

## A Literature Review On Trunk Muscle Exercises in Parkinson's Disease

V.CHANDRAKALA<sup>1</sup>, PAYAL JAIN<sup>2</sup>, Dr. ANJALI SURESH<sup>3</sup>

<sup>1</sup>(Physiotherapy postgraduate student, Garden city university, INDIA)

<sup>2</sup>(Assistant professor, Garden city university, INDIA)

<sup>3</sup>(Professor & HOD, Garden city university, INDIA)

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### ABSTRACT

**BACKGROUND:** Parkinson's disease (PD) is a progressive neurodegenerative movement disorder, caused by the degeneration of substantia nigra dopaminergic neurons present in basal ganglia. Abnormal postures in PD are observed in the entire body, namely, flexion to the anterior, lateral, or anterolateral parts of the trunk, neck flexion, flexion of the extremities, and abnormal postures of the hands, fingers, and toes such as thalamic hand or hammertoe. Improving trunk muscle functioning helps to improve postural stability and reduce falls in Parkinson's disease patients.

**AIM:** To review the relevant articles which focus mainly on trunk muscle exercises in patients with Parkinson's disease.

**SEARCH METHOD:** PubMed, Google scholar, Pedro, Research gate, science direct, and Cochrane from these databases articles were searched. By using the keywords 92 articles were collected from the past 20 years.

**SELECTION CRITERIA:** Selection criteria include the articles focusing on trunk muscle exercises, posture, and gait in patients with Parkinson's disease.

**RESULTS:** In these 12 articles stated that giving trunk muscles to patients with Parkinson's disease will help in improving postural stability, balance, gait, physical performance, trunk rotation, quality of life, and frequent falls.

**CONCLUSION:** Our study concluded that using trunk exercises should include in the trunk rehab protocol in patients with Parkinson's disease. Since the results show that using trunk exercises will improve balance, gait, and postural stability which is a major problem faced by Parkinson's diseases patients.

**KEYWORDS:** Parkinson's disease, trunk muscle exercises, postural instability and re-education, gait and balance training in Parkinson's disease

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Date of Submission: 05-05-2022

Date of Acceptance: 20-05-2022

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### I. INTRODUCTION

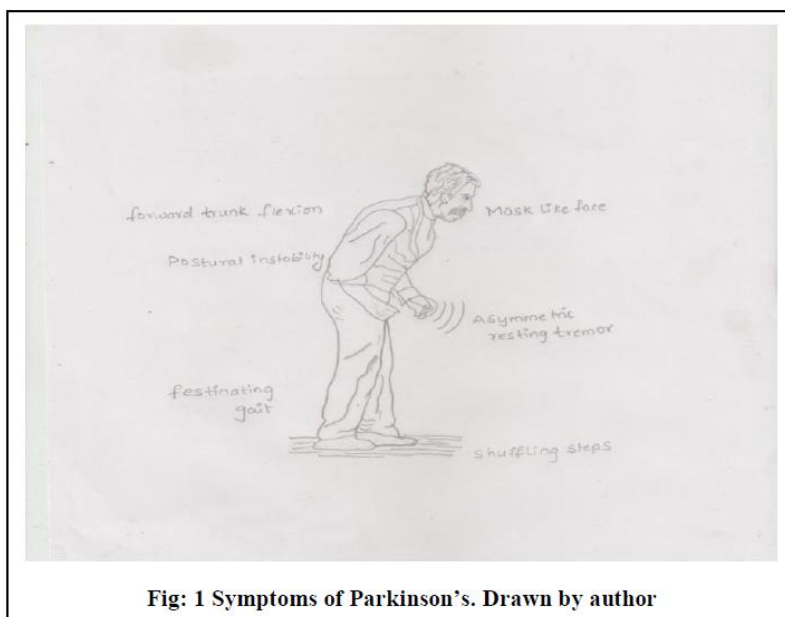
Parkinson's disease (PD) is a progressive neurodegenerative movement disorder, caused by the degeneration of substantia nigra dopaminergic neurons present in basal ganglia. The disease is effecting 2-3% older adults above 60 years of age<sup>1</sup>. Incidence is 250 per 100,000 population. Male to female ratio is 3:2 in Parkinson's disease<sup>2</sup>. After Alzheimer's disease, Parkinson's disease is the second most common neurodegenerative disease. And also there is a prediction that by 2030 nearly 3% of the population above 65 years of age will be affected by PD. Postural Instability occurs in 16% of the cases. As the disease progresses, Postural Instability worsens & leads to falls, falls occurs among 60% of Parkinson's disease patients<sup>3</sup>.

