Research Article

Comparison of Proprioceptive Neuromuscular Facilitation Vs Balance exercise along with Conventional therapy for balance and gait in Chronic Parkinson's Patients.

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Submitted: 10 Feb 2023; **Accepted**: 17 Feb 2023; **Published**: 07 Mar 2023

Abstract

Objective
The purpose of the study is to determine the effect of Proprioceptive Neuromuscular Facilitation Vs Balance Exercise along with Conventional Therapy for balance and gait in Chronic Parkinson's patients.

Study Design
Randomized Controlled Trial (RCT).

Place and Duration of study
This study took place in Lahore, Pakistan and the duration of the study was 6 months.

Method
This study is a Randomized Controlled Trial utilized a non-probability purposive sampling technique, the primary outcome measure was Berg Balance Scale and Functional Gait Assessment which were used to check the balance and gait. The findings were then statistically analysed by non parametric tests Mann Whitney U Test and Friedman Test were used for between group and within the group comparisons respectively.

Results
A total of 60 patients participated in the study among which after randomized allocation of 30(50%) in PNF group and 30(50%) in Balance T group. The data shows that there is a big difference mean value difference between the two groups i.e. Balance T group showed better results than the PNF group and the p value is 0.000 which is less than 0.05 hence suggesting that the difference between both the experimental the groups after 12 weeks is highly significant. Hence we are rejecting the Null hypothesis and accepting the alternating hypothesis. . The data shows that there is a difference mean value difference between the two groups i.e. Balance T group showed better results than the PNF group and the p value is 0.492 which is more than 0.05 hence suggesting that the difference between both the experimental the groups after 12 weeks is non-significant. Hence we are rejecting the Alternate Hypothesis and accepting the Null Hypothesis.

Conclusion
Both of the treatment approaches have proven to be effective in treatment of balance of lower limb among chronic Parkinson's patients but the Balance Exercises has proven to be significantly more effective than of Proprioceptive Neuromuscular Facilitation and show effective results in the treatment of balance more efficiently but among two of these treatment strategies none of them has been proven to be better than other for gait.

Discussion
In the current study where PNF and Balance exercise are compared to each other shows that Balance exercise is highly effective for the treatment of balance in chronic Parkinson's patients as compared to PNF. However Del Carmen et.al. Conducted a research in 2019 i.e. "the development of ballet exercises with Proprioceptive Neuromuscular Facilitation techniques for patients with Parkinson's disease" which indicated that of Proprioceptive Neuromuscular Facilitation technique also improve balance and gait in Parkinson's disease patients [1].

Introduction

Parkinson's disease is caused by degenerative changes in the nervous system that cause the cerebral basal ganglia to malfunction. Patients frequently suffer from posture control and mobility issues, which harm their quality of life [2]. Basically, dopaminergic nigrostriatal system is going through the degeneration in Parkinson disease [3]. A specific area located in midbrain in which dopaminergic neurons are loss, is known as substantia nigra pars compacta (SN). In Parkinson disease, not only dopaminergic neurons are effected but non dopaminergic neurons are also effected [4].

Parkinsonism have many different forms from which one of the most common is Parkinson disease. Parkinsonism is the cluster of disorders related to neurology. If we talk about the some types of the Parkinson disease some are here, diffuse malignant subtype, mild motor-predominant type and intermediate subtype [5]. If we talk about the cause of Parkinson disease, there are basically 2 main cause from which one is idiopathic means unknown cause and other one is genetic cause [6].

In the 26 years since 1990, the global burden of Parkinson's disease has more than doubled, from 25.5 million people (95 percent uncertainty interval 0–30) to 61.1 million patients (50–73) in 2016 [7]. According to estimates, one million persons in Pakistan have Parkinson's disease, with the number rising to 1,200,000 by 2030. Both non-modifiable (age, gender) and modifiable (occupation, pesticide exposure, and depression) risk factors have been linked to Parkinson's disease [8].

