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EFFECT OF BACKWARD WALKING ON BALANCE AND FUNCTIONAL ABILITY IN PATIENT WITH DIABETIC NEUROPATHY

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ABSTRACT

Introduction: Diabetic Neuropathy (DN) is always an alarming complication in diabetes mellitus patients affecting the peripheral nerve. Backward walking (BW) is an activity that results in joint kinematic patterns different from those experienced during forward walking. BW is beneficial for your brain, it sharpens your thinking skill and enhances cognitive control. Backward locomotion helps to maintain better blood sugar control in diabetics, balanced hormones. Benefits gained in BW include reduced ground reaction force at contact, potential of proprioceptive/balance control training during activity. **Methods:** 60 diagnosed Diabetic Neuropathy patients were divided randomly into two groups of 30 each. Group A received backward walking with conventional therapy whereas Group B received forward walking with conventional therapy for 3 weeks. Pre and post intervention balance on Berg balance scale and functional ability on Activities-specific Balance Confidence (ABC) scale was measured. Statistical Analysis was done by using t-test and significance was accepted at the confidence interval of 95%. **Results:** Balance significantly improved in Group A from 33.30±3.78 to 46.97±3.68 with t value of 23.02 (p=0.00) than Group B from 33.17±3.76 to 36.97 ± 3.77, t value13.51(P=0.000) Significant improvement in functional ability in Group A & in Group B from 50.43±7.45 to 63.41±7.70, t value of 18.49(P=0.00) & from 49.85±7.24 to 52.68± 7.21, t value of 23.07 (P=0.00). **Conclusion:** Backward walking along

with conventional therapy is effective in improving balance and functional ability in patient with diabetic neuropathy.

KEYWORDS: Diabetic Neuropathy, Backward Walking, ABC, BBS.

INTRODUCTION

Diabetes Mellitus is a clinical syndrome characterized by hyperglycemia caused by absolute or relative deficiency of insulin.[1] The prevalence of Diabetic Neuropathy (DN) increases with the duration of diabetes mellitus. The incidence of neuropathy increased from 7.5% on admission to 50% at 25 years follow up.[2] DN leads to pain, impaired sensation and reduced movement in the limbs thus reducing patient's ability to control their balance during daily activities.[3] Balance problems are caused by proprioception impairment, movement-strategy impairment, biomechanical structural disorders and disorientation.[3]

Agrawal et al. studied a population of > 21,000 individuals and reported a prevalence rate for vestibular dysfunction of 35.4%, and increased with age and were 70% higher among people with diabetes.[5] Any changes in shear stress and pressure on the soles of the feet during standing tasks can stimulate mechano-receptors to the higher nervous centers, which leads to increased balance ability in patients with DN.[4]

The scientific data suggest that with good glucose control, most of the complications can be prevented or minimized. Glucose can be controlled easily by starting exercise program, diet modification and medications under close supervision. Insulin plays a key role in controlling glucose transport into cells. When you exercise, your cells become more sensitive to insulin and glucose is transported into cells at a faster rate and the increased metabolic rate due to exercise together help control glucose levels.[2]

It is suggested that walking backward increases energy expenditure to a level high enough to maintain cardio respiratory fitness.[6,7] Increase quadriceps strength and improves fitness without putting excessive stress on already painful knees.[5] Researchers found that when you walk backwards, it sharpens your thinking skill and enhances cognitive control. This may be because even though BW is a physical activity, it requires brain activity since it puts your senses into overdrive as you move in an unfamiliar way.[8] Backward locomotion is showing to be a very powerful trigger to mobilize physiological resources for better health ie better blood sugar control in diabetics, balanced hormones and stronger immunity.[9]

METHOD AND PROCEDURE

A Pre – post experimental study was conducted on 60 diabetic peripheral neuropathy subjects after an approval from ethical committee of the institute. Subjects were recruited from tertiary hospitals and private clinics of Pune. Subjects diagnosed with DN, age group 40 to 60 years, controlled diabetes, BBS score from 21-40, and MNDS score more than score ≥4, Time up and go ≤ 10 seconds were included in the study. Subjects with Foot ulcers, Uncontrolled Hypertension, Eye infection, Other neurological impairment affecting balance, Severe lower limb injury or deformity which unable the patients to walk were excluded. All the subjects were informed about the procedures and written consent to participate in the study was taken. Subjects were divided randomly into two group**.**

Group A- Experimental received BW along with conventional therapy.

Group B-Control group received forward walking (FW) along with conventional therapy.

Baseline parameter for balance and functional ability was assess by Berg Balance Scale (BBS) and Activities specific Balance confidence Scale (ABC) scores.