Four primary motor symptoms of Parkinson's disease are tremor, rigidity, bradykinesia, and postural instability (PI)<sup>1-4</sup>. Parkinsonian posture is characterized by a flexed posture of the trunk and extremities, as described in an essay written by Dr. James Parkinson<sup>4</sup>. Postural abnormalities affect the clinical and functional status of patients with PD. Trunk deformities may lead to the development of symptoms such as pain and discomfort, balance disturbances and disruption of gait, and increase the risk of injurious falls, difficulty will be there in turning or inability to turn in bed<sup>5</sup>. Abnormal postures in PD are observed in the entire body, namely, flexion to the anterior, lateral or anterolateral parts of the trunk, neck flexion, flexion of the extremities, and abnormal postures of the hands, fingers and toes such as thalamic hand or hammer toe<sup>2, 4, 5</sup>. In Parkinson's disease (PD) an abnormal posture is very common symptom. Abnormal posture is caused not only by the disease as it progresses, but also by antiparkinsonian drugs<sup>1-5</sup>.

PD patients develop postural changes, including stooped posture, dropped head, and a flexed trunk, hips, and knees. In some patients, postural changes include spinal deformities, such as Scoliosis, Ante Collis, Camptocormia, and Pisa syndrome<sup>6</sup>. Falls and fall-related injuries commonly lead to a fear of falling, reduced

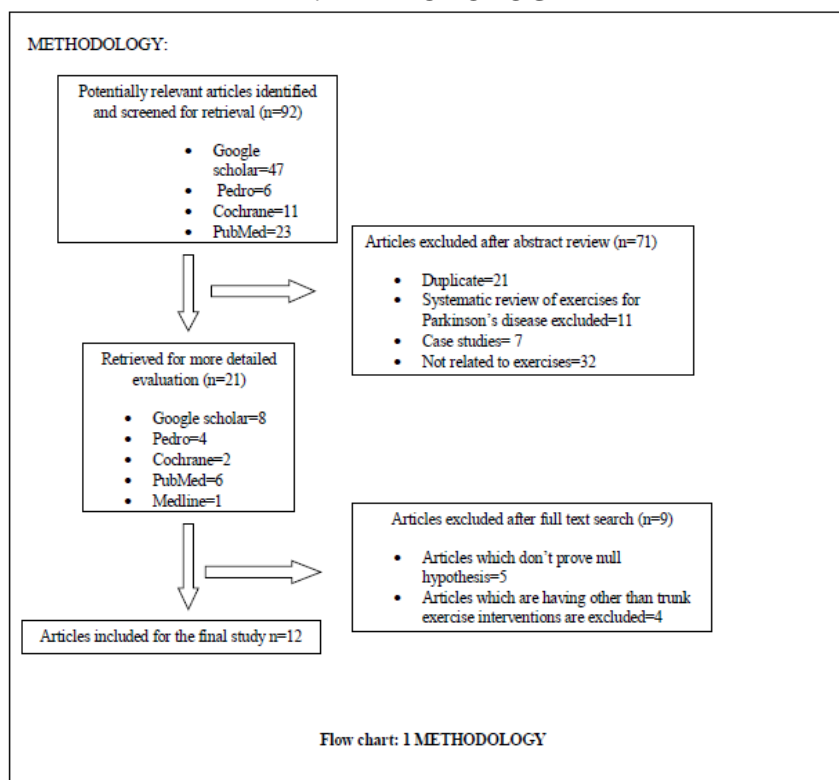


mobility, poorer muscle strength and loss of independence, all of these causes influence an individual's mortality, morbidity and quality of life. Improving trunk muscle functioning helps to improve postural stability and reduce falls in Parkinson's disease patients<sup>5,6</sup>



Change in posture to flexion causes weakness of the back extensors and spinal stiffness with or without associated pain<sup>8</sup>. Respiration is also affected by the large changes in trunk posture, it is an important factor that given the fear of pneumonia to the person with PD<sup>9</sup>. Postural abnormalities affect the clinical and functional status of patients with PD<sup>7, 8, 9</sup>. The review was conducted to know various available articles explains the efficacy of trunk exercises in Parkinson's disease.