Various types of fitness training have been utilized to treat Parkinson's disease in recent years [9]. Interventions used to improve gait and balance in Parkinson's disease include dance therapy, music therapy, LSVT BIG Intervention, balance exercise, whole body vibration and Proprioceptive neuromuscular facilation that are effective in improving gait and providing social well-being and quality of life in the patient. But We will compare the two techniques from them that are Proprioceptive neuromuscular facilitation versus balance exercise in Parkinson's patients. Postural instability causes walking difficulty in those with Parkinson's disease, which can be alleviated with proper balance training. Its effect depends on the dosage and type of the exercise which we guide our patient [10].

Mainly, there are two type of therapeutic treatment of Parkinson's disease patient. One is non-invasive therapeutical option and the other one is invasive therapeutical option [11]. If we talk about the non-therapeutical treatment of the Parkinson's disease, main option is conventional physical therapy which said to be the routine physical therapy or traditional physical therapy [2].

Proprioceptive Neuromuscular Facilitation is a type of physiotherapy treatment for Parkinson's disease. It is defined as the activation of proprioceptors to promote the response of the neuromuscular system [12]. Facilitation, inhibition, strengthening, and relaxation of muscular groups are used in this strategy to enhance functional movement. As its clear from name of balance training exercises that they use to improve balance and also the function. Other than these two factors balance training exercises decreases the chance of falling. These are the one of type of exercises which are used to improve motor functioning and performance [13].

Material and Methods

Study Design

The study design was A Randomized Control Trial (RCT).

Study Population

The study population was Chronic Parkinson's disease patients.

Setting

As per permission of head of department of physiotherapy from superior university I had collected data from:
• Shadman medical center
• Chaudhry Muhammad Akram Teaching and research hospital
• Services hospital Lahore
• Aziz bhatti Shaheed teaching hospital

Duration of Study

The duration of the study was 6 months after the approval of synopsis.

Sample Size

The calculated sample size using Berg Balance Scale as the outcome measure in each group is 28. After adding 10% dropout the sample size was 28+2= 30 in each group so the total sample size of the study is 60 [14].

Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)		95%	
Power		80%	
Ratio of sample size (Group 2/Group 1)		1	

	Group 1	Group 2	Difference*
Mean	53.4	50.7	2.7
Standard deviation	3.3	3.85	
Variance	10.89	14.8225	

Sample size of Group 1	28
Sample size of Group 2	28
Total sample size	56

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

Z1-α/2 Level of significance=95%

μ1 Expected mean change in Motor Functioning in Group A= 53.4.(14)

μ2 Expected mean change in Motor Functioning in Group B= 50.7.(15)

δ1 Expected standard deviation in group A= 3.3.(14)

δ2 Expected standard deviation in group B= 3.85.(14) Z1-β power of the study= 80% n Expected sample size in a group= 28.(14) After adding 10% drop out in each group 28+2 = 30 in each group so the total sample size of both groups was 30+30= 60.(14)

Sampling Technique

The sampling technique was Non – Probability purposive sampling technique.(16)

Eligibility Criteria

Inclusion criteria:

Following people was included in this study:

- Chronic Parkinson's patients.(17)
- Patients from both gender around the age of 45-65.(18)
- Patient with a score of 42 above on the Berg Balance Scale. (19)
- Patient with good cognitive function minimum score of 20 or more on Mini-mental Status Examination Scale (MMSE).(20)

Exclusion criteria:

Following people was excluded from the study.

- Patients with a history of CVA.(21)
- Patient with peripheral vascular disease.(22)
- Patient with fracture or dislocation of lower limb.(23)
- Patient with peripheral nerve injury.(24)

- Patient with skin discoloration, skin ulcers, and skin allergy. (25)

Ethical Approval and Screening

After giving informed signed consent participants was have a detailed neurological examination and assessed for eligibility as defined in the inclusion/exclusion criteria. For assessing the eligibility, participants had undergo screening and examination. After this pre test was performed on eligible participants then we were apply Berg balance scale to assess the balance and Functional gait assessment to assess the gait. . We also assess the patient's cognitive level by Mini Mental State Examination (MMSE).

After the baseline assessment, the eligible participants was randomly assigned to (in 1:1 ration) both groups group A and group B. Group A was receive the Routine Physical Therapy treatment with Proprioceptive Neuromuscular Facilitation and Group B was receive the Routine Physical Therapy treatment with Balance Exercises.

