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EFFECT OF SLOPE WALKING ON BALANCE AND GAIT IN PARKINSON'S PATIENTS – RANDOMIZED CONTROL TRIAL

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ABSTRACT

Balance and Gait disturbances is common feature in Parkinson's disease (PD). An abnormal stooped posture contributes to development of festinating gait pattern, Characterized by a progressive increase in speed with a shortening of stride. Gait disorders, balance impairment, falls, and fall related injuries are present in PD patients. Walking on slope increases the activity levels in some of the lower extremity muscles and may be an excellent way to improve muscle strength and increase endurance.

Objectives

To study effect of slope and ground level walking on balance and gait in Parkinson's patients.

Method and methodology

Total number of 30 patients between the age 50-80 years with diagnosed Parkinson's disease since 1 year were selected by simple random sampling. Berg balance scale, timed up and go and dynamic gait index were used to assess balance and gait pre and post intervention. Participants were divided in 2 groups, Group A was given Slope walking training, Group B was given ground level walking.

Results

After comparing pre and post intervention data using paired and unpaired t test results showed, there was significant improvement on balance($p<0.0001$) and gait($p<0.0013$) in Parkinson's patients.

Conclusion

There is significant effect of slope walking than ground level walking on balance and gait in Parkinson's patients.

Keywords: Balance, Gait, Parkinson's patient, Slope walking, Ground level walking.

INTRODUCTION

Parkinson's disease is a progressive disorder of central nervous system with both motor and Non motor symptoms. Parkinson's disease is common

disease that affects an estimated 7 to 8 million people worldwide. Parkinson is the group of disorders with primary disturbances in the dopamine system of basal ganglia. Individuals with Parkinson's disease demonstrate abnormalities of

posture and balance, resulting in postural instability. Patient demonstrate abnormal and inflexible posture response controlling their center of mass within their base of support. [2] Gait disturbances are also common feature. The patient with Parkinson's disease demonstrate a number of significant gait changes resulting from impoverished movement. An abnormal stooped posture contributes to development of festinating gait pattern, Characterized by a progressive increase in speed with a shorting of stride. Thus the patient takes multiple short steps to catch up with his or her COM to avoid falling, and may eventually break into a run or tort. Gait can be anteropulsive i.e forward festinating gait or less commonly retropulsive that is backward festinating gait. Problems with controlling posture and balance limit independence, community ambulation, and safety [2]. Difficulty in walking is a pathological sign of Parkinson's disease. Indeed, patients with PD demonstrate impaired ability to walk and to change direction [2]. Walking is an beneficial exercise for people with Parkinson's disease. Slope surfaces are encountered in both man-made and natural environments. When walking on slopes, the muscles raise or lower the body center-of-mass (COM) while maintaining balance. The altered biomechanical demands of slope walking, particularly with slope angles, require greater activity from lower-limb muscles, such as the gluteus maximus on inclines and rectus femoris and vasti on declines. On slope, metabolic power is increased compared to level-ground walking. Walking on slope is another scenario that induces distinctive gait pattern changes. More specifically, the gait patterns of healthy, young adults on incline and decline surfaces relative to level ground must be looked at more closely. When comparing incline walking to level walking the demands imposed on the human body are different and require various adaptations that have been outlined in the literature and summarized in this paper. Unfortunately, to date virtually no data have been compiled on older adults walking on slope. It is logical to assume while walking on inclines resultant patterns adapted by older adults will be different than those seen in younger populations due to age-related physiological changes. In order to maintain forward progression, maximize safety

and assume an overall efficient gait pattern on inclines, a variety of adaptations occur.