## II. METHODOLOGY





### III. REVIEW OF LITERATURE

An extensive literature search was done, the search used was PubMed, Google scholar, Medline, Journals and Pedro. Based on the available study trunk muscle exercises are effective for the postural instability in Parkinson's disease. Keywords used are trunk exercises, postural instability, Parkinson's disease, posture in Parkinson's disease. The articles focusing on trunk exercises and postural instability in Parkinson's disease are only included in the study and the articles which were not published in English language were excluded.

S.NO	NAME OF THE ARTICLE	NAME OF THE AUTHOR	PUBLISHED YEAR	REMARKS
1.	Impact of trunk resistance and stretching exercises on fall-related factors in patients with PD	Changhong Youm, Youkyung Kim	2020	A randomized controlled pilot study focused to examine the impact of trunk resistance and stretching exercises on fall-related factors in patients with PD. 17 patients with PD were randomly divided into an exercise group or a control group. Exercise group received the exercise program in 60-90 min/sessions for 3 days/week. The primary and secondary outcome measures used in the study were trunk mobility scale, functional fitness test, standing balance and sit-to-walk test. The final results stated that compared to the controlled group exercise group showed improvements in functional fitness test, standing balance trunk mobility and dynamic stability <sup>11</sup> .
2.	Trunk exercise improve balance in Parkinson disease; A phase II Randomized controlled trail.	Ryan P. Hubble, PhD, MD, Peter A. Silburn, PhD, MD	2019	A randomized controlled trail to study the effects of trunk exercises that improve balance in Parkinson's disease patients. In these 24 patients with Parkinson's disease with a history of falls were included than randomly divided into two group one group received 12 weeks of exercises and other group with education only. The primary outcome measures used in this study were standing balance (sway area, velocity and variability) and the secondary outcome measures were clinical measures like measuring of mobility, balance and confidence, symptom severity, disability/ quality of life. They concluded that 12 week trunk specific exercises improves select measures of quite standing balance under challenging sensory conditions in PD patients who have mild to moderate disease severity <sup>12</sup> .
3.	Progressive modular re-balancing system and visual cuing for gait rehabilitation in PD; A pilot, randomized control trail with cross over.	Mariano Serrao, Francesco Pierelli	2019	A RCT conducted to study the effects of progressive modular re-balancing system and visual cuing for gait rehabilitation in PD. 40 patients with idiopathic PD in Hoehn Yahr stages 1-4 were included in the study and randomly divided into 2 groups. One group received 8-week rehab programs, 3 days/week with 60 min duration including progressive modular rebalancing (PMR) which proposes a trunk specific exercise program and gait training with visual cues were imposed and the other group received conventional physiotherapy. The primary outcome measures used in the study was kinematic parameters of gait and the secondary outcome was UPDRS-III to evaluate disease severity. The results of the study stated that PMR plus VC is effective in improving gait performance, balance and trunk control and also it should be used as a rehab strategy for the PD treatment and other neuro degenerative diseases <sup>13</sup> .
4.	Four-week trunk specific exercises decreases forward trunk flexion in Parkinson's disease; A single- blinded, randomized controlled trial	Marialuisa Gandolfi, Michale Tinazzi, Francesca Magrinelli	2019	A randomized control trial to know the results of 4 week trunk specific exercises decreases forward trunk flexion in Parkinson's disease, in which 37 Parkinson's disease patients having forward trunk flexion were randomly divided into experimental group (n=19) and control group (n=18), used outcome measures in the study were forward trunk flexion degree, secondary outcome measures were UPDRS III, Numeric Rating