Randomization

Computer generated randomization assignments was designed by an independent statistician and randomization was done by one of the research team members who was not involve in patient recruitment or assessment or data analysis. Randomization assignments was kept in opaque, sealed envelopes and unsealed by a researcher after baseline testing. Outcome assessors was unaware of group assignment. The experiment was started on the day after randomization. For both groups, the intervention progressed during the regularly scheduled therapy session and all other routine interdisciplinary rehabilitation proceeded as usual. After randomization,

study participants was only informed about the content of their allocated program by their therapist, remaining unaware of the intervention in the other group.

Blinding
Patient information was state that the study purpose is to determine the effects of Proprioceptive Neuromuscular Facilitation in addition to routine physical therapy in comparison to Balance exercise, without specifying the details of both programs except for similarities across both groups. Both programs was personalized to the patient's abilities to ensure all eligible patients could complete the program. Researchers who was assess outcomes or do data analyses was masked to group allocation. Patients was instructed not to talk about the content of their exercise program during the post intervention visit and could contact their therapist in case of any problems during trial participation.

Intervention
Group A
Group A was given Proprioceptive Neuromuscular Facilitation with routine Physical Therapy for 45 minutes on lower limb. The intervention was conducted 3 times a week for a period of 12 weeks.

Proprioceptive Neuromuscular Facilitation exercises include D1 flexion and D1 extension of lower limb, D2 flexion and D2 extension of lower limb, Rhythmic Initiation, Hold Relax, Pelvic Patterns and Contract Relax

Group B
Group B was receive Balance Exercise with routine Physical therapy for 45 minutes on lower limb, 3 times a week for a period of 12 weeks. The interventions was performed by a trained physiotherapist.

Balance exercises include Static and dynamic stability patterns, Tandem, weight shifting exercise in order to improve center of gravity, Wobble board and Open eyes and closed eye exercises.

Results
Normality of Data
 The data shows that the Kolmogrov Smirnov and Shapiro-Wilk Significance in all 3 values of PNF and Balance groups are 0.000 which is less than p-value 0.05 suggesting that the data is not normal hence the Manwhitney and FriedMann tests will be used. Table 1.

Table 1: Tests of Normalit

Group		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	Df	Sig.
BBS.cutoff	PNF GROUP	.277	30	.000	.774	30	.000
	Balance T GROUP	.312	30	.000	.772	30	.000
a. Lilliefors Significance Correction							

Comparison Between the groups for balance:
The result shows that the mean value difference between the two groups is very minimal at baseline and after 6 weeks and p=0.655, p=0.169 which are greater than p=0.05 so the difference is non-significant. After 12 weeks a big mean value difference is present and p=0.00 which shows that difference between the two groups is significant. So that at baseline and after 6 weeks null hypothesis is accepted and after 12 weeks alternating hypothesis is accepted. Table 2.

Table 2

	Group	N	Mean Rank	Sum of Ranks
BBS.cutoff	PNF GROUP	30	31.40	942.00
	Balance T GROUP	30	29.60	888.00
	Total	60		
BBS.cutoff.6 weeks	PNF GROUP	30	33.20	996.00
	Balance T GROUP	30	27.80	834.00
	Total	60		
BBS.cutoff.12weeks	PNF GROUP	30	41.00	1230.00
	Balance T GROUP	30	20.00	600.00
	Total	60		
Test of significance				
Mann-Whitney U (BBS.cutoff)			423.000	
Wilcoxon W			888.000	
Z			-.447	

Asymp. Sig. (2-tailed) p-value	.655
Mann-Whitney U (BBS.cutoff.6weeks)	369.000
Wilcoxon W	834.000
Z	-1.375
Asymp. Sig. (2-tailed) p-value	.169
Mann-Whitney U (BBS.cutoff.12weeks)	135.000
Wilcoxon W	600.000
Z	-5.636
Asymp. Sig. (2-tailed) p-value	.000
a. Grouping Variable: group	

Comparison Between the groups for gait:

The results show that the mean value difference between the two groups is very minimal at baseline, after 6 weeks, and after 12 weeks, and p=0.38, 0.158, and 0.492 respectively that are greater than p=0.00 so the difference between the two groups is non-significant. The alternate hypothesis is accepted because of the non-significant result.

