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Research Article

IMPACT OF TRUNK ROTATION EXERCISES ON BALANCE, COGNITION & PHYSICAL PERFORMANCE IN GRADE 3 PARKINSON'S PATIENT

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Article Received: August 2020**Accepted:** September 2020**Published:** October 2020**Abstract:**

Background: Parkinson Disease (PD) is a growing neurological disorder that affecting nearly 6.2 million individuals worldwide. It is estimated that the number might augment twice by 2040 as compared 2015 from 6.9 million to 14.2 million. This staggering rise in incidence of PD will make Parkinsonism a pandemic that will nearly become a leading cause of disability around the globe. PD is characterized by four typical motor symptoms such as rigidity, in substantial nigra premature neuronal apoptosis leads to tremor, rigidity and bradykinesia.

Method: Single blinded quasi experimental study was conducted to investigate the effects of trunk rotation exercises on Physical Performance in grade 3 Parkinson patients. Thirty-two participants with grade 3 Parkinson, presented for treatment at neuro rehabilitation sciences, Ziauddin Hospital, Clifton, Karachi.

Included participants were given 12 sessions. Each session lasted for 60 min where participants performed trunk rotation exercises to improve physical performance. The patients assessed before 1st session (baseline assessment) were then assessed on 12th session (post treatment) to see the improvement.

Results: The trunk rotation exercises improved physical activity from 9.71 ± 1.02 to 20.75 ± 2.28 on PPT scale after 12 sessions.

Conclusion: The results of this study showed significant improvement in physical performance of all thirty-two participants investigated by berg balance scale, MOCA and PPT scale. The substantial improvement in all three parameters after 4 weeks of rehabilitation program concluded that trunk rotation exercises increase independence and physical performance by improving weight shifting, initiation of different movements, coordination, memory and performance of daily activities of life.

KEYWORDS: Balance, Cognition, Disability, Motor Function, Physical Performance, Parkinson's Disease, Rotation Exercises.

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INTRODUCTION:

Parkinson Disease (PD) is a growing neurological disorder that affects 6.2 million individuals worldwide and it is estimated that the number will almost double from 6.2 million in 2015 to 14.2 million by 2040 [1]. The prevalence of PD in various continents and countries around the globe were investigated, which revealed that it is common in most of the countries with maximum percentages in developed and highly populated countries like USA, Russia, Germany, United Kingdom, China, India and Australia etc. The prevalence of Parkinson disease in Pakistan is 4% [2]. This staggering rise of incidence of PD is likely to make Parkinsonism a pandemic that may become a leading cause of disability around the globe [3]. PD is mainly characterized by four typical motor symptoms such as rigidity, tremor, bradykinesia and postural disability occurring due to premature apoptosis of neurons in substantia nigra [4]. Besides that, some non-motor symptoms may also present that includes cognitive impairments, emotional issues and behavior problems [5].

The diagnosis of PD is mainly based on medical history and neurological examination because no blood tests, imaging and laboratory tests have been proven to help in the its diagnosis. Parkinsonism often has an unidentifiable cause and sometimes can occur due to multiple strokes, exposure to toxins, methamphetamine, trauma or other neurological illness or disorders.

According to the previously conducted studies balance dysfunction, poor functional mobility and cognitive impairment are the primary cause of frequent fall among patients with PD [6].

It is estimated that 65% of patient fall every year and out of which two-third experience recurrent falling that causes injuries, loss of functional independence in daily living and even death [7]. Multiple management strategies for PD are available ranging from pharmacotherapy to physiotherapy where dopamine replacement strategies are presently available to provide symptomatic improvement but the treatment often failed to provide sustained clinical benefit and most of the patient developed motor fluctuations and dyskinesia as the disease progresses [8]. Those patients suffering from parkinson's disease may also suffer gait imbalance leading to postural instability along with brady kinesea. Postural disturbances in Parkinson can be identified as postural instability, difficulty in changing positions, falls, restricted mobility and

various deformities. Furthermore non-motor symptoms like autonomic disturbances, sensory variations, olfactory dysfunction, mood disorders, sleep disturbances and cognitive impairment cause substantial functional disability and these symptoms frequently fail to respond to customary dopaminergic treatments [9]. Despite the optimal pharmacological treatment, the rate of disability increases as the disease progresses therefore delay or preventing further complications related to instability or disability pharmacological treatment should be the priority.

