additional activities, performed in daily life, sports or specific tasks. The primary goal of functional strength training is to improve the functional movements and enhance overall functional stability.

Functional strength training includes

- Sit to stand from stool
- Walking up and down on ramp
- Stair climbing
- Single leg stand
- Toe and heel raises

Dosage: 10 repetitions for sit to stand from chair for 3 sets

Walking up and down on a ramp (6 laps)

Stair climbing 1 stair- 12 steps, 6 lapsToe and heel raise 10 repetitions

Group –B (Proprioceptive Neuromuscular Facilitation)

Proprioceptive neuromuscular facilitation is a stretching technique utilized to improve muscle elasticity and improves range of motion**.**

Technique; Rhythmic stabilization, Hold relax, Contract relax, WARM UP

5 minutes of light exercise like self paced walking for 3 minutes and self stretching to the muscles like hamstring and quadriceps designed to prepare the participants for muscle conditioning and improving overall flexibility

30 minutes of exercise training were used for 5 days a week for 3 months

1st week – 10 repetitions

2ndweek -2 sets of 10 repetitions

3rdweek- 3 sets of 10 repetitions

RESULT

Descriptive statistics for Berg balance scale– Group A and Group B

Group	BBS	Mean	Standard deviation	Paired t- test
Group A	Pre-test	37.40		
	Post-test	47.07	4.77	33.64
Group B	Pre-test	37.93	4.91	12.27
	Post-test	41.33		

Descriptive statistic for Berg Balance Scale in Group A shows that paired't' test values of pre Vs post-test values of Group A was 33.64 at 0.0001 level which was greater than tabulated 't' values (2.13). Group B shows that paired 't' test values of pre Vs post-test values of Group B was 12.27 at 0.0001 level which was greater than tabulated 't' values (2.13).

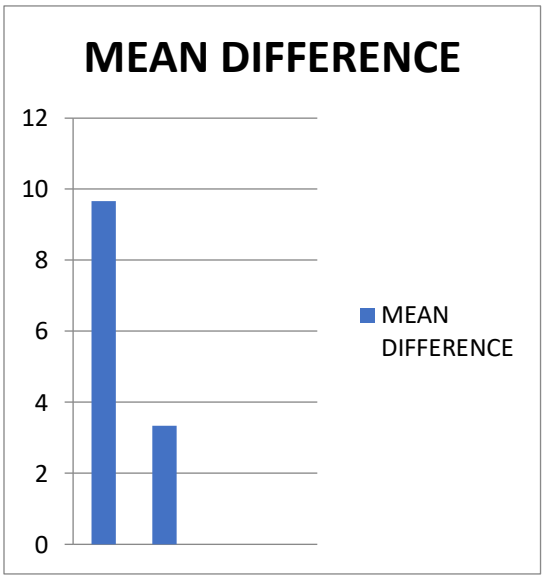
This showed alike therein significant difference between pre Vs post test results of Group A and Group B for BBS. This exposed that there was significant

improvement in post – test mean values in response to BBS in Group A and Group B.

Berg Balance Scale (POST TEST ANALYSIS)

Berg Balance Scale	Mean	Mean difference	Standard deviation	Unpaired t- test
Group A	9.67	6.33	1.11	5.0008
Group B	3.33			

The above table shows the post-test analysis result in PBS for Group A and B. The mean value of Group A is 9.67 which was greater than Group B value of 3.33 and the unpaired't' test value was 5.0008 at 0.0001 level, which was greater than tabulated 't' value (2.15). It showed statistical significance difference between mean values of Group A and B.



Descriptive statistics for Dynamic Gait Index Scale- Group A and Group B

Group	DGI	Mean	Standard deviation	Paired t- test
Group A	Pre-test	19.00	1.69	16..03
	Post-test	21.60		
Group B	Pre-test	17.47	1.77	10.02
	Post-test	19.53		

Descriptive statistic for Dynamic Gait Index scale in Group A shows that the paired't' test values of pre Vs post-test values of Group A was 16.03 at 0.0001 level which was greater than tabulated 't' values (2.13). Group B shows that the paired 't' test values of pre Vs post-test values of Group B was 10.02 at 0.0001 level which was greater than tabulated 't' values (2.13). This showed that there was significant difference between pre Vs post test results in Group A and Group B.There was a significant improvement in post – test mean value in response to Dynamic Gait Index Scale.

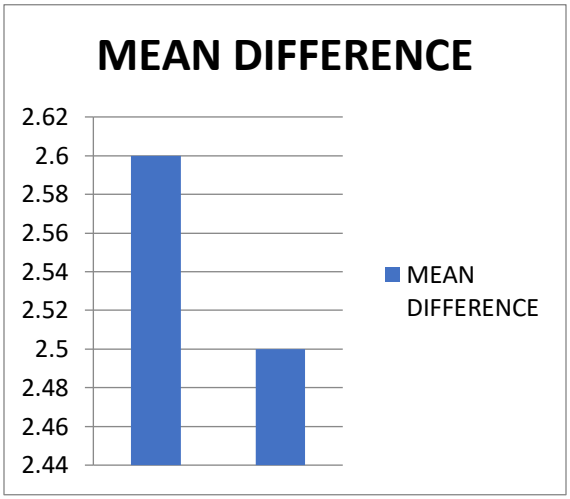
RESULT- Dynamic Gait Index Scale (POST TEST ANALYSIS)

Dynamic Gait Index	Mean	Mean difference	Standard deviation	Unpaired t-test
Group A	2.60	0.60	0.74	2.35
Group B	2.00			

The above table shows the post-test analysis result in BBS for Group A and B. The mean value of Group A is 2.60 which was greater than Group B value of 2.00 and the unpaired't' test value was 2.35 at 0.0001 level, which was greater than tabulated 't'

value (2.15). It showed statistical significance difference between mean values of Group A and B.

DISCUSSION



The purpose of the study was to determine the effectiveness of functional strength training and proprioceptive neuromuscular facilitation. The berg balance scale and dynamic gait index scale was taken as the parameters to assess the balance and gait[9,10].

The study sample comprised of 30 patients of age group 50-70 years grouped as A and B. In each group 15 subjects participated. Group A with functional strength training whereas Group B with proprioceptive neuromuscular facilitation. The result of the statistical analysis brings out the following for consideration.

The result showed that there was statistical significant difference between Group A and B. The diabetic peripheral neuropathy patient who were treated with functional strength training had shown good improvement in balance, coordinated muscular activity and gait.

In the analysis and interpretation of Berg Balance Scale in Group A and Group B for 15 patients in each group

The unpaired t test value of BBS in Group A and B post- test analysis was 15.58 which were greater than the tabulated t value.

In the analysis and interpretation of Dynamic gait index scale in Group A and Group B for 15 patients in each group

The unpaired t test value of DGI in Group A and B post- test analysis was 2.35 which were greater than the tabulated t value.

The result showed that there was statistical significant difference between Group A and B. The Diabetic Peripheral Neuropathy who was treated with functional strength training had shown good improvement in balance and gait.

Ethical clearance: Ethical clearance was obtained from the Institutional ethical committee, JKKMMRF. College of Physiotherapy, Komarapalayam with reference No. IRB/MPT/N-502/24, dated 03/03/2023.

Conflicts of Interest: There is no conflict of interest to conduct and publication of this study.

Fund for the study: This was a self funded study.

CONCLUSION

The study which was conducted for 3 months period of intervention showed that Group A of those who received functional strength training resulted in improvement on balance and gait than Group B who

received Proprioceptive neuromuscular facilitation.

The study concluded that functional strength training was effective treatment for balance and gait in diabetic peripheral neuropathy.

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