



e-ISSN:2582-7219



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 7, Issue 7, July 2024



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.521



6381 907 438



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Challenges and Adaptations in Boxing: A Case Study of Idiopathic Parkinson's

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ABSTRACT: Postural instability and resulting falls are a detrimental aspect of Parkinson's disease. There are multiple systems that influence one's balance and differing theories regarding physical rehabilitation to improve balance and postural control. The purpose of this case study is to document the effects of strength and proprioceptive training on balance in an individual with Parkinson's disease. It is hypothesized that strength and proprioceptive training using a soft surface will reduce fall risk and improve balance. This case study is focussed on a 60-year old male diagnosed with idiopathic Parkinson's disease with primary complaints of fatigue, postural instability, and social withdrawal. The patient is a retired boxing coach who was referred to physiotherapy after several falls with the intention of improving balance, and ultimately returning to recreational boxing. In order to measure clinical changes the Berg Balance Scale, Multidirectional Reach Test^[1], and Clinical Test for Sensory Integrity and Balance (CTSIB) were used. The treatment intervention implemented a 10-week protocol including external resistance and bodyweight exercises, postural control exercises on a foam surface with varying conditions, as well as aerobic activity. The prescribed exercises included walking 2 times per day 4 times per week in addition to daily balance and resistance training^[2]. The subject achieved the maximum score for the first 3 conditions of the CTSIB upon initial assessment; thus, these were not retested post treatment. The remaining conditions however, were not fully completed. Conditions 5 and 6 were performed quite poorly at just 6 and 5 seconds, respectively. Conditions 4, 5, and 6 of the CTSIB, as well as all directions in the multidirectional reach test and total score of the Berg Balance Scale (from 46 to 53) improved from pre-to-post intervention. This indicates positive balance outcomes from a 10-week proprioceptive and resistance training protocol in individuals with Parkinson's disease.

I. INTRODUCTION

This case will be focusing on Parkinson's disease, which is a progressive neurological disorder that presents with an insidious onset. This report will explore how a physical therapist could go about diagnosing and treating this condition in an evidence-based manner. The American Academy of Neurology believes that both pharmacological treatment and the promotion of physical activity are essential to the optimal treatment of PD^[3]. Physical therapists teach patients with Parkinson's how to manage their impairments, disabilities and independently perform their activities of daily living. In addition, they assist with more complex tasks that are done daily such as walking. There seems to be enormous evidence for the effects of physical therapy throughout all stages of the disorder^[3]. However, only a few sufficiently controlled prospective studies have shown evidence for the promotion of physical activity in PD^[3].

Postural instability causes frequent falls in this population and physical therapists are in an ideal position to address this issue with balance training. Balance is seen as an individual's capacity to control their center of mass in response to fluctuating internal and external environmental conditions. Consequently, maintaining static and dynamic balance requires proper functioning of central balancing mechanisms^[3]. Damage to any part of the sensory or motor pathway may lead to the inability to maintain the center of mass within the base of support. However, it is believed that no one system alone dictates an individual's ability to balance. There are different ways of tackling a balance dysfunction whether it is working on the vestibular, somatosensory, vision system. There is evidence showing that improving the influence of proprioception among clients with neurological disorders will lead to improvements in balance^[3]. The studies administered balance exercises with deprived vision in order to reduce visual dependence^[3]. Also, the studies had patients standing over a smooth surface to further facilitate proprioceptive inputs^[3]. In addition, an extensive meta-analysis suggests that strength training is associated with improved balance and gait performance in Parkinson's disease^[3]. Thus, this case study intends to document the influence of proprioception and strength training in order to improve balance among Parkinson's disease.



II. PATIENT CHARACTERISTICS

The condition usually occurs in individuals in their mid-fifties and the occurrence of the disease increases with age. Epidemiological data on the prevalence and incidence of the condition show differing estimates among Europeans ranging from 65.6 and 12,500 per 100,000^[4]. In addition, there seems to be mixed data for prevalence and incidence based on race and more extensive studies are needed^[4]. Several studies have shown that Parkinson disease seems to be more common in men, with a male: the female ratio between 1.1 and 2.3^[4]. The earliest clinical sign that can be documented occurs when around sixty percent of the dopamine-producing cells in the substantia nigra have deteriorated. The clinical signs of this condition include resting muscle tone, involuntary movements, bradykinesia, rhythmic tremors, and postural instability. Ultimately, our patient has been referred to physical therapy by his physician, after a series of falls, in order to work on his balance.