Parkinson Disease (PD) is a growing neurological disorder effecting population 0-1%. According to studies in Russia 18% of population were affected with parkinson's disease. Prevalence of disease showed up to be 1% in mostly effected countries in Europe. Whereas, prevalence in many other countries was not detected. Data generated in Asian countries revealed that the rate of disease occurrence is common. According to researchers' studies conducted in china revealed 36% of the population effected. Disease prevalence observed in studies conducted in Pakistan showed 4% of the total population suffering from Parkinson's. countries such as Singapore, Kazakistan, Tajikistan are those countries that show there were no patient effected from Parkinson's disease. 12 observed. [3].

In initial stages of Parkinson disease, the dopamine precursor known as levodopa is highly effective. It has the tendency to restore dopamine levels in the striatum of Parkinson patients by crossing the blood brain barrier and separating the extracellular fluid of the brain from systemic circulation. Along with benefits it also has some adverse effects such as reducing the effects of medicine, dyskinesia and on and off fluctuations in generation of response [10].

Several evidences are available that are supporting the impact of physiotherapy on balance related activities on PD such as various exercises regimes like treadmill training, progressive resistance exercises and aquatic therapy improve balance but still there is a need for further high-quality studies [11]. The studies that have used trunk rotation exercises along with other exercise regime as a form of combine therapy are available but limited studies are conducted till date that have used trunk rotation exercises as an exclusive strategy in improving balance, cognition and physical performance of patient with PD. Hence the present study is specifically designed to determine the impact of

trunk rotation exercises on balance, cognitive function and physical performance in grade 3 Parkinson patient.

METHODOLOGY:

The study design was Quasi-Experimental. This study was conducted at Department of Rehabilitation Sciences of Ziauddin Hospital Clifton and this study was completed in the duration of six months. Sample size was calculated by using an open Epi Software. By taking a Confidence Interval of 95%, power of test 90% a sample size of 32 was calculated by using a following formula:

$$n = \frac{Z_{(1-\alpha/2)} \cdot Z_{(1-\beta)} (\sigma)^2}{\Delta^2}$$

Inclusion criteria:

- Both male and female population of age >40 years.
- Mid stage or stage three parkinsonism (diagnosed) according to Hoehn and Yahr Scale.
- Ability to stand unaided and walk with and without an assistive device.
- At least a score of 2 or more for tremor, rigidity, postural stability and bradykinesia in the motor section of Unified Parkinson's Disease Rating Scale.
- Mini-Mental State Examination (MMSE) score >23.

Exclusion criteria:

- Motor Fluctuation affect balance and locomotion
- Neurological conditions other than PD
- Uncompensated Cardiovascular Diseases
- Visual Disturbance
- Musculoskeletal disorders in the back or lower limb
- Brain tumor and behavior disorders

The privacy, anonymity, and dignity of all participants were maintained throughout the research. The confidentiality of the data was maintained and only accessed by authorizing personals whereas informed consent was obtained prior to conduction of the research procedure. A total 32 number of participants were recruited for the purpose of our study. All the participants were initially screened on the basis of inclusion/exclusion criteria of the study (under the supervision of trained therapist). Before starting the rehabilitation program, the initial readings of PPT score were recorded and then the readings were taken again after four weeks

to investigate the improvement. Treatment protocol included four week of trunk rotation exercises that were performed by the participants for 3 days a week (every alternate days) for duration of 60 minutes that was further divided into three parts such as warm up (5minutes), conditioning (45 minutes) and cool down (10 minutes). Physical Performance Test (PPT) tools were used for data collection: Nine items Physical Performance Test (PPT) was used to assess participant's physical performance before and after completion of the exercise program. The scale includes nine items to be performed by the participants within the given time on the basis of which the scoring was done. The scale comprises of a total of 36 score (ranges from 0-4 for each item) with higher values showing better result [12]. The inter-rater reliability of the score as per previously conducted study was found to be 0.95 to 0.99 [13] A Quasi-Experimental study was conducted at the Department of Rehabilitation Sciences, Ziauddin Hospital Karachi. All participants signed the consent form. The purpose and technique of interventional strategy was explained to the participants before being inducted into the study and all participants were ensured for confidentiality and privacy.

