

Original Research Article

## Significance of Sensory Specific Intervention on Balance in Type 2 Peripheral Diabetic Neuropathy Individuals

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### ABSTRACT

**Background and Purpose:** Diabetes is a serious ailment that terribly affects an individual in all domains. The most troublesome complication, peripheral neuropathy, leads to decreased sensation and motor weakness which progresses from distal to proximal direction. In due course the patients will come across with balance disorders, which puts them at risk of gait difficulty and falls. To overcome this problem one should focus on treating the condition physiotherapeutically. So far existing literature is more in favour of exercises which focus on muscle strengthening but the sensation specific regimens are scarce. Hence this work is projected to know the effect of sensory specific intervention on balance and neuropathic symptoms in peripheral diabetic neuropathy individuals.

**Materials and Methods:** This experimental study included 30 participants with peripheral diabetic neuropathy who were randomly allocated into two groups; group A(n=15) has received sensory specific intervention for balance improvement and group B(n=15) underwent conventional exercises alone for 4 weeks. Pre and post treatment balance was assessed by Berg Balance Scale (BBS).

**Results:** Results of Berg Balance Scale analysed using non parametric tests. The observed differences of values were tested with the Z at 95% level of significance ( $p < 0.05$ ).

**Conclusion:** All of 30 participants have shown good results after the treatment. The subjects who received sensory specific intervention have showed significant improvement when compared to subjects who received conventional exercises alone ( $p < 0.05$ ). Therefore we conclude that sensory specific intervention will definitely be an additional benefit for patients in improving balance in diabetic neuropathy.

**Keywords:** Peripheral Diabetic neuropathy, Balance, sensory specific intervention.

### INTRODUCTION

Diabetes mellitus is a relentless and problematic concern of the world. [1] According to IDF the global estimated prevalence of diabetes in the age group of

20-79 years is around 425 million cases and in 18-99 years is 451 million cases, where as it is expected to rise to 629 million cases in 20-79 years and 693 million cases in age group of 18-99 years by 2045. [2]

The very recent studies in India revealed that, this most significant and debilitating complication neuropathy has varied prevalence ranging from 41.4% in Karnataka, 26% in Chennai and 29.2% in north india. [3] One more study emphasized the 33.33% prevalence rate of neuropathy in Tamilnadu. [4]

Distal symmetrical sensorimotor polyneuropathy (DPN) is a type of diffuse and common neuropathy. Clinically there is predominant sensory involvement progressing from distal to proximal regions. The large fiber involvement in the nerve leads to impaired proprioception and light touch perception. Vibration, pressure, Pain and temperature are involved due to offense of the small fibers. [5,6,7] The severity increases with Longer duration of diabetes. [8]

The symptomatology of this chronic and progressive disorder comprises of muscular symptoms such as muscle atrophy, weakness, imbalance and ataxic gait and sensory symptoms include pain, numbness, paraesthesia, cramps and night time falls. [9] Normal posture and balance are under the control of visual, vestibular and proprioceptive systems which work on the sensory information given by the peripheral receptors. As there is sensory impairment, the patients of DPN experience gait difficulty, feel less safe and land with falls at 15 times greater rate than age matched adults. [10]

In physiotherapy many sensory modalities were established to be effective in treating this complication, such as Transcutaneous electrical nerve stimulation to reduce pain, proprioceptive neuromuscular facilitation techniques for balance, use of different textures to enhance the perception of touch, Biodex stability system etc. [11,12] These sensory specific exercises chiefly use stimulation procedures to help sensory impaired patients recover sensibility, fine discrimination abilities and the skill to carry out other tasks involved in daily life and work place. [11]

Till the date most of existing treatment interventions was mainly emphasizing on motor system, rather sensory interventions are very few. Therefore our study is intended to know the additional benefit of sensory specific intervention to improve the balance in DPN individuals.

## METHODOLOGY

After completing the initial screening for 30 patients with type2 diabetes, they were included in the study based on the criteria of 10-15 years of diabetes duration, both genders, age between 50-65, strength of lower limb muscles not less than grade 3 by manual muscle testing, Berg balance scale score between 35-45 were selected. The exclusion criteria are individuals having foot problems and plantar ulcers, vestibular disorders, having neurological and orthopedic complications, hearing and visual defects, peripheral vascular complaints and cognitive deficits.

Before starting the procedure, all participants were clearly explained about the study and informed consent was obtained. They were randomly divided into Group A and Group B of 15 each. Baseline values were taken by using the 2 outcome measures BBS and TCSS. Individuals in both the groups have received Conventional balance exercises for 30 mins, in addition the group A individuals were underwent sensory specific training for 30 min. The exercises were given to both the groups for 4 weeks.

