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# Effectiveness of PNF along with stair gait training on dynamic balance assessed by functional reach test in patients with idiopathic Parkinson's disease

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**Abstract**
The purpose of the study was to find out the effect of PNF along with stair gait training on dynamic balance in patients with Idiopathic Parkinson's Disease by the end of 4weeks. 30participants (including both males and females) ranging from 60-90years old with Hoehn & Yahr stage 2&3 were randomly selected. PNF along with stair gait training sessions were c0onducted for 3 times per week for about 4 weeks. The subjects were evaluated before and after the 4 week. Functional Reach Test was used to assess the effect of PNF along with stair gait training. Statistical analysis of the data was done and significant improvement in the Functional Reach Test Scores ($p<0.05$) was noted. Hence, these results suggest that 4-week PNF along with stair gait training program significantly improves dynamic balance in patients with Idiopathic Parkinson's Disease.

**Keywords:** PNF, stair gait, dynamic balance, idiopathic Parkinson's disease, functional reach test

## 1. Introduction

Parkinson's disease (PD) is a progressive disorder of extrapyramidal system affecting over 4 Million people over age 50 years with rates expected double over the next 2 decades [1]. It comprises of both motor and nonmotor symptoms. Primary cause of the disease is not known. Motor symptoms include:

Rigidity: Decreases the ability to move easily, reduced range of motion, postural instability. Bradykinesia: leads to increased time on task, freezing episodes and dependence in daily activities. Tremors: interferes with activities of daily living.

Postural instability: Weakness of antigravity muscles contributes to adoption of stoop posture, difficulty during dynamic destabilizing activities [2]. As the disease progresses there is an inflexible pattern of excessive postural tone and consequent reduced range of motion mechanically impedes the ability to execute postural reactions effectively making patients vulnerable to loss of balance and falls [3]. According to a retrospective fall study of 489 in-patients admitted to a department of neurology, approximately 60% of PD patients had a history of at least one fall over previous 12 months [4]. It has been also reported that 46% of ambulatory PD participants without Dementia experience a fall annually. Thus from the results of epidemiologic studies, it is evident that balance dysfunction and related falls are common in individuals with PD and the risk of fall increases gradually with disease progression without vigorous intervention to reduce the risk. Balance is the result of interactions among the visual system, vestibular system, proprioceptive system, musculoskeletal system and cognitive ability. Dynamic balance is the ability to transfer the vertical projection of the centre of gravity around the supporting base of support. Dynamic balance is the ability to maintain postural stability and orientation with centre of mass over the base of support while the body parts are in motion. Proprioceptive neuromuscular facilitation (PNF) is an approach to therapeutic exercise that combines functionally based diagonal patterns of movement with techniques of neuromuscular facilitation to evoke motor responses and improve neuromuscular control and function [10]. A PNF technique effective for improving muscle strength necessary for independent gait and retraining muscles was applied, on the balance [8]. Differing from a horizontal gait on the ground, in stair gait training one foot moves the centre of gravity in the forward and vertical directions at the same time; therefore, stair gait training requires more lower limb muscle strength and adjustment ability than ground gait training [7]. Stair gait training is an essential element for independent activities of daily living and performing stair gait training may achieve qualitative improvements in independent and social life activities, and is the most important movement training program among treatment processes for patients who are recovering their lower limb functions [7].

### Methodology

a. **Purpose:** The purpose of this study was to find the effect of PNF along with stair gait training on dynamic balance by the end of 4 weeks in patients with Idiopathic Parkinson's disease.
b. **Selection of the subjects:** 30 patients with Idiopathic Parkinson's patients (including both males and females) ranging from 60-90 (7) with Hoehn & Yahr 2or 3 were selected randomly from Parkinson society and nearby hospitals in Pune.
c. **Procedure:** PNF session was given in "ON" period of medication, which is within 45min to 1 hour after medication.

Start with Warm up: which will includes stretching and free range of motion exercises for trunk, arms, and legs for 10mins.