The data was analyzed by using SPSS version 23.0. Demographic details were present in the form of frequency, percentage charts and table. For the purpose of determining normality Kolmogorov-Smirnov test was applied. Paired t test was applied on normally distributed data, Level of significance was taken at 95% of CI, P-value of less than 0.05 was considered significant.

RESULTS:

In this study 32 patients were enrolled with grade 3 Parkinson's disease. These participants met the inclusion criteria. All participants were supposed to complete 12 session rehabilitation protocol and their results were analyzed. Each individual's data was collected before the first session and after the 12th session. The physical performance (time activities) were the assessment parameters. The PPT time activities value was taken by non-parametric (assessed by Kolmogorov-Smirnov test) Wilcoxon test were applied. The mean age was 69.59±5.96. Male patients were 75 % (n=24) and female 25 % (n=08) present in table 01.

Table 01: Age & Gender Distribution

Age	Mean	SD
	69.59	5.96
Gender	Male	Female
	N=24 (75%)	N=08(25%)

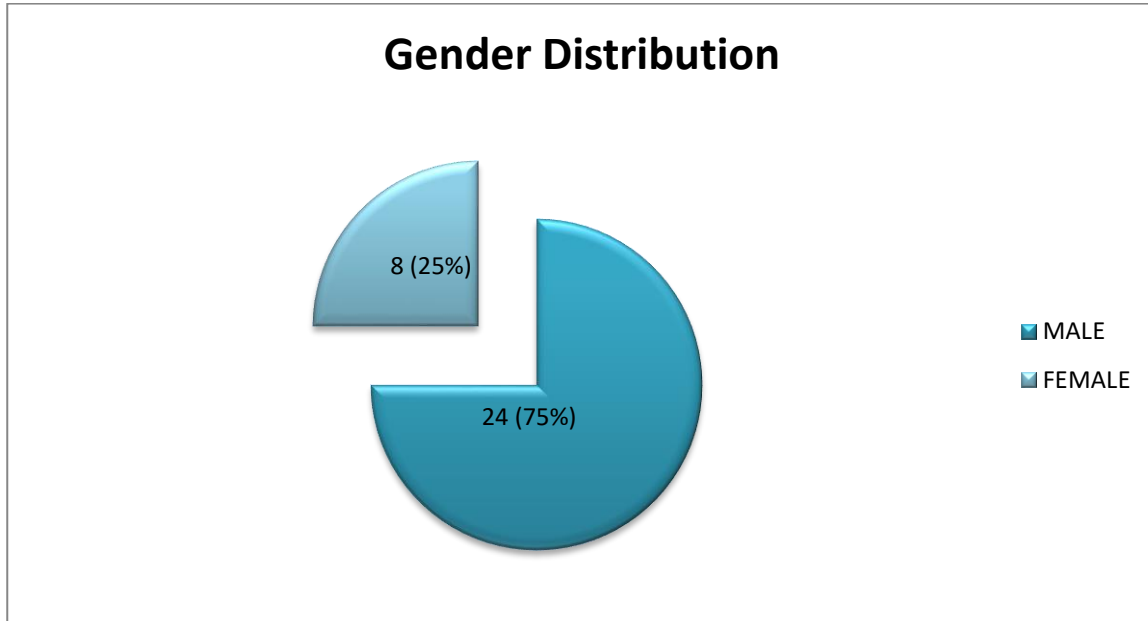
**Figure 01: Gender Distribution**

Figure 01 shows gender distribution, 75% male patients and 25% female patients.

Table 02: Comparison pre and post PPT - paired test

	N	Baseline		Post Treatment		Paired Differences		95% CI	P-value
		Mean	SD	Mean	SD	Mean	SD		
Physical Performance	32	9.71	1.02	20.75	2.28	11.03	2.22	10.23 To 11.83	<0.0001

Paired samples t-test

There was statistical difference between the readings of pre rehabilitation and post rehabilitation program on physical performance test. There was significant ($p < 0.0001$) improvement of 11.03 ± 2.22 on physical performance test. Present in table 02.