III. ASSESSMENT

A 60-year-old male patient presents with complaints of rapid fatigue, postural instability, and a lack of interest in all social events for the past two years. He was just diagnosed with idiopathic Parkinson's disease at a local hospital in Gujarat. He has been referred to physical therapy by his physician, after a series of falls, in order to work on his balance. Also, he has been diagnosed with Diabetes Mellitus for the last ten years and has been receiving insulin therapy. Other than that, there is no other history of infections, illnesses or accidents in the last five years. Importantly, the patient has brought up concerns about depression and has been referred to a psychiatrist for an assessment. He lives with his wife in a three-story building that requires him to walk three flights of stairs that includes thirty-six steps. The patient is a retired heavyweight boxer whose main passion still is boxing. He states that his central goal is to continue recreationally boxing at home or the gym. He is independent in all his activities of daily living except bathing and toileting, which he needs supervision from his spouse. The patient reports good strength in all limbs and has been able to walk independently. He enjoys taking thirty minute walks to the park, but he has noticed that he is starting to have a festering gait and is having trouble slowing down. Ultimately, he is concerned with his increase in falls lately. He is afraid of falling and breaking his hip like his uncle Johnny, who died from the complications of a hip fracture.

IV. OBJECTIVE ASSESSMENT

- Posture: Slight forward head posture, symmetrical, slight resting tremor in right forearm/ hand.
- Strength: Upper and lower extremities all within normal limits
- ROM: Upper and lower extremities within functional range of motion
- Reflexes: Biceps, triceps, brachioradialis, quadriceps and tendo achilles (all 1+ bilaterally)
- Myotomes: Normal bilateral
- Dermatomes: Normal bilateral
- Tone: Mild non velocity dependent increase in muscle tone (MAS grade of 1+)
- Dexterity: Mild increase in tremor when completing UE tip to tip and pulp to pulp
- Romberg: negative
- Rapidly Alternating Movement Evaluation: negative
- Point-to-Point Movement Evaluation: slight tremor when completing task bilaterally
- Heel to shin: negative
- Gait: Demonstrated an independent gait and the walking pattern showed mild features of festination, decreased step length, trunk flexion while walking, shuffling gait, and mild freezing.

Outcome measures

- BERG Balance scale: 46/54^[5], ("Clinical Tests of Sensory Interaction on Balance", 2013)
- Multidirectional reach test: Forward 18.5 cm, Backward 10.0 cm, Left 13.5 cm, Right 14.0 cm^{[1], [6]}
- Clinical test for sensory integrity and balance (CTSIB). ("Clinical Tests of Sensory Interaction on Balance", 2013)
 - 1: Eye open + Firm surface 30/30 seconds
 - 2: Eye closed + Firm surface 30/30 seconds
 - 3: Visual conflict + Firm surface 30/30 seconds
 - 4: Eye open + Compliant surface 26/ 30 seconds



- 5: Eye closed + Compliant surface 6/30 seconds
- 6: Visual conflict + Compliant surface 5/ 30 seconds

V. CLINICAL IMPRESSION

Analysis: Patient is a previously independent 60 year old male, who presents with decreased balance, mild increase tone, mild resting tremor, mild festinating gait, reports increased levels of fatigue with activity, and reports needing assistance with bathing and grocery shopping. Patients lives in a supportive home, however needs to climb 3 flights of stairs to get into his apartment. Patient is a good candidate for physiotherapy to help increase balance, decrease fatigue, increase tolerances to meaningful activities, and decrease the likelihood of future falls.