Table 3

	Group	N	Mean Rank	Sum of Ranks
FGA.CutOff	PNF GROUP	30	31.40	942.00
	Balance T GROUP	30	29.60	888.00
	Total	60		
FGA.CutOFF.6weeks	PNF GROUP	30	33.20	996.00
	Balance T GROUP	30	27.80	834.00
	Total	60		
FGA.CutOff.12weeks	PNF GROUP	30	41.00	1230.00
	Balance T GROUP	30	20.00	600.00
	Total	60		
TEST OF SIGNIFICANCE				
Mann-Whitney U (FGA.CutOff)			396.500	
Wilcoxon W			861.500	
Z			-.873	
Asymp. Sig. (2-tailed) p-value			.383	
Mann-Whitney U (FGA.CutOFF.6weeks)			367.500	
Wilcoxon W			832.500	
Z			-1.412	
Asymp. Sig. (2-tailed) p-value			.158	
Mann-Whitney U (FGA.CutOff.12weeks)			420.000	
Wilcoxon W			885.000	
Z			-.687	
Asymp. Sig. (2-tailed) p-value			.492	
a. Grouping Variable: group				

Interval based comparison of balance and gait in the PNF group and Balance T group:

The Chi Square X2 (df=2, N = 30) = 29.778(PNF group), 45.516(Balance T group) p=0.00 < 0.05 shows that significant differences exist in the balance improvement across all three assessment intervals. The result shows that there is significant improvement seen after 6 and 12 weeks in balance in Balance T group but slight improvement in balance after 12 weeks in PNF group.

The Chi Square X2 (df=2, N = 30) =. 45.912(PNF), 42.829(Balance T group) p< 0.05 shows that significant differences exist in the gait improvement across all three assessment intervals. The result shows that there is significant improvement in gait after 6 and 12 weeks in PNF group but a bit lesser improvement in gait after 12 weeks in Blance T group. Table 4.

Table 4 a. Friedman Test

Group		Mean Rank
PNF GROUP	BBS.cutoff	2.53
	BBS.cutoff.6weeks	1.83
	BBS.cutoff.12weeks	1.63
Balance T GROUP	BBS.cutoff	2.77
	BBS.cutoff.6weeks	1.98
	BBS.cutoff.12weeks	1.25
PNF GROUP	FGA.CutOff	2.80
	FGA.CutOFF.6weeks	1.92
	FGA.CutOff.12weeks	1.28
Balance T GROUP	**FGA.CutOff**	**2.77**
	FGA.CutOFF.6weeks	1.83
	FGA.CutOff.12weeks	1.40
TEST OF SIGNIFICANCE		
PNF GROUP	N	30
	Chi-Square	29.778
	Df	2
	Asymp. Sig. (p-value)	.000
Balance T GROUP	N	30
	Chi-Square	45.516
	Df	2
	Asymp. Sig. (p-value)	.000
PNF GROUP	N	30
	Chi-Square	45.912
	Df	2
	Asymp. Sig. (p-value)	.000
Balance T GROUP	N	30
	Chi-Square	42.829
	Df	2
	Asymp. Sig. 9 (p-value)	.000

Discussion

Gustavo jose luvizutto et.al. Conducted a research in 2020 i.e. "Proprioceptive Neuromuscular Facilitation concept in Parkinson disease" shows that PNF technique have a little bit superior effect than other therapies and also he concluded that in the comparison of some therapies PNF have similar effect on the gait. Whereas, the current study that is "comparison of Proprioceptive Neuromuscular Facilitation Vs Balance Exercise along with conventional therapy for balance and gait in chronic Parkinson's patients" shows that Proprioceptive Neuromuscular Facilitation is not a very effective treatment as compare to balance training for gait. It shows good results but it is not very much efficient for the treatment of gait [12-25].