The subjects received hip joint flexion, adduction, and external rotation, knee extension and ankle dorsiflexion and inversion from the therapist as a part of PNF pattern training.
After PNF, stair training was done in which subjects received: While stair climbing- weight acceptance -> Pull up -> forward continuance -> foot clearance -> foot placement [20, 21, 22].
While returning down from stairs – weight acceptance -> forward continuance -> controlled lowering -> leg pull through -> foot placement [20, 21, 22].
If the patient was not able to achieve the desired position, manual assistance was given. During the training, when patient had acute fatigue, respiratory problems, or dizziness, the training was stopped immediately. Rest period of about 1-2min was given.
PNF with stair gait training was given for 3times per week for a period of about 4weeks.Functional Reach Test was taken at the beginning and at the end of 4weeks.The collected data was analyzed and interpreted by performing paired t test and conclusion was taken out.

### d. Findings

**Table 1**

| Gender | Total |
|---|---|
| Males | 18 |
| Females | 12 |

Pre and Post data was analyzed with the help of Graph Pad Instats®.

**Table 2:** Shows interpretation of balance using Functional Reach Test [8]

| Scale | Mean + SD | t-value | p-value | Significance |
|---|---|---|---|---|
| Frt pre | 11.80+ 1.63 | 9.755 | <0.0001 | Extremely Significant |
| Frt post | 13.02 + 1.46 | | | |

Graph 1: FRT pre and post treatment data showing significant results.

## Results

Post data analysis shows that that the p-value < 0.0001 which is extremely significant and hence PNF is effective in improving dynamic balance in patients with idiopathic Parkinson's disease. (Table 2).

## Discussion

The present study was done to check the effectiveness of PNF along with stair gait training on dynamic balance assessed by Functional Reach Test in patients with idiopathic Parkinson's disease. In this study total 30 patients both males and females were included with mean age 70±10. We found that PNF is effective in improving dynamic balance in patients with idiopathic Parkinson's disease.
Proprioceptive neuromuscular facilitation technique stimulates proprioceptors within the muscles and tendons, thereby improving their functions and increasing muscle strength, flexibility, balance, and coordination, effectively maximizing responses of the motor units. FRT result significantly increased as movements were triggered more greatly during stair gait than during ground gait training, stimulating proprioceptive functions of the ankle joints.
In addition, when the lower limb joints were flexed for support on the stairs, vertical movements of the body in the forward and upward directions occurred, maintaining the force generated in the lower limb and requiring more balance ability for body alignment. Our results are in account with Westerholt, Horst and Dietz, as they reported that PNF has beneficial effect on the balance in idiopathic Parkinson's patients, as a facilitation method can activate the mechanism of neuroplasticity, and; it was proven as a treatment intervention through diverse research. Westerholt noted facilitation occurred when pressure was applied against the direction of muscle contraction and when stimulation was applied to the skin and pressure sensations [13]. Horst observed that an improvement in independent activities of daily living is the most important goal of treatment and to achieve the goal, all usable information should be mobilized in combination, as well as visual and auditory information [14].
Dietz reported that appropriate resistance with a gross muscle exercise of three-dimensional motions by a PNF pattern combination strengthened static and dynamic contractions [15].
In the present study, Parkinson's patients who received stair gait training with a PNF technique saw effective improvements in balance, and the present study result will provide important data that a PNF technique may provide balance recovery through rehabilitation training owing to manual therapeutic effect based on Dietz's grounds [15].
In contrast to our study E Mirek conducted a study to assess effect of Proprioceptive Neuromuscular Facilitation method of therapeutic Rehab in the treatment of patients with Parkinson's disease. Evaluation was made by three dimensional motion analysis using "Vicon" system. A sample of three subjects with Idiopathic Parkinson's was taken and PNF for pelvis, upper limbs and lower limbs were applied in order to improve movement for three weeks. After therapy there has not been a marked variability in scope of angular changes. However, stance phase and swing phase improved noticeably, so resulted in better rhythm of gait, but stride length and duration of single limb support has not changed significantly [23]. In their study the sample size was less which is covered in our study.
In the future, if gait training through diverse double tasks is conducted as well as mere stair training, lower limb gait training using PNF pattern will result in a better functional recovery for patients' balance ability.

## Conclusion

In this study PNF along with stair gait training shows significant effects on dynamic balance as assessed by Functional Reach Test in patients with Idiopathic Parkinson's Disease.

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