Problem list:

- Decreased balance
- Mild increased tone
- Mild resting tremor
- Mild festinating gait
- Increased fatigue
- Dependence with bathing and grocery shopping

VI. INTERVENTION

Training the patient’s balance was the priority in order for him to return to activity. We prescribed strength training and foam mat balancing exercises to improve his balance^[7]. We wanted to include strength training and balancing with focus mitts in order to replicate the skills needed to achieve a day-to-day coaching session. A second person was present when the patient was performing their balancing exercises for support. The following sequences of activities were performed for one hour for 10 weeks:

Strength/warm up

Exercise	Frequency	Intensity	Time	Type	Volume
Cycle ergometer	3 times a week	30% 1 Rep max (RM)	5 min	Warm up	1 set
Knee extension		3 lb ankle weights	2:1:4 s	Strength eccentric	- 10 reps 3 set 2 min rest
Glute bridge		80% 1 RM	1:2:4 s	Strength eccentric	- 10 reps 3 set 2 min rest
Ankle plantar flexion		Resistance (RTB)	band 1:1:4 s	Strength eccentric	- 10 reps 3 set 2 min rest
Walk	2 times a day 4 times a week	Comfortable walking speed	10 min (10% increase every week)	Endurance	2 sets

Foam Mat Balance (30 s holds, 3 sets, 1 min rest):

- Eyes open



- Feet shoulder width apart
- Feet together
- Tandem
- Eyes closed
 - Feet shoulder width apart
 - Feet together
 - Tandem
- Eyes open, focus mitt with external perturbation
 - Feet shoulder width apart
 - Feet together
 - Tandem

VII. OUTCOME

Berg balance score:

- 53/54

Multidirectional reach test:

- Forward 24.0 cm
- Backward 13.0 cm
- Left 17.5 cm
- Right 18.0 cm

Clinical test for sensory integrity and balance (CTSIB)

- 4: Eye open + Compliant surface 30/ 30 seconds
- 5: Eye closed + Compliant surface 21/30 seconds
- 6: Visual conflict + Compliant surface 18/ 30 seconds

Patient responded well to treatment with improvements in balance and reaching. His Berg balance score on reassessment increased by 7, multidirectional reach test increased on average of 25%, and shown improvement in conditions 4, 5, and 6 on the CTSIB by 4 seconds, 15 seconds, and 12 seconds, respectively. Based on the patient's reassessment, he is ready for outpatient physiotherapy to continue working on balance and progress strengthening program.

VIII. DISCUSSION

This case detailed the assessment and treatment of an individual with common Parkinson's symptoms. The aim of the case was to describe in detail a typical presentation of an individual with Parkinson's and also to identify effective treatment strategies to address the problems faced by the client. My case example detailed the experience of a typical first time presentation and referral to physiotherapy. The gentleman in my case presented with many of the common early identifying symptoms of Parkinson's and also presented within the most common demographic for diagnosis of the disease. Often case studies focus on specific or rare cases as these cases may garner more attention, however there is also merit in describing assessments and treatments in a case that is broadly applicable and most representative of the client population. As clinicians we may see on occasion atypical presentations of various conditions, but the majority of my client interactions will be with individuals who present with more typical symptoms and challenges. It is therefore paramount that we have extensive knowledge in assessment and treatment of these typical cases so as to provide the greatest care to the greatest number of clients.

The main focus of treatment in my case was to improve the balance of the patient and we were able to do so through a combination of strength training and foam mat balance exercises. The foam mat exercises encompassed the principles of sensory specific balance training by isolating and training both the visual and proprioceptive balance systems. It is possible that proprioceptive deficits may be a cause of impaired balance and adverse events in Parkinson's^[3]. We also know that proprioception and other sensory specific balance can be trained^[3]. It is for these reasons that we targeted these areas for treatment in our case. Balance and strength problems are pervasive among a variety of neurological conditions. It can then be justified that both the assessments and treatments used in my case can be applied to a host of other conditions. For example sensory specific balance training would also be an ideal treatment for balance impaired individuals with Post-Concussion



Syndrome, Stroke, Multiple Sclerosis (MS), and many other conditions. In addition to the balance treatment, the assessment items used in our case could also be applied to a number of clinical scenarios, namely any situation where there are balance impairments or fall risks and any conditions that present with declining strength, range of motion or proprioception.

In summation, the goal of this case study was to add to the already rich body of information on the assessment and treatment of Parkinson's from a physical therapy perspective (See Parkinson's - Clinical Presentation, Parkinson's - Physiotherapy Management and Interventions) and to provide a resource for students who have not yet had the chance to assess and treat an individual with Parkinson's. In addition to this it is hoped the broad applicability of the assessment and treatment measures chosen will provide useful in the management of other similar conditions.

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