				Scale, PDQ-8, static balance by electronic monoaxial platform, dynamic balance by mini BESTest. They concluded that experimental group with a 4-week trunk rehabilitation program by muscle straitening, stretching, gait and balance exercises reduced forward trunk flexion than in control group with a P value of experimental group $P=0.03$ and control group $P=0.04$ <sup>14</sup> .
5.	Effect of trunk muscle strengthening on gait pattern and falls in Parkinson's disease	Emma Bestaven, Etienne Guillaud,	2018	A pilot study, including 10 patients who received deep brain stimulation of subthalamic nuclei to assess the effectiveness of trunk muscle strengthening on gait patterns and falls in Parkinson's disease. A standardized patient trust muscle strengthening protocol was designed and given daily for 4 weeks with a duration of 90 mins/ session. Outcome measures used were UPDRS-III, gait kinematic (step length, walking, cycle duration variability, gait speed) <sup>15</sup> .
6.	Effects of progressive resistance and flexibility exercise program of trunk on static and dynamic stability for PD.	M. Lee, C. Youm, M. Son, H. Park, Y. Kim	2018	An experimental study conducted to study the effects of progressive resistance and flexibility exercise program of trunk on static and dynamic stability for PD in which 17 patients were included and divided into 2 groups exercise group and control group. The exercise group received exercises for 3 times a week for 12 weeks. The static stability for the study was evaluated by analysing the trajectory of the centre of pressure in an upright trunk with the eyes open whereas the dynamic stability was elevated by kinematic and kinetic variables during sit-to-walk fast at max speed. The final results stated that the progressive resistance and flexibility exercises for the trunk show a positive effect and improves functional fitness, trunk mobility, static and dynamic stability of patients with PD <sup>16</sup> .
7.	Efficacy of neurofunctional versus resistance training in improving gait and QOL among patients with PD.	Suhaila Mahmoud Smaili, Maria Eduarda Brando Bueno	2018	A RCT was conducted to study the efficacy of neurofunctional versus resistance training in improving gait and QOL among patients with PD. In this study 40 patients were included and randomly divided into two groups. Resistance training and neurofunctional training were divided groups. RT group focused mainly on the resistive exercises that emphasis the lower limbs and trunk whereas NT group focused on gait, functional independence and balance training. The training session for each group includes 60 min, twice a week and total of 24 sessions. The outcome measures were gait- video gait analysis and foot print analysis, QOL- PDQ-39 questioner. The results stated that all gait variables improved after NT intervention, only stride length improve in RT group. Both groups shows improvement in QOL <sup>17</sup> .
8.	Trunk exercises improve gait symmetry in Parkinson's disease- a blind phase II randomised control trail	Ryan P. Hubble, PhD, Geraldine Naughton,	2018	A randomized control trail study to know the efficacy of trunk exercise to improve gait symmetry in Parkinson's disease. 24 Parkinson's disease patients who are having falls history were included in the study and randomly divided into 2 groups, one group with 12 weeks of trunk exercises and other group with education on falls prevention. The primary outcome measure used in the study is gait step-to-step symmetry and the secondary outcome measure is trunk muscle function which was evaluated through EMG. The results of the study stated that the exercise group shows statistically significance increase in the