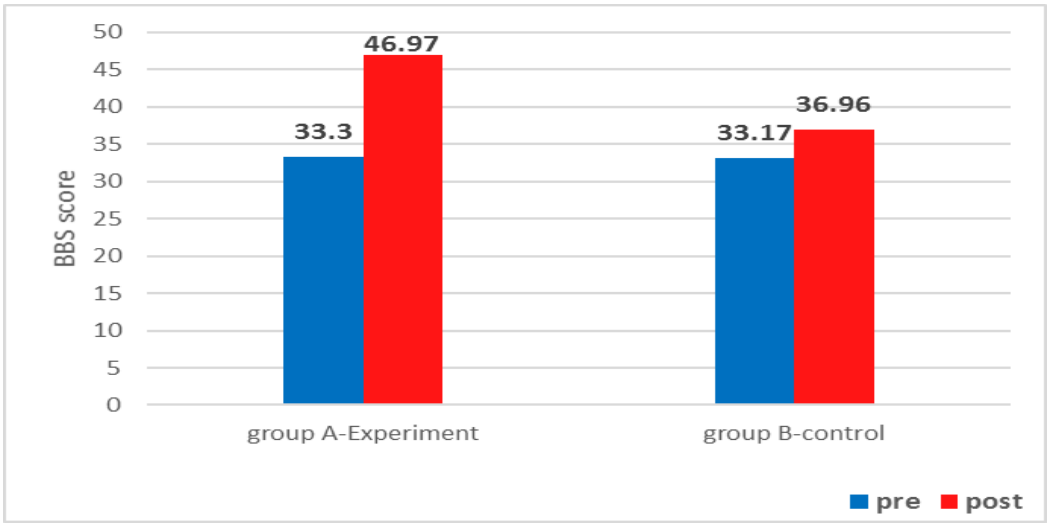
Conventional therapy included

Warm up Exercises like Ankle toe movements, Heel slides Stretching for tightness muscle like Hamstring and Dorsiflexors Active Exercise like Straight Leg Raise (in all planes), Dynamic quadriceps, Balance Exercise such as One leg standing, Heel raise (bilateral& unilateral), on Heels Each exercise was given 10 repetitions with 1-minute break in between each exercise.

BW Training Protocol includes walking 10 steps forward and 9 step back and then observe if patient experience discomfort in either direction. If not walk backward for 10 minutes for 6 days a week. *FW* was carried out for 45 minutes to 60 minutes for 6 days a week. Walking surface should be plain, clear of traffic or any object.

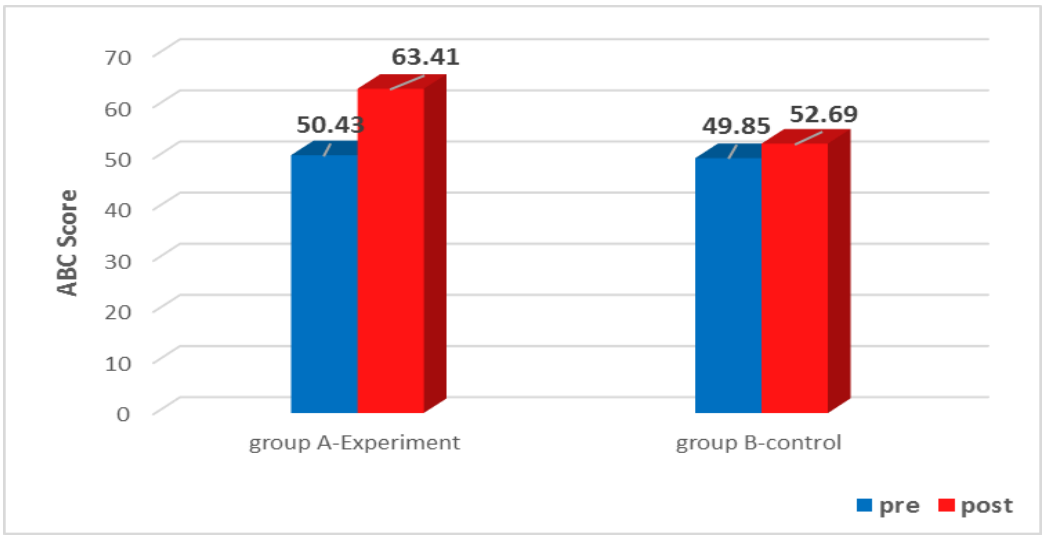
Data analysis and interpretation

Descriptive statistics was calculated by paired and unpaired student t test for intra and inter group comparison, by using Win Pepi Software.



Graph 1: Comparsion of mean value of BBS for balance in group A& B.

