

Effects of Task-Oriented Exercises on Improving the Balance, Minimizing the Risk of Fall in Patients with Diabetic Neuropathy- A Comparative Study

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Abstract

Background: Diabetic peripheral neuropathy often demonstrates impairments in balance and thus an increased risk for falls. This affects the both static balance and dynamic balance, but static balance is more affected. Balance training is considered to be a very important tool for prevention of falls in older population. It has been shown to produce improvements in different aspects of balance.

Objective: To find out the effect of task-oriented exercises on improving the balance and minimizing the risk of fall in patients with diabetic neuropathy- a comparative study.

Methodology: 18 patients meeting the inclusion and exclusion criteria were allocated into 2 groups. Group A (n=8) received conventional Physiotherapy & Group B (n=10) received task-oriented exercises along with conventional Physiotherapy.

Result: Result of this study showed that there is significant difference in pre and post values for both FFABQ and BBS scales except for BBS the scores of group A no significant changes. On comparison between Group A and Group B, the group B showed more improvement in FFABQ and BBS score than group A.

Conclusion: This study concluded that the Task-oriented exercises with Conventional Physiotherapy were more effective in improving balance and reducing the fear of fall than with only conventional physiotherapy in diabetic neuropathy patients after 3 weeks of duration.

Key Words: diabetic neuropathy, risk of fall, conventional physiotherapy, task- oriented exercises, balance.

Introduction

Diabetes is a common metabolic disorder with severe health consequences, and its prevalence is on the rise [1]. Retinopathy, nephropathy, neuropathy, arteriosclerosis, and other complications of long-term diabetes may occur[2]. Diabetic peripheral neuropathy

(DPN) is a diabetes mellitus complication described as “the occurrence of signs or indications of peripheral”[3]. Diabetics with mild to severe nervous system disruption make up 60 to 70% of the population. [4] Diabetic peripheral neuropathy is one of the most severe documented microvascular complications of both type 1 and type 2 diabetes mellitus [5-7], with 20-50 percent of the diabetic population suffering from it. [8-12]

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Falls cause significant morbidity, immobility, and mortality in the elderly. Every year, nearly 35 to 40 percent of the community-dwelling population over the age of 65 dies. The ratios are higher for people over the

age of 75^[39]. Breaks can occur for a variety of reasons; however, falls of diabetics are a big issue, resulting in feelings of unsteadiness, subsequent psychosocial effects, and immediate physical repercussions. Sensory and motor neuropathy of the foot and lower limb are significant contributors of gait impairments, resulting in unsteadiness, and elevated risk of falling. Along with vestibular dysfunction and diabetic retinopathy, diabetic peripheral neuropathy is a major contributing factor for the likelihood of dropping in diabetic patients. In particular, patients with DPN have a 2–3 times higher chance of falling^[38]. This has an effect on both static and dynamic equilibrium, but static balance is more influenced.^[24] Formalized paraphrase As a result, diabetic peripheral neuropathy affects gait characteristics^[25]. They did not, however, consider balancing exercises as an action. Furthermore, Liu and Frank^[26] and Streckman et al^[27] provide reports on the effectiveness of activities in improving balancing characteristics in older patients and patients with peripheral neuropathy, respectively. Balance teaching is regarded as a critical method for the reduction of crashes in the elderly community. It has been shown to enhance various facets of posture and gait. Previous studies have investigated balancing exercises as an intervention in diabetic peripheral neuropathy patients and found them to be effective whether used alone or in conjunction with other treatments. Weight exercise directly improved balance sway index^[28-31], static balance such as one leg stance^[30-32-34], tandem stance, and dynamic balance such as forward reached measure^[30,32,33], walk over beam^[29], and five times sit to stand^[33].

Following posture exercise, there was a significant improvement in gait parameters such as gait pace^[29], stride length^[33], and cadence^[35], as well as 10 minute walk time^[30] and 6 minute walk distance^[36]. Functional and agility tasks, such as time up and go tests or performance-oriented agility, increased post-balance testing^[30, 31, 33, 34]. Balance exercises have aided in decreasing response time^[37], lowering the chance of falling^[30-37].