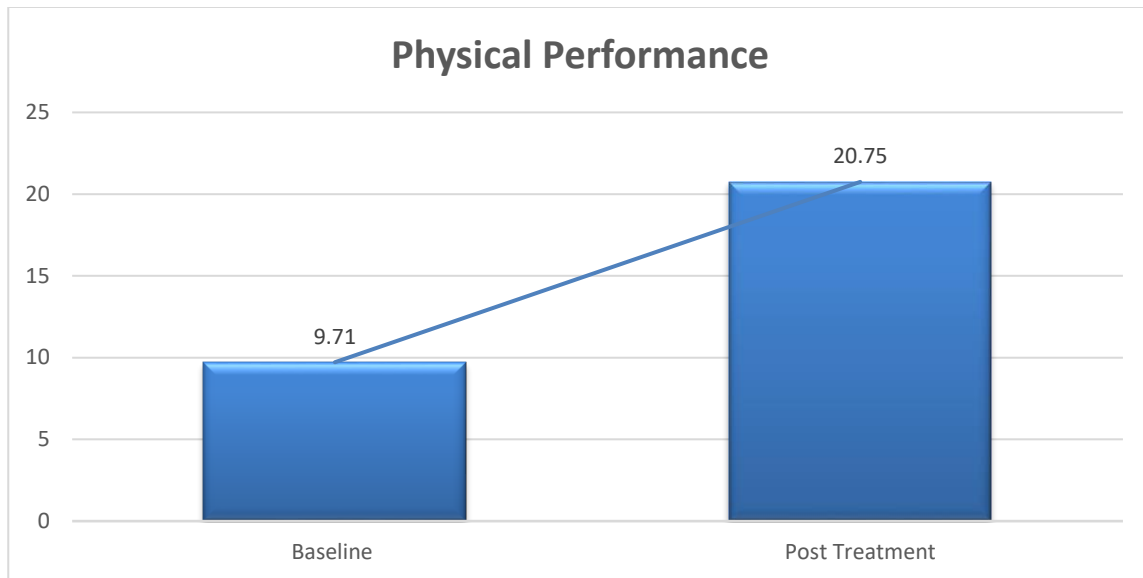


Figure 02: Physical Performance

Figure 02 shows substantial improvement of physical performance was also observed from pre rehabilitation reading of 9.71 ± 1.02 to post rehabilitation reading 20.75 ± 2.28 .

Table 03: Comparison pre and post Time Activities-Wilcoxon test

	N	Baseline	Post Treatment	Paired differences	
		Median	Median	Median	P-value
Standing up from lying position on treatment table(s)	32	4.50	2.90	1.60	<0.0001
Standing up from sitting position (s)	32	1.50	0.80	0.70	<0.0001
PPT (score)	32	25.00	32.00	7.00	<0.0001
360° turn number of steps	32	11.00	6.50	4.50	<0.0001
10 m walk step length (m)	32	1.00	0.60	0.40	<0.0001

Wilcoxon test (paired samples)

According to table 03 there was significant improvement in post rehabilitation readings of Wilcoxon test such as standing from lying position from treatment table improved by 4.50, standing up from sitting position improved by 1.50, PPT score improved by 25.00, 360 turn improved by 11.00 and step length of 10 m walk improved by 1.00.

Table 04: Comparison of Timely Activities – Wilcoxon test

	N	Baseline	Post Treatment	Paired differences	
		Median	Median	Median	P-Value
10 m walk number of steps	32	17.50	14.83	2.67	<0.0001
10 m walk, time (s)	32	10.50	8.50	2.00	<0.0001
Tandem stance (s)	32	24.50	28.50	4.00	<0.0001
Thoraco-lumbar spine rotation L (cm)	32	4.50	7.50	3.00	<0.0001
Pastor test (score) (shoulder tug)	32	3.00	2.50	0.50	<0.0001

Wilcoxon test (paired samples)

According to table 04 there was significant improvement in post rehabilitation values of Wilcoxon test such as number of steps in 10 m walk improved by 14.83, time taken for 10 m walk improved by 8.50, tandem stance improved by 28.50, thoracolumbar spine rotation improved by 7.50 and pastor test improved by 2.50.