Inference: Group A showed more significant increase in BBS as compared to Group B thus suggesting that balance improved in group A.



GRAPH 2: Comparsion of mean value of ABC for functional in group A& B

Inference: Group A showed more significant increase in functional ability confidence in patient with DN as compared to Group B on ABC.

RESULT

Graph1 represents comparison of balance by BBS between Group A and B which showed significant improvement in balance in Group A with mean value from 33.30±3.78 to 46.97±3.68 with t value of 23.02 (P=0.00) than Group B from 33.17±3.76 to 36.97 ± 3.77, t value13.51 (P=0.000) within the Groups A & B which shows statistically significant.

Intergroup comparison showed statistically significant improvement in balance in Group A with mean difference of shows 13.7±3.3 P(0.000) than in Group B with mean difference 3.8±1.5 (P=0.000).

Graph 2 shows comparison between Group A and B in functional ability on ABC with significant improvement in Group A with mean value from 50.43±7.45 to 63.41±7.70, with t value of 18.49(P=0.000) & in Group B mean values from 49.85±7.24 to 52.68± 7.21, with t value of 23.07(P=0.000) within the Groups which is statistically significant. Intergroup comparison shows significant improvement in functional ability on ABC score in Group A with mean difference of 12.97±3.8 than in GroupB with mean difference of 2.83±0.67 with (P=0.000).

DISCUSSION

The purpose of this study was to investigate the effect of BW exercise program on 60 DN Patient. The result of this study indicate that there is a significant improvement in balance on BBS in both the groups. Components of BBS, standing unsupported with eyes closed, standing unsupported with feet together, one leg standing showed more increase in balance ability in Group A whereas in Group B, one leg standing components showed more improvement. Group A showed significant improvement in functional ability on ABC score than Group B.

Some of the benefits of BW training program includes reduced shear forces, increased energy expenditure and it puts no eccentric loading of the knee joint. It is said that 100 steps of backward walking are equivalent to 1000 steps of conventional walking. So 10 minutes of BW, would give the benefits of more than one hour of FW. From physiological and biomechanical perspectives, BW and FW are quite different. Backward locomotion produces higher cardiopulmonary demand than forward locomotion at the same speed as compared to forward motion.[9]

The differences of BW gait patterns from FW may also play roles in the mechanism of BW exercise causing improvement of balance. Stance begins with heel strike and ends at toe-off in FW. In order to keep with the higher level of demand for the balance ability in BW, the ground contact time for the entire foot area must increase, thus the center of plantar pressure would be shifting within a much wider range across the whole foot area, suggesting that BW might exert a certain ameliorating effect to the balance of the body et al Zhang.[10]

Balance requires the systems within the body to work in concert to move the center of mass in relation to the base of support in a controlled manner when engaged in dynamic task. There are three primary systems involved for the balancing process, the sensory system (visual, cutaneous and proprioceptive, and vestibular senses), which gives feedback to alter the balance action during a voluntary motor task, the motor system, which creates the coordination movement to maintain balance and the biomechanical system or musculoskeletal system, which includes the muscles that create the movement torques and the bony and joint frame on which movements are made. All those three systems may be associated with the improvement of balance by BW exercise. During BW, the visual cues doesn't provide visual information necessary to anticipant ground condition, and motor pattern are unconventional, Wei –Ya Hao et al in his study BW training improves balance in school aged boys says the children have to reorganize and adapt the changed information from visual, cutaneous and proprioceptive, and vestibular senses, and then enhance the movement control to maintain dynamic balance.[11]

The study report also stated that there is significant increase in functional ability of the subjects in Group A. It is due to increase in muscle strength in the lower extremities, reducing joint impact on knee, enhanced walking speed and stride length. Also it is stated in a study that retrowalking improve the strengthen of core muscle.[12] In BW more energy & more calories are burned than those who work out at the same pace consistently for a longer duration. When engaging in a new activity which requires a greater effort, exertion more. The increased metabolism will result in weight loss and controlling blood glucose level in the body. Thus, a combination of pharmacotherapy and BW could provide more effective treatment and rehabilitation for patient with DN as the benefits observed in BW are more energy consumption, increases metabolic activity, controls blood sugar level in DM which can be easily done in 10 minutes whereas FW requires 45 minutes to 60 minutes for the same results.

CONCLUSION

This study concludes that BW has significant effect in improving balance and functional ability in patient with DN. Thus we can incorporate BW training in the treatment protocol of DN. Future studies can be done on cognitive effect of BW on DN Patient. Monitoring blood glucose level can also be included in further study.

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Conflict of Interest: Authors declares no conflict of interest.

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