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Core and balance: Advancing rehabilitation for multiple sclerosis patients

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Abstract

Background: Multiple Sclerosis (MS) is a chronic neurological disorder marked by demyelination in the central nervous system, leading to impairments in balance, coordination, and mobility. Balance dysfunction is a frequent symptom in MS, significantly affecting quality of life. Core muscle strengthening is proposed as an effective intervention for improving balance in MS patients.

Objective: This case study evaluates the effectiveness of a core strengthening program in improving balance in a patient with MS.

Methods: A 32-year-old male with relapsing-remitting MS (RRMS) and moderate balance difficulties, assessed by the Berg Balance Scale (BBS) and Timed Up and Go (TUG) test, underwent a 6-week physiotherapy intervention focused on core strengthening exercises including planks, bridges, pelvic tilts three times weekly. Balance was reassessed post-intervention.

Results: Significant improvements were observed, with BBS scores increasing from 32 to 38 and TUG time decreasing from 14 to 11 seconds, indicating enhanced balance and functional mobility. The patient also reported greater confidence during daily activities.

Conclusion: Core strengthening appears effective in improving balance in MS patients. Further research with larger samples is recommended to generalize these findings.

Keywords: Multiple sclerosis, core strengthening, balance, physiotherapy, berg balance scale, functional mobility

1. Introduction

Multiple Sclerosis (MS) is a chronic, progressive, and demyelinating disease of the central nervous system (CNS) that affects an estimated 2.8 million individuals globally (Multiple Sclerosis International Federation, 2020) [7]. MS is characterized by periods of exacerbation and remission, where the immune system attacks the myelin sheath, the protective covering of nerves, leading to impaired nerve transmission. This can result in various symptoms, including motor, sensory, and cognitive dysfunction, and notably, balance and coordination impairments. The frequency and severity of these symptoms vary widely, but for many patients, difficulties with balance and coordination are common and disabling, often leading to reduced mobility and a lower quality of life (Larochelle *et al.*, 2016) [5].

In recent years, core muscle strengthening has been proposed as a key intervention to mitigate balance dysfunction in individuals with MS. Core muscles, including the abdominals, back muscles, and pelvic floor, provide a foundation for maintaining posture and dynamic balance. By targeting these muscles, physical therapists aim to enhance the stability and coordination required for daily functional movements (Freeman *et al.*, 2018) [3]. This case study explores the impact of a core strengthening regimen on balance in a 36-year-old male patient with relapsing-remitting MS (RRMS), a common subtype characterized by alternating periods of symptom exacerbation and remission.

2. Case Presentation

2.1 Patient Background

The patient, a 32-year-old man, was diagnosed at age 28 with relapsing-remitting multiple sclerosis (RRMS). Moderate balance and coordination issues are his main complaints, and they have gotten worse over the last three years. The Berg Balance Scale (BBS) and the Timed Up and Go (TUG) test are two established measures of balance that were used to

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evaluate the patient prior to the intervention.

2.2 Pre-Intervention Assessment

2.2.1 Berg Balance Scale (BBS): The 14-item BBS scale assesses both static and dynamic balance in daily work. According to Downs *et al.* (2013) ^[2], the patient exhibited a moderate deficit in balance, as shown by their pre-intervention BBS score of 32.

2.2.2 Timed Up and Go (TUG) Test: Timing how long it takes a person to get up from a seated position, walk three meters, turn, walk back, and sit down is how the TUG test gauges functional mobility. The patient's TUG time prior to intervention was 14 seconds, which is within the range of those with MS who have limited mobility (Huisinga *et al.*, 2014) ^[4].

3. