Physiotherapy strategies for balance and gait in Parkinson Disease- A Case Study

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Abstract

Study Design: A case study

Objectives: The purpose of the study was to implement physiotherapy strategies on a single patient diagnosed with Parkinson Disease to improve balance and gait parameters.

Background: Balance and gait parameters are commonly affected in Parkinson’s Disease. In order to maintain balance and gait adequate control is required from sensory and motor systems. Numerous studies have been done to improve the static and dynamic balance along with objective and subjective gait parameters in these patients but due to variation of impairments of every Parkinson patient common protocols may not be beneficial. Hence, a tailor made protocol works efficiently on individual patient. In this case study a physiotherapy protocol has been devised which can be used in any clinical setup.

Methods and Measures:

A 67 year old male diagnosed with Parkinson’s Disease having difficulty in balance and gait has been managed using balance and gait training for 30-60 minutes/day for 4 weeks. The treatment started with 5-10 minutes of warm up and cool down phase. The training included LSVT Big Exercises, static and dynamic exercises along with gait training using augmented visual and auditory feedback. The scores of Functional Reach Test in forward, backward and sideways direction, Berg Balance Scale, Time Up and Go test and 10 m walk test has been compared.

Results:

The patient depicted improvement in all four outcome measures. The scores were 25% improvement in FRT in all directions, 16% improvement in Berg Balance Scale, Time up and go Test was improved by 4 seconds and 10 m walk test by 0.92 m/s.

Conclusion:

The result of this case study suggests that if simple exercise interventions are planned for Parkinson patients involving Big Exercises, Perturbations and Augmented feed back then balance and gait parameters may be improved.

Key words:

Parkinson Disease, balance, walking speed, Big Exercises, Augmented feedback gait training.
1. Introduction

Parkinson’s Disease (PD) is also known as ‘shaking palsy’ as defined by James Parkinson in his essay. It’s a progressive disorder in which both motor and non motor impairments are there. The disease is dominated by cardinal signs namely bradykinesia (slowness of movement), rigidity, tremor, and postural instability. In order to be more clear Parkinson’s Disease may be classified under Parkinsonism which is a group of disorders involving dysfunction in basal ganglia. PD is one of the commonest type of parkinsonism. It is also known as Primary Parkinsonism or Idiopathic Parkinson’s Disease. The other types include secondary Parkinsonism and Parkinson Plus Syndrome (Suzainne Martin, 2016). 1-2 per 1000 people are diagnosed with PD. The chances of getting this disease is directly proportional to age of the person. It affects 1% of the population above 60 years. A total of 10 million people have been reported diagnosed with PD which is substantial number to affect any nation’s economy. Not much data is available for prevalence of PD in India. But it has been reported by some studies that the burden of Parkinson’s in India is less as compared to other countries (Surathi, Jhunjhunwala, Yadav, & Pal, 2016). Due to vast cultural diversity and ethnicity gross data for epidemiology of PD is not available for India. However, few studies have reported the prevalence rate of this disease is 14.1 per 10,0000 population is the state of Jammu and Kashmir where as it is 12 per 10,0000 in Bangalore and other parts of South India. (Radhakrishnan & Goyal, 2018). Generally the age of onset in PD is 50-60 years but some cases have been reported in young adults as well with age between 21-40 years known as Young-onset PD. Men are more likely to be affected by this disease. The cause of Primary Parkinsonism is idiopathic but, secondary Parkinsonism may occur following traumatic brain injuries, stroke and other reasons(Susan B. O’Sullivan,Thomas J. Schmitz, 2007). The cardinal signs of the disease namely rigidity, bradykinesia, tremor and postural instability leads to balance and gait impairments in these patients. In Parkinson patients balance control is compromised due to involvement of one of the major systems such as visual, vestibular and somatosensory ((Rinalduzzi et al., 2015). Altered visual acuity, colour discrimination, reactivity of pupils to light, movements of the eye ball, motor perception , sensitivity of visual field and speed of processing visual stimuli may be responsible for the changes in vision. These patients exhibit abnormal kinaesthesia and control from vestibular system (Rinalduzzi et al., 2015).In addition to this the disease disrupts sensory, cognitive and motor systems leading to increased risk of falls.(Pelicioni, Menant, Latt, & Lord, 2019) A number of gait abnormalities are seen in these patients for instance, akinesia leading to freezing episodes known as freezing of gait(FOG), stopped posture and alteration in centre of gravity resulting in festinating gait.(Susan B. O’Sullivan,Thomas J. Schmitz, 2007). Therefore, these patients face difficulty in doing activity of daily living which effect their quality of life. In this case study, a tailor made protocol has been implemented on the a Parkinson patient which has depicted promising result in improving patient’s quality of life.
2. Case Report