Conventional exercises: for 30mins: Relaxed deep breathing exercises, free range of motion exercises for bilateral ankle joints, sit to stand, weight shifts in standing position, heel standing, toe standing, reaching activities, single limb stance, stair climbing, ramp walking, spot marching and tandem walking. [13]

## EXERCISES FOR GROUP A

Special and focused exercises were given with emphasis on senses: Warm up and cool down for 4 min, which includes ankle

plantar flexion and dorsiflexion, inversion and eversion, short walk and self stretching.

[14] For PAIN: TENS is given for 10 mins, the machine settings are : Pulse Width: 100 to 200  $\mu$ s; Frequency: 80 to 100 Hz; Intensity: Gradually increased to the patient's comfortable level. Placement of electrodes: 2 electrodes are placed Para-spinally on the lower lumbar region, 2 electrodes are over the painful area. [15,16,17]

TOUCH: Walking on different surfaces like sand, mattress, land etc.

PROPRIOCEPTION- Exercises on stability disc: Standing and balancing on the stability disc, Bilateral heel rise, single limb stance, hip flexion balancing on one leg and keep the other hip at 90 degree flexion, Hip extension- balance on one leg extend the other leg, Knee bending- balance on one leg bend the other leg to keep the knee up to 90 degree flexion. All the exercises were repeated with other lower limb. [18,19]

VISUAL AND VESTIBULAR STIMULATION:- The following exercises were performed with eyes open and eyes closed. Vestibular stimulation is facilitated by head turns:- Double limb stance, tandem stance, walking forwards, backwards, tandem walking, single limb stance on each leg. [20,21]

## RESULTS

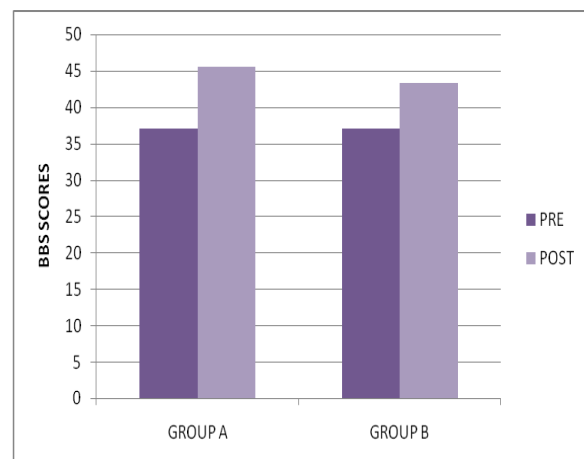
Scores of Berg Balance Scale, between the groups are analysed by Mann-Whitney U Test and within the same group before and after results are done by Wilcoxon Signed Rank test. Results showed that there is improvement with both the treatment interventions, but when we compare the means more improvement was seen in Group A individuals concluding that the sensory specific exercises are more effective.

Table 1: Berg Balance Scale Scores in Group A and Group B before and after treatment.

	Group	N	Mean	Std. Deviation	P value
BBS_Pre	Group A	15	37.0000	1.36277	<0.05
	Group B	15	37.0667	1.27988	
BBS_Post	Group A	15	45.5333	1.30201	
	Group B	15	43.3333	2.41030	

## DISCUSSION

The abnormal sensory perception in diabetics is the main source of postural instability. This is because of the aggregated loss of cutaneous sense in the sole of the feet and muscle spindles in both legs. [22] 60-75% of postural control is majorly by the somatosensory system and the exteroceptors in the sole of the foot are concerned with judging the texture and quality of the surface. [23]



Graph 1

Therefore treatment with emphasis on this area will definitely help these individuals. Present study results have given us a conclusion that the diabetic neuropathy individuals will be benefited from balance training. These findings are in favour of the work done by M.S.Ajimsha et al 2011 [19], M.Akbari et al 2012 [24], K. Jyoti et al 2016 [18]; Sowjanya.M et al 2018. [23] Their studies have proved that balance training is certainly effective in diabetic neuropathy individuals. The second conclusion is that a focused sensory specific intervention could also be more beneficial than conventional exercises. Which is consistent with the work done by Hoda M et al 2008 [11]; N. A. M.Kutty et al 2013 [20]. Their research suggesting that the multi sensory stimulation is helpful balance improvement in type2 diabetic neuropathy individuals. By giving exercises the proprioceptive information from the joint receptors pass through the Spinocerebellar tracts and reach cerebellum which is a chief controlling

organ for balance. The somatosensory input given will increase the sensitivity of the receptors there by balance is improved. [22] Adding the visual and vestibular inputs alteration will make the individual to depend on the somatosensory inputs to control balance. Therefore combining all these will certainly help the individual. [20] W. Taube *et al* proved that with balance training there will be adaptability in the spinal structures as the spinal reflex system is highly adaptable. Even on unstable surfaces there is increased inter muscular activation. Balance training will also increase corticospinal excitability. [25] Future studies can be done on large samples, taking a quantitative outcome measure like NCV.

## CONCLUSION

We can come to a conclusion that sensory specific balance exercises are more effective in making the neuropathic individuals more stable.

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