

## Effects of conventional physical therapy with and without proprioceptive neuromuscular facilitation on balance, gait, and function in patients with Parkinson's disease

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### Abstract

The study was conducted at University of Lahore Teaching Hospital and Sir Ganga Ram Hospital, Lahore, using non-probability convenience sampling. Thirty-eight patients of Parkinson's disease were allocated by randomisation into two groups. PNF Group (group A) performed proprioceptive neuromuscular facilitation incorporated with conservative treatment, while for the conventional therapy group (group B) only conservative treatment was followed. Berg Balance Scale, Freezing of Gait questionnaire, and Functional Independence measure were used as outcome measuring tool. Berg balance scale values were significantly improved in group A at 12th week as compared to group B. Freezing of gait and functional independence was more significantly reduced in group A at sixth and 12th week as compared to group B. Hence, it is concluded that Proprioceptive neuromuscular facilitation combined with routine treatment regime improves balance, gait, and function of Parkinson's patients more effectively as compared with routine treatment protocol only.

**Keywords:** Balance, Functional Independence, Gait, Parkinson disease, Proprioceptive Neuromuscular Facilitation.

**Trial registration:** Trial protocol of this study is prospectively registered in US clinical trials registry (ID#NCT05154552).

**DOI:** 10.47391/JPMA.6710

**Submission completion date:** 25-06-2022

**Acceptance date:** 23-02-2023

### Introduction

Parkinson's disease (PD) is a deteriorating disease of the central nervous system (CNS). It is a complex neurodegenerative disorder which leads to a lot of

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impairments, like tremors, bradykinesia, rigidity, and postural imbalance, which causes the individual to lose their independence. To improve the activity level and quality of life of the patient, a complete therapeutic exercise programme is required along with comprehensive medical management.<sup>1</sup>

According to a study conducted in Canada, it is generally accepted that Parkinson's disease ranges from one to two per thousand individuals in the whole population and affects 1% of the population above 60 years of age.<sup>2</sup> In Pakistan, more males were affected by Parkinsonism and it is common in sixth and seventh decades of life.<sup>3</sup>

The clinical characteristics of Parkinson's disease patients can be highly variable, due to which it can be divided in different subtypes which are: tremor dominant type, postural instability type and gait impairment type, or indeterminate.<sup>4</sup> The important motor symptoms of Parkinson disease include tremors, bradykinesia, rigidity, postural problems, gait disturbances, micrographia, speech problems, and alteration of eye movements and blinking disturbances. Non-motor symptoms include hallucinations, hyposmia, depression, anxiety, dysphagia, sleep disturbances, and different problems in the sensory system.<sup>5</sup>

Proprioceptive neuromuscular facilitation (PNF) is an impressive approach for rehabilitation that is used nowadays. This study incorporated three PNF techniques including rhythmic initiation, slow reversal, and agonistic reversal. These PNF techniques will be applied along with the conventional therapeutic exercises to see its effectiveness on patient's recovery and independence, so that PNF can be added to routine treatment protocol to enhance patient's recovery based on the results of the current study.

### Patients/Methods and Results

A single blinded randomised control trial was conducted in the department of physiotherapy at University of Lahore Teaching Hospital and Sir Ganga Ram Hospital, Lahore, Pakistan, from October 2021 to February 2022 using non-probability convenient sampling. All the ethics

and rules were followed throughout the trial that were formulated by the ethical review board of The University of Lahore. The sample size was calculated as 38 (19 in each group), using FOGQ as outcome measure after adding 20% dropout.<sup>6</sup>

$$n = \frac{2\delta^2 (Z_{1-\beta} + Z_{1-\alpha/2})^2}{(\mu_1 - \mu_2)^2}$$

**Inclusion and exclusion criteria:** Thirty-eight Parkinson's patients (Table 1) of both genders aged between 60 and 85 years, diagnosed and referred by the neurologist were included in the study.<sup>8</sup> All the patients were on a consistent drug programme for at least two weeks as per prescription.<sup>9</sup> Patients who were between stage 1 and 3 of Hoehn and Yahr staging system were included in the trial.<sup>10</sup> Patients with cognitive deficits that showed scores of less than 26 on the Mini-Mental State examination and patients with moderate and severe depression with scores of less than 17 on the Beck Depression Inventory (BDI) scale<sup>9</sup> were excluded from the study. Individuals suffering with diseases of CNS other than Parkinson's disease, and patients who had undergone total hip replacement surgery were also excluded from the study.<sup>10</sup>

**Table-1:** Demographics and clinical characteristics of study participants.

Demographics	Group A (PNF along with conventional physical therapy)	Group B conventional therapy)
N	19	19
Mean Age (years)	69.5 (± 4.07)	68.9 (± 5.82)
Gender (Male/Female)	12 (63%)/7 (37%)	10 (52%)/9 (48%)
Time since on medication (months)	14.42 (± 7.86)	12.68 (± 6.83)
Height (ft)	5.2 (± 0.73)	5.3 (± 0.709)
Weight (kg)	71.32 (± 12.36)	73.21 (± 10.46)
Body Mass Index	28.6 (± 4.5)	28.5 (± 7.02)
Mini mental state examination score	27.11 (± 0.75)	27.37 (± 0.87)
Beck Depression Inventory score	10.12 (± 3.42)	9.32 (± 1.97)

After signing consent forms, baseline assessments were performed on all the patients who fulfilled the eligibility criteria. Berg balance scale (BBS) was used to evaluate balancing capabilities of participants. Freezing of Gait Questionnaire (FOG-Q) was used for evaluation of gait. Functional independence measure (FIM) scale was used to evaluate functional status of participants.<sup>8</sup> After baseline testing, participants were assigned randomly into PNF group/group A (routine physiotherapy and PNF) and conventional therapy group/group B (routine

physiotherapy only). Outcome assessors were not aware of group assignment.