Materials and Method

This was a comparative study which was conducted

to evaluate the effects of task-oriented exercises along with conventional therapy on improving balance and reducing the risk of fall in diabetic neuropathy patients. The subjects who meet the inclusion and exclusion criteria and willing to participate in the study were included. We had approached about 20 participants out of which 18 patients completed the protocol. They participants and relatives were explained about the study and the evaluation procedure. The informed written consent form was collected from the participants. Inclusion criteria:- Both male and female participants Medically diagnosed with diabetic neuropathy, Patients with impaired balance. Patients having risk of fall, and Patients who were willing to participate. The exclusion criteria of the study was: - Severe retinopathy and nephropathy, Patient with musculoskeletal deformity in lower limb Eg. Arthritis, fractures, Patient with cognitive impairments or with psychiatric disorders or seizures or with visual impairment or tremors influence balance, Patients with balance impairment i.e. berg balance scale score more than 0-20, Patients with maximum or complete sensory loss.

Procedure

The study received ethical approval from the Institutional Ethical Committee (IEC) of PIMS, Loni. The patients were screened according to the inclusion and exclusion criteria. The patients who were willing to participate in the study were briefly explained about the study in the language best understood by them. They were encouraged to clarify queries regarding the study, if any. An informed written consent form, previously approved by the IEC was then obtained from the patients. The demographic data was obtained and detailed assessment was done.

Twenty patients diagnosed with diabetic neuropathy and admitted to Pravara Rural Hospital (PRH) Loni were randomly divided into two groups (Group A and Group B) of 8 patients in Group A and 10 patients in Group B. Among those 20 patients, there were 2 dropouts in group A as the intervention period was not completed due to Covid-19 situation. The variables like Balance and Risk of fall were assessed using the berg balance scale and

fear of fall avoidance behavior scale. The conventional therapy session for group A was given for 30 minutes and the conventional therapy along with task-oriented session for group B was given for 50 minutes. The intervention was given for 3 days in a week for 3 weeks. The data was entered in the excel spread sheet tabulated and subjected to statistical analysis. Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as unpaired t test and ANOVA parametric test was

done. The confidence interval was set at 95% and data was considered statistically significant with $p < 0.05$ and highly or considerably significant with $p < 0.001$.

Outcome Measures

1. Berg balance scale
2. Michigan Neuropathy disability symptoms scale
3. Fear of Falling Avoidance Behavior Questionnaire

Data Analysis and Result

Table 1: Age distribution

Groups	Mean Of Age In Years	Standard Deviation (Sd) Of Age In Years
group a	53.12	6.28
group b	54.8	8.61

The average age of Group A (Conventional Physiotherapy) was 53.12 ± 6.28 years and in Group B (Conventional Physiotherapy and task-oriented exercises) was 54.8 ± 8.61 years.

Table 2: Comparison of pre-post intervention of Michigan neuropathy screening instrument in group A

MNSI	Intervention	Mean	Standard deviation (sd)	t value	p value	Result
Group A	Pre	1.25	0.46	0.000	<0.0001	not significant
	Post	1.25	0.46			

Michigan neuropathy screening instrument was used for physical evaluation of the lower limb in patients with diabetic neuropathy. In group A the mean score for pre assessment was 1.25 ± 0.46 and the same was for post assessment as there was no significant changes in the pre-post assessment hence the unpaired ‘t test = 0.000 (with DF=18)

Table 3: Comparison of pre-post intervention of Michigan neuropathy screening instrument in group B

MNSI	Intervention	Mean	Standard deviation (sd)	T Value	P Value	Result
Group B	Pre	1.2	0.42	0.000	<0.0001	not significant
	Post	1.2	0.42			

In group B the mean score for pre assessment was 1.2 ± 0.42 and the same was for post assessment as there was no significant changes in the pre-post assessment hence the unpaired ‘t test = 0.000 (with DF=18)

Table 4: Comparison of post intervention of fear of falling avoidance behaviour questionnaire scale in group A and B

FFABQ	Intervention	Mean	Standard deviation (sd)	T Value	P Value	Result
Group A	Post	31.75	3.28	2.067	0.0553	significant
Group B	Post	27.3	5.31			

Post intervention FFABQ mean score for Group A and Group B were 31.75 ± 3.28 , 27.3 ± 5.31 respectively. On comparison of Post-intervention FFABQ mean scores between Group A and Group B by using unpaired t test, it is observed that this difference is significant. Group B shows improvement in FFABQ after 3 weeks of duration than the Group A and showed reduced fear of fall. ($p=0.0553$ and $t=2.067$ for part A and B with $DF=14$).