A 67 year old retired bank professional diagnosed with Parkinson’s Disease since 10 years presented with a complaint of difficulty in transfer activities and walking. He also reported associated problems of tremors and difficulty in moving the upper and lower limb. He never took physiotherapy treatment before. He was referred for physiotherapy by the neurologist as the patient reported progressive increase in symptoms. While interviewing the patient for detailed history he revealed that the condition started with the initial problem of tremors in his left hand. Gradually other symptoms such as stiffness, difficulty in transfer activities, walking, sudden freezing episodes were also exhibited. No history of infection has been reported but he had a fall 3 months ago while crossing the road. He is a known case of hypertension and diabetes mellitus since 16 years for which he is taking medications regularly. He was diagnosed with idiopathic Parkinson disease by his family physician. The patient was a retired bank employee. He reported gait blocks when he tried to do something while walking for instance taking out wallet from his pocket. The freezing episodes lasts for about 20 minutes. From past few years he experienced more episodes of imbalance while standing and walking due to which he stopped going of his home often. He faced more difficulty to get up from the bed and standing up from the chair independently. In addition to this, sometimes he reported sleep disturbances. As the symptoms are progressing the medication was not having good effect. On examination he was well oriented and alert with mild impairment in short term memory. He was able to speak clearly. On motor examination the he reported restricted range of motion in hip extension, knee extension, elbow extension and thoracic lumbar spine extension. On plum line evaluation a stooped forward flexed posture has been observed. The sensory examination revealed proprioceptive deficits in both lower extremities. The tone was assessed by fast passive movements and rigidity has been reported in neck and trunk. The posture control and balance was evaluated using Functional Reach Test (FRT) in multiple directions and Berg Balance Scale (BBS). The patient depicted the score of 16 cm in forward reach. The patient scored 43 on BBS. For gait speed and risk of falls Timed up and go test along with 10 m walk test were used. He scored 15 seconds on TUG and 0.18m/s for 10MW test. Reciprocal arm swing was preserved in the patient. The patient is having grade III as per Hoehn and Yahr classification as per overall assessment.

3. Materials and Methods

A 67 year old male diagnosed with Parkinson’s Disease has been selected for the case study. The study was approved by Institutional Ethical Committee and written consent was signed by the patient. A physiotherapy protocol of 4 weeks has been given to the patient. The baseline assessment was done 1 month ago. Post training readings were recorded after 4 weeks from baseline. A total of 4 outcome measures has been used to assess the progress of balance and gait in the patient.
3.1 Outcome measures

3.1.1 Functional Reach Test (FRT)

The procedure has been executed in multiple directions forward, backward and sideways. A measuring tape was mounted on the wall parallel to the floor. The subject was instructed to stand bare feet and comfortable distance apart, making a fist and flexing the arm at 90 degrees. The patient was standing close to the wall but was not touching it. The reading was marked on the measuring tape where the MCP joints of fist lined up. After attaining this position the patient was instructed to reach in front maximally according to his capability without taking a step in forward direction. Similar instructions were given for backward and sideways.

3.1.2 Berg Balance Scale

This is an objective and gold standard measure to evaluate the balance abilities. There are 14 items in this scale. These items test the patient’s ability to maintain positions or movements in different scenarios ranging from minimal to maximal difficulty. The base of support is reduced in progressive items such as sitting and standing to single-leg stance. It also assesses the patient’s ability to change positions.

3.1.3 Timed Up and Go Test (TUG)

This test assesses walking, dynamic balance along with risk of falls in patients. For this chair with arm rests, stop watch and measuring tape is required. The patient was instructed to be in a seated position at the beginning of the test. The therapist commands the patient to stand and start walking for 3 meters then turns around and continue walking back to the chair and sits down. The duration is noted with the help of stop watch. The time stops when the patient was seated. The average of three trials has been considered for assessment.

3.1.4 10 m walk test

It’s a performance based test used to evaluate gait speed to determine functional mobility. The patient was asked to walk without assistance for 10 metres, with the time recorded for the intermediate 6 metres to allow progression of gait speed and deceleration. The time needs to be noted when the toes pass the 2 metre mark and stopped when the toes pass the 8 metre mark. The patient was made to walk at his preferred walking speed and maximum walking speed both. The average of three trials has been considered for assessment.