In the Experimental group, physiotherapy routine treatment regime along with PNF was performed. Conventional physiotherapy was in accordance with the European Physical therapy guidelines<sup>11</sup> for Parkinson's disease. PNF based exercises included pelvic patterns (pelvic interior elevation and posterior depression), PNF lower extremity D1 Flexion and PNF lower extremity D1 extension. These patterns were performed unilaterally from first to third week and progressed to both limbs from fourth week onwards. Three techniques of PNF were performed, beginning with rhythmic initiation, at sixth week slow reversal technique and agonist reversal technique were performed and continued up to 12th week.<sup>12</sup> Routine physical therapy treatment protocol

**Table-2:** Berg Balance Scale score, Freezing of Gait Questionnaire, Functional Independence Measure score within groups before intervention, at sixth week and after 12th week\*.

Group		Median	IQR (Interquartile range)	Mean rank value	p-value**
<b>Experimental group/ PNF group</b>					
<b>BBS</b>	Before intervention	34	10	4.00	<0.001
	At 6 <sup>th</sup> week	42	8	5.05	
	At 12 <sup>th</sup> week	45	4	5.95	
<b>FOGQ</b>	Before intervention	16	1	3.00	<0.001
	At 6 <sup>th</sup> week	13	2	1.95	
	At 12 <sup>th</sup> week	11	6	1.05	
<b>FIM</b>	Before intervention	97	4	7.00	<0.001
	At 6 <sup>th</sup> week	114	8	8.13	
	At 12 <sup>th</sup> week	115	7	8.87	
<b>Control Group /conventional therapy group</b>					
<b>BBS</b>	Before intervention	33	6	4.00	<0.001
	At 6 <sup>th</sup> week	40	6	5.00	
	At 12 <sup>th</sup> week	43	7	6.00	
<b>FOGQ</b>	Before intervention	16	2	3.00	<0.001
	At 6 <sup>th</sup> week	14	3	2.00	
	At 12 <sup>th</sup> week	13	2	1.00	
<b>FIM</b>	Before intervention	97	3	7.00	<0.001
	At 6 <sup>th</sup> week	107	2	8.03	
	At 12 <sup>th</sup> week	108	2	8.97	

\*. Friedman Test

BBS- Berg Balance Scale, FOGQ- Freezing of Gait Questionnaire, FIM- Functional Independence Measure, Experimental group- PNF along with conventional physical therapy, Control group- conventional physical therapy group

**Table-3:** Between group comparisons for mean change in Berg balance scale, Freezing of Gait Questionnaire and Functional Independence Measure\*.

variable	Mean rank (PNF group)	Mean rank (conventional therapy group)	Median/interquartile value (PNF group)	Median/interquartile value (conventional therapy group)	p-Value	Z-Value
<b>BBS</b>						
At baseline	20.42	18.58	34/10	33/6	0.607	-.515
At 6th week	22.74	16.26	42/8	40/6	0.071	-1.803
At 12th week	24.74	14.26	45/4	43/7	0.003	-2.95
<b>FOGQ</b>						
At baseline	20.37	18.63	16/1	16/2	0.618	-.49
At 6th week	15.11	23.89	13/2	14/3	0.012	-2.5
At 12th week	12.97	26.03	11/6	13/2	0.000	-3.7
<b>FIM</b>						
At baseline	17.42	21.58	97/4	97/3	0.245	-1.164
At 6th week	28.61	10.39	114/8	107/2	0.000	-5.09
At 12th week	28.29	10.71	115/7	108/2	0.0001	-4.905

\* Mann-Whitney U test

BBS- Berg Balance Scale, FOGQ- Freezing of Gait Questionnaire, FIM- functional independence measure

(45 minute) was given to control group/group B participants. The rehabilitation programme was performed for three days per week. Treatment protocol was performed for 12 weeks on alternate days (36 sessions).<sup>11</sup> Patients were re-evaluated on the outcome measuring scales at the end of sixth week (t1) and then after treatment i.e. after 12 weeks (t2). The screening, detailed neurological examination, assessments of outcome measures and intervention were performed by different researchers.

Data interpretation was done by using statistical package for social sciences version 24. After fulfilling the parametric assumptions (Kolmogorov-Smirnov), non-parametric tests were applied. Mann-Whitney U test was used to determine mean difference of variables between groups. Within group differences were measured with the help of Friedman test.

Parkinson's patients improved significantly for balance (p value<0.001), freezing of gait (p value<0.001), and functional status (p value<0.001) within both the groups (Table 2). However, Berg balance scale values were significantly improved (P value<0.05) in group A undergoing PNF at 12th week as compared to group B without PNF (Table 3). Freezing of gait was more significantly reduced in group A at sixth and 12th week as compared to group B (P value<0.001) (Table 3). Also, Functional independence was more significantly improved (P value<0.001) in group A as compared to the other group at both sixth and 12th week (Table 3).

## Conclusion

Proprioceptive neuromuscular facilitation incorporated

with conventional physiotherapy is more effective in enhancing balancing capabilities (P value<0.05), freezing of gait (p value<0.001), and function (p value<0.001) in Parkinson's disease patients as compared to conventional physical therapy alone.

**Acknowledgments:** We are grateful to the dean of University of Lahore (AHS department) Dr Ashfaq Ahmad and HOD, Dr Asadullah Arslan for their help and support. We also acknowledge the efforts of all the study participants.

**Disclaimer:** None.

**Conflict of Interest:** None.

**Source of Funding:** None.

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