Table 5: Comparison of post intervention of berg balance scale in group A and B

BBS	Intervention	Mean	Standard deviation (sd)	T Value	P Value	Result
Group A	Post	40	5.01	3.880	0.0013	extremely significant
Group B	post	48.2	3.97			

Post intervention BBS mean score for Group A and Group B were 40 ± 5.01 and 48.2 ± 3.97 respectively. On comparison of Post-intervention BBS mean scores between Group A and Group B by using unpaired t, test, it is observed that the difference observed is highly significant and shows increase in BBS after 3 weeks of duration than the Group A. ($p=0.0013$; $t= 3.880$ for group A and group B with $DF=16$).

Result of this study showed that there is significant difference in pre and post values for both FFABQ and BBS scales except for BBS the scores of group A no significant changes. On comparison between Group A and Group B, the group B showed more improvement in FFABQ and BBS score than group A.

Discussion

The results of this study revealed a greater increase in the BBS score and a reduction in fear of fall scale which showed that the patient now has lower risk of

fall following a task-oriented exercise program in comparison with conventional physiotherapy in patients with diabetic neuropathy. It showed that balance control has significant improvement using task oriented approach for balance training. Scores of berg balance scale suggested a remarkable improvement in dynamic balance between tasks oriented balance training group and traditional balance training group. The results of this study suggested that dynamic balance and fear of fall is improved and reduced respectively in task oriented training group than traditional balance training group^[39]

The current study’s findings were confirmed by Ghazal et al., who demonstrated that balance deficiency is normal in the diabetic community. In his research, the complex and anticipatory equilibrium of diabetic neuropathic patients was measured, and aimed at task-oriented training and conventional training were extended to the patients for 8 weeks. According to the findings, there was a significant change in the score

during the therapy session in both the participant and the task oriented group. The task-oriented approach yielded a better outcome in terms of decreasing fall probability and improving equilibrium. To avoid more complications and improve quality of life, adequate and proper task-oriented preparation must be included as part of diabetic management. The task-oriented equilibrium training group was found to have a lower chance of falling.^[39] Furthermore, Laufer et al. backed the current study's findings. They hypothesised that there was a substantial gap between the impact of task-oriented instruction and traditional physical therapy activities on diabetic neuropathy patients' equilibrium disruption.^[40] Sisupadol et al. performed a double blind RCT in 2009 to compare the impact of single task vs dual task balance training on balance performance. The study's participants were randomly assigned to one of three groups: single task, dual task, or dual task with variable priority. After four weeks, the Berg Balance Scale and Activity Balance Confidence scores were tested. They concluded that both single task and dual task testing improved BBS scores, and that gait speed was faster in the dual task group than in the single task group.^[41] Refay et al found that combining lower extremity range of motion (ROM) exercises, muscle building exercises for toe flexor/extensor and foot intrinsic muscle, posture training, and gait training exercises increased walking pace, cadence, and ankle range of motion with a substantial decrease in step time, while no significant improvement was found in the control group.^[42] This may be attributed to fitness therapy, which has been shown to enhance macro and microvascular factors in diabetics.^[43,44] As a result, vascular adaptations induced by exercise can boost blood flow to peripheral nerves while also improving balance and gait function. Similarly, Allet et al found that gait and balance exercises along with function-oriented strengthening strengthened diabetic patients' gait functions as compared to a control group that received no care.^[45]

The task oriented training has significant effect on balance improvement and fall risk reduction because such approach has specific goal oriented and focus activities which directly linked with the performance of daily tasks.

Conclusion

This study concluded that the Task-oriented exercises with Conventional Physiotherapy were more effective in improving balance and reducing the fear of fall than with only conventional physiotherapy in diabetic neuropathy patients after 3 weeks of duration.

Limitation of Study

- è Short duration Intervention period
- è No follow up after 3 weeks, so long term effect of intervention could not be suggested.
- è The study was limited to Pravara Rural Hospital.
- è The sample size was small due to Covid 19 situation.

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