				anterio-posterior step-to-step trunk symmetry, education group shows reduction in medial-lateral and vertical step-to-step trunk symmetry at 12 weeks <sup>18</sup> .
9.	Effects of postural exercises in patients with Parkinson's disease and Pisa syndrome	Francesco Lenea, Ennio Iezzib, Mohammad Etoom	2017	A pilot study by the author to assess the effectiveness of postural exercises for Parkinson's disease patients who are having Pisa syndrome. The outcome measures used were URDRS – II and III, degree on LFT and visual analogues scale for back pain. A specific program of trunk rehab exercises with 90mins/session duration on 10 therapy sessions were given and concluded that giving the trunk rehab exercises as a protocol regime for Parkinson disease will give positive effects for maintaining LFT and seen good results in URDRS <sup>19</sup> .
10.	The effect of the rehabilitation program on balance, gait, physical performance and trunk rotation in Parkinson's disease	Joanna Stozek, Monika Rudzinska	2015	An experimental study to know the effectiveness of rehabilitation by including trunk mobility and trunk rotation exercises on balance, gait, physical performance and trunk rotation in Parkinson's disease. They included 6 patients with Hoehn and Yahr scale 1.5 to 3.0 stage, randomly divided into rehabilitation and control group with a total of 28 therapeutic sessions. The outcome measures used were Tandem stance, Pastor test for balance, 10 minute walk test for gait, trunk rotation with tape, physical performance test for motor assessment. They concluded that 4 week rehabilitation training program improve by means of $P < 0.05$ in balance, gait, trunk rotation and physical performance. Effect of rehabilitation program maintained at least one month <sup>20</sup> .
11.	Trunk muscle exercises as a means of improving postural stability in people with Parkinson's disease: a protocol for a randomised controlled trial	Ryan P Hubble, Geraldine A Naughton, Peter A Silburn, Michael H Cole	2014	A randomised controlled trial to prove that progressive trunk exercises and low intensity exercises can give non-invasive and effective treatment for maintaining and improving postural instability in Parkinson's disease patients. 45 patients with idiopathic Parkinson's disease with a fall history were included and done the pre-assessment and divided into 3 intervention groups (i.e., exercises once/week, exercises 3 days/week, education), done 12 week training programme with an outcome measure for postural instability (static, dynamic) harmonic ratio, peak RMS displacement. They concluded that 12 week continues exercise programme will improve postural instability in Parkinson's disease patients <sup>21</sup> .
12.	4 – Week trunk specific Rehab treatment improves lateral flexion in Parkinson disease.	Michelangelo Bartolo MD, Mariano Serrao MD, PhD,	2010	An experimental study to examine the 4 trunk specific rehab training is going to improve LFT in Parkinson's disease. 22 patients with mild to severe lateral trunk flexion were studied. Outcome measures UPDRS-III, kinematic behaviour of the trunk was recorded by means of opto electronic system. The post rehab assessment results shown decrease in trunk flexion with $p < 0.00$ <sup>22</sup> .

#### IV. DISCUSSION

Our study explains the efficacy of trunk exercises in patients with Parkinson's disease. Our research for the current study gives an outline that the trunk exercises will help in improving postural stability, balance, gait, physical performance, trunk rotations, quality of life and frequent falls in Parkinson's disease. In the study most of the rehab durations were in between 4–12-week trunk exercise rehab program. Trunk exercises included exercises routine focusing on the endurance, strength and stability of trunk muscles (multifidus, erector spinae, obliques, transverse abdominus, rectus abdominus), range of motion exercises, stretching exercises, exercises of



trunk rotation in various body positions mobility exercises, functional training, postural re-education, balance exercises and gait training.

A total number of 288 patients were included in the mentioned articles and proven the null hypothesis. The outcome measures used in the studies were to evaluate the disease severity UPDRS-III, to quality-of-life PDQL-39 questionnaire, trunk mobility scale, to measure gait- Gait step-to-step symmetry, degree of forward and lateral trunk flexion.

## V. CONCLUSION

Our study concluded that using trunk exercises should include in the trunk rehab protocol in patients with Parkinson's diseases. Since the results shown that using trunk exercises will improve balance, gait and postural stability which is a major problems faced by the Parkinson's diseases patients.

## ABBREVIATIONS

Abbreviations	Full form
PD	Parkinson's disease
PI	Postural instability
RCT	Randomized controlled trial
PMR	Progressive modular rebalancing
UPDRS	Unified Parkinson's disease rating scale
VC	Visual cues
PDQ	Parkinson's disease questionnaire
NT	Neurofunctional training
RT	Resistance training
QOL	Quality of life
EMG	Electromyography
LFT	Lateral flexion of trunk

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V.CHANDRAKALA, et. al. "A Literature Review On Trunk Muscle Exercises in Parkinson's Disease." *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 11(03), 2022, pp. 01-07