Table 05: Comparison of Timely Activities – Wilcoxon test

	N	Baseline	Post Treatment	Paired differences	P-Value
		Median	Median	Median	
10 m walk number of steps	32	17.50	14.83	2.67	<0.0001
10 m walk, time (s)	32	10.50	8.50	2.00	<0.0001
Tandem stance (s)	32	24.50	28.50	4.00	<0.0001
Thoraco-lumbar spine rotation L (cm)	32	4.50	7.50	3.00	<0.0001
Pastor test (score) (shoulder tug)	32	3.00	2.50	0.50	<0.0001

Wilcoxon test (paired samples)

According to table 05 there was significant improvement in post rehabilitation values of Wilcoxon test such as standing from lying position from mat improved by 5.50, standing up from lying to sitting position improved by 2.20, sitting down from standing position improved by 1.40, lie down on the patient bed from standing position by 5.80 and lie down on patient bed from sitting position by 4.50.

DISCUSSION:

The rehabilitation program of this current study was carried out for four weeks and was consisted of 12 therapy sessions that were performed by the participants for 3 times a week (every alternate day) for duration of 60 minutes. The focus of the treatment was to improve physical activities of the patients suffering from grade 3 Parkinson's disease [14]. The program consisted of a protocol that included breathing exercises, relaxation exercises, range of motion exercises, stretching, trunk rotations, functional training, mobility and postural re-education. All the exercises were performed by giving cues through verbal, visual, auditory and tactile stimulation and the activities were practiced in various body positions [15- 17]. The participants performed exercises that trained them to shift their weight while walking, initiate the movements, changing direction, rotating the trunk, coordination, memorizing things and perform simple daily living activities [18,19]. In this study 32 participants of grade 3 Parkinson disease performed a specific protocol of exercises that composed of 5 min of warm up, 45 min of trunk rotation and 10 min of cool down exercises [20]. The three set of trunk rotation exercises were performed with ten repetitions. It was indicated that four weeks of rehabilitation program improved the PPT score and performance of daily

living activities such as lying down, rolling from supine to prone, side lying, rising from lying to sitting and sit to stand in addition to their ability to perform these activities more quickly [21-23]. Similar to our results Joanna Stozek (2015) also obtained substantial improvement in Parkinson disease after a 4-week of rehabilitation program. The timing of the performed activities was shortened along with a significant improvement in posture, physical activity and PPT score.

Along with physical activities and cognition significant improvement in balance and gait was also observed. After 4 weeks of rehabilitation there was improvement in the steady standing in tandem position, reaction to external perturbation and performance of certain predetermined tasks [24]. The results of the study conducted by David Sparrow (2017) is consistent with our results. In this study sixteen patients of Parkinson disease performed certain progressive exercises twice a week for 90 min that improved their postural adjustments, stability limits, sensory orientation, biomechanical constraints, stability in gait and risk of falls [25]. In addition to this the study conducted by Xia Shen (2015) also concluded that there were positive effects of exercise on improving gait performance and balance in patients with Parkinson disease. The study

conducted by Collen G canning (2015) investigated the effects of exercise on falls prevention along with secondary outcomes of physical, psychological and quality of life. The review concluded that there were no significant effects on the prevention of falls but balance, mobility, freezing of gait, habitual physical activity, psychological health and quality of life was improved [26].

In this study after 4 weeks of rehabilitation program substantial improvement were seen in all three parameters of the participants suffering from grade 3 Parkinson's Disease. Trunk rotation exercises improved physical activity from 9.71 ± 1.02 to 20.75 ± 2.28 on PPT scale [27]. The results indicate that trunk rotation exercises are a key to productive and healthy life as it improves quality of life by enhancing mobility, increasing independence and improving memory of the patients suffering from grade 3 Parkinson diseases. This study is in complete agreement with the study conducted by Muniba Fayyaz (2018) who concluded that exercise has the most effective improvement in physical capacities and cognitive functional capacities.

CONCLUSION:

The results of this study showed significant improvement in balance, cognition and physical performance of all thirty-two participants investigated by berg balance scale, MOCA and PPT scale. The substantial improvement in all three parameters after 4 weeks of rehabilitation program concluded that trunk rotation exercises increase independence and physical performance by improving weight shifting, initiation of different movements, coordination, memory and performance of daily activities of life.

LIMITATIONS:

The limitation of this study is the short observation period of the effects. Further studies should be conducted to determine the residual effects of trunk rotation exercise on physical activities in addition to prevent disability in Parkinson's patients.

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