MATERIALS AND METHODOLOGY

The study has been designed to find out effect of 6 weeks of slope walking in Parkinson's patient. Experimental study was carried out by doing convenient sampling in age of 50-80 years old subjects diagnosed with Parkinson's disease. Duration of study was 6 weeks inclusion criteria was both male and female, Patient in 1.5 and 2.5 stage of Modified Hoehn-Yahr classification of disability, people who are willing to participate, subject diagnosed with Parkinson's disease since 1 year and exclusion criteria was individuals Patient with 3rd 4th 5th stage of Modified Hoehn-Yahr classification of disability, Parkinson-Plus syndrome, Non ambulatory patient, Not willing to participate. Patients with severe impairment of walking or balance. Material used were Consent form, Demographic data sheet, Arm chair with and without arm rest, measuring Tape, Stop watch, Various size of cones, Ruler, Footstool.

PROCEDURE

Approval was obtained from institutional ethical committee before starting procedure and informed consent was taken. A survey on approximately 30 Parkinson's individuals was done. The consent form filled by the subjects. Study and the procedure was explained to them. The sample size selected on the basis of inclusion criteria. The patient fitting in the inclusion criteria was evaluated by the outcome measures viz. Berg balance scale, dynamic gait index, time up and go. Patient was checked for balance and gait. All patients were divided into two groups- group A and group B. In group A patient was instructed to walk on slope and group B patient was instructed to walk ground level. Effect was compared with ground level walking patient and with slope walking patient. Intervention was given 4 days per week for 20 min.

Duration: 4 days/week for 6 weeks

Warm up: 10 min

Slope/ground level walking: 20 min

Cool down: 5 min

After the complete intervention results were noted according to the scales.

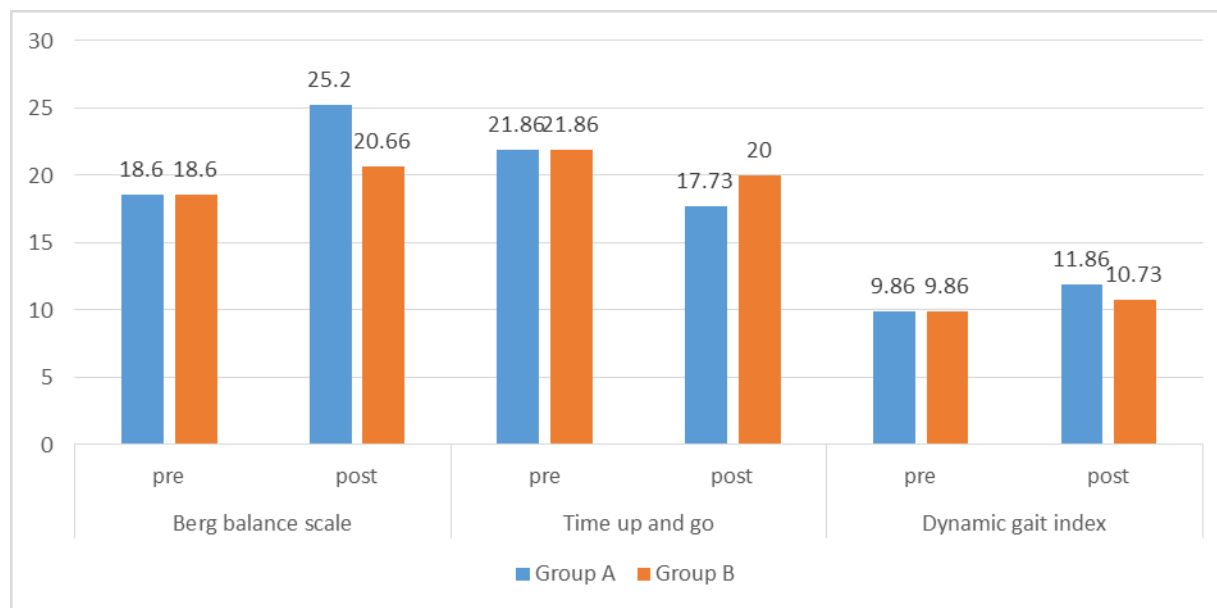
RESULTS

Table no 1: Demographic characteristics of the samples

Group	Gender	Age (years) (mean±SD)	Duration of Parkinsons disease
Experimental group (A)	Male = 11 Female = 4	66±4.79	7±1.51
Control Group (B)	Male = 12 Female = 3	64±5.40	6.33±1.58