The current study is shows that balance exercise give better results in improving balance in Parkinson as compared to the gait in PNF group. Balance exercise and PNF is very much effective to improve balance compared to gait but still from both techniques balance exercise is more significant. Whereas, Lilian T.B. Gobbi et.al. Conducted a research in 2009 i.e. "Exercise programs improve mobility and balance in people with Parkinson disease" shows that There is no significant difference between the results of both groups i.e. in balance and in mobility. Both the balance exercise and intensive exercise programs give effective results in improving mobility and balance in Parkinson patients [26].

Irene S.K. Wong-Yu et.al. Conducted a research in 2015 in China that stated as "multi-dimensional balance training programme improves balance and gait performance in people with Parkinson's disease" shows that this balance training technique is effective in improving balance and dual task gait performance up to the 12 months of follow-up in Parkinson disease patients. The aim of this study was to investigate the short term and long term effects in a multi-dimensional outdoor and indoor exercise programme on balance and gait performance in people with Parkinson's disease eligible participants with Parkinson's disease were randomly

allocated to an eight weeks outdoor and indoor balance training Similarly in our study, i.e. balance training programme have been proven to give very effective results in improving balance not only in the 6 weeks but also in the 12 weeks of the treatment program and improves the patient outcome to a great extent but show less effect on gait improvement in patients with chronic Parkinson's disease [27].

Kamatchi, K. et.al. Conducted a research in 2019 i.e. "comparative study to analyse the effectiveness of PNF vs Balance exercises in Parkinsonism".The study population excluded musculoskeletal conditions, Dementia and Cardiovascular conditions. Berg balance scale and unified Parkinson's disease rating scale used to collect data regarding balance in Parkinson patients. The results of this study shows that both techniques i.e. balance exercises and PNF is effective to improve balance in Parkinson patients. However PNF technique is more effective then balance exercises in improving the balance in Parkinson's disease patients. Whereas the current study, Berg balance scale is used to check balance. The result of this study shows that that both techniques i.e. balance exercises and PNF is effective to improve balance in Parkinson patients. However balance exercises is more effective then PNF technique in improving the balance in Parkinson's disease patients [28].

Del Carmen et.al. Conducted a research in 2019 i.e. "the development of ballet exercises with Proprioceptive Neuromuscular Facilitation techniques for patients with Parkinson's disease" shows that dance therapy alone also improve dynamic balance and gait in in Parkinson's disease patients. However, studies also show that of Proprioceptive Neuromuscular Facilitation technique also improve balance and gait in Parkinson's disease patients. Similarly, Proprioceptive Neuromuscular Facilitation have been proven to give very effective results in improving balance not only in the 6 weeks but also in the 12 weeks of the treatment program and improves the patient outcome to a great extent but show less effect on gait improvement in patients with chronic Parkinson's disease [1].

Margaret K.Y.Mak et.al. 2014 conducted a randomized controlled trials to determine balance and gait training with augmented feedback improves balance confidence in people with Parkinson's disease. The conclusion of this study shows that there was no significant difference between both groups no difference was found during home based period for exercise compliance between both groups. If we talk about the current study it shows that balance training have more significant effect for improving balance and gait in Parkinson patient as compare to proprioceptive neuromuscular facilitation [29].

Limitations
• The financial recourses and time available to us as students were extremely limited due to which study was conducted in Lahore but can be conducted in northern regions of Pakistan where the environmental factors are completely different.
• This research has been conducted on the local population. Thus people in this area have a different socioeconomic status than that

of other regions of the world hence effecting their personal and environmental factors leading to change in recovery time.
• The study used a non-probability sampling technique.

Recommendation
• It is recommended that if it is possible to conduct this study in large geographical area with huge population and with large amount of funding this study will be more beneficial due to higher geographical areas covered.
• It is recommended that if probability sampling technique will used then precise results will be given.

Conclusion
As per the current study which compared the effectiveness of Proprioceptive Neuromuscular Facilitation versus Balance Exercises in treatment of balance and gait among chronic Parkinson's patients. Both of the treatment approaches have proven to be effective in treatment of balance of lower limb among chronic Parkinson's patients but the Balance Exercises has proven to be significantly more effective than of Proprioceptive Neuromuscular Facilitation and show effective results in the treatment of balance but when comparing for gait both treatment techniques have proven to be effective with no approach better than the other.

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