3.2 Physiotherapy Treatment Protocol

The treatment protocol for balance and gait. Prior to the intervention stretching of hip flexors, knee flexors, pectorals and back extensors was done on the patient as 5-10 minute warm up session. The interventions used for balance and gait training was given for 30-60 minutes/day for 4 weeks (Ni, Hazzard, Signorile, & Luca, 2018). The protocol consisted of exercises based on LSVT Big exercise program in which patient was asked to perform high amplitude movements of upper extremities, lower extremities and trunk.(Janssens,
Malfroid, Nyffeler, Bohlhalter, & Vanbellingen, 2014),(Fox, Ebersbach, Ramig, & Sapir, 2012). Apart from this weight shifting and perturbations were given in sitting, quadruped and standing positions.(Stożek, Rudzińska, Pustułka-Piwnik, & Szczudlik, 2016)

For gait training augmented visual and auditory feedback was used. The patient was asked to walk with the help of canes in both hands to assist arm swinging. The safety of the patient was ensured during all the interventions. The protocol was ended again with 5- 10 minutes of cool down phase.

4. Results

The intervention has shown improvement in all four outcome measures. The average increase in Function Reach Test in all directions was 25 %. Similarly improvement was seen in Berg Balance Scale Score which was 43 at the baseline and 52 post intervention. Improvement was noted in Timed Up and Go Test from 15 seconds to 11 seconds. The score of 10 meter walk test was also improved from 0.18m/s to 1.10m/s. The post training assessment has shown the improvement in all the parameters.

5. Discussion

This case study included simple strategies for improving balance and gait which can be easily used in any clinical setup. The type of exercises chosen in this study focus on over all involvement of body systems resulting in improved balance and gait. For improving balance of the patients they must be trained to control their centre of mass and limits of stability. The LSVT exercises used in this intervention included high amplitude exercises which improved his flexibility hence balance. The common muscle groups which become tight in PD are hip and knee flexors, trunk flexors due to stooped posture. Due to stooped posture the COM and LOS gets altered in the patients. Therefore, balance may be improved by correcting the posture of the patient. The Big exercises have shown improvement flexibility of the PD patients. The finding is similar to the work done by Janssens et al (2014) in which they performed Big performed big exercises on three patients for 4 weeks which have shown improvement in posture, balance and gait (Janssens et al., 2014). In LSVT Big Program the change of amplitude rather than speed has been used to overcome rigidity and bradykinesia in PD patients. Exercising using large amplitude not only results in bigger, but also in faster and more precise movement . The aim of BIG exercises is to overcome deficient speed-amplitude regulation leading to underscaling of movement amplitude at any given velocity (Fox et al., 2012). The weight shifting and external perturbations have shown improvement in balance of the patients. The result is consistent with the finding of Stozek et al.(Stożek et al., 2016) They obtained improvement in balance and gait by giving external pushing and tandem standing for 28 sessions. In this study the patient has explored his LOS by practising balance exercises in different positions such as sitting, quadruped and standing. Reaching activities in quadruped has shown improvement in dynamic balance of the patients. The gait training using canes in both hands has helped to improve walking speed. The canes used to provide the feedback for the upright alignment of the patient along with safety. The findings of this study is similar with
Krishnamurthi et al. In their work the authors have given polestriding intervention for 12 weeks to PD patients which has improved the gait parameters. (Krishnamurthi et al., 2018). The reason for improvement may be attributed to the enhancement of gait rhythm and speed of walking. In addition to this the augmented visual and auditory feedback has also improved the gait parameters. Previous literature depicts that that external stimuli (acoustic, visual, and somatosensory) are able to modulate the motor pattern in PD, helping the patients to start and maintain a rhythmic motor task. (Muthukrishnan, Abbas, Shill, & Krishnamurthi, 2019) Studies have also shown that auditory cuing has more promising effects as compared to visual cueing. Extensive research is lacking in retention of post training effects in long term. (Muthukrishnan et al., 2019) In this case study also visual and auditory feedback helped to improve the walking speed of the patient.

6. Conclusion

The result of this case study suggests that if simple exercise interventions are planned for Parkinson patients involving Big Exercises, Perturbations and Augmented feedback then balance and gait parameters may be improved. Due to improvement in balance the walking speed may be enhanced hence, reducing the fear of falls in patients suffering from Parkinson Disease.

7. References