Table no 2

Outcome measures		Group A Mean±SD	Group B mean±SD
Berg balance scale	Pre	18.6±2.74	18.6±2.74
	Post	25.2±3.71	20.66±2.89
	P value	0.0001	0.0546
Timed up and go	Pre	21.86±3.81	21.86±3.81
	Post	17.73±3.81	20±3.26
	P value	0.0035	0.1568
Dynamic gait index	Pre	9.86±1.64	9.86±1.64
	Post	11.86±1.40	10.73±1.53
	P value	0.0013	0.1464



Graph no: 1

Interpretation

This graph describes the pre and post intervention mean values of Berg balance scale, timed up and go scale and dynamic gait index within group A and group B which shows significant improvement.

DISCUSSION

The study was aimed to find out effect of slope walking on gait and balance in Parkinson's disease patients between age group of 50-75 years. An intervention based study was performed among 40 subjects were included, out of which 2 subjects had

complications like recent injuries, 3 discontinued follow up and 5 subjects refused to continue the participation in study. So 15 subjects were in Experimental group and 15 subjects were in Controlled group. Participants in this study showed significant improvements in walking speed, balance and gait following six weeks of slope walking training.

Muscle like quadriceps in which the rectus femoris, vastus lateralis, vastus medialis and vastus intermedius that work together to extend the leg at the knee. When walking on slope surface quadriceps work to straighten the leading limb. In hamstrings the biceps femoris, semitendinosus and semimembranosus works together to extend the thigh and flex the knee. While walking on slope hamstring primarily work to extend the thigh on leading leg. Then gluteus maximus works with the hamstring to extend the thigh while walking on slope. The gluteus medius and gluteus minimus work to stabilize the pelvis and it prevents one side from sagging and thus allowing the swinging limb to clear the ground. The calf muscle work more intensely walking on the slope than walking on a level surface. Calf muscles as you push foot away from the ground at the end of stride.

In this study, the mean of berg balance scale score for experimental group pre and post intervention was significant ($p=0.0001$) which showed improvement in balance by slope walking. In the previous study by Richard A. Ferraro et al showed that older participants decreased their step length on inclines, this adaptation suggests a shift toward increasing postural stability by ensuring the participant's center of mass remains within their base of support. Results of this study further support that when balance or safety is a concern, older adults alter their walking pattern to prioritize stability. By taking smaller, more controlled steps older adults were able to compensate for reductions in dynamic balance control that naturally occurs while walking on slope. As reported in previous

Studies, Alexandra Nadeau et al. showed that Walking on an incline increases the activity level in lower extremity muscles and may be an excellent means of increasing endurance and improving muscle strength. The present study also showed that slope walking may help to reduce gait variability and increased mobility [3].

In this study the mean of dynamic gait index score for experimental group pre and post intervention was significant ($p=0.0013$) and timed up and go score was also significant ($p=0.0035$) which showed there was improvement in gait by slope walking. Previous study showed that, inclined Treadmill Training reduced gait variability it reduced stride length variability and a shorter double support phase are both associated with a lower risk of falling [3].

It should be noted that the Control group following six weeks of ground level walking exercise routines did not worsen in terms of their gait performance, quality of life and Parkinson specific symptoms. Other studies, with a duration ranging from 6 to 24 weeks, also showed no worsening of gait parameters in their control groups. Inclined treadmill training had positive effects on motor and non-motor symptoms of PD and had positive effects on walking speed, gait parameters, walking endurance and health related quality of life. The use of incline adjustments during training sessions may constitute an interesting way of increasing endurance and improving muscle strength, which may ultimately lead to improved gait patterns [3]. It appears that individuals with poor baseline performance may benefit the most from slope walking.

CONCLUSION

There is significant effect of slope walking than ground level walking on balance and gait in Parkinson's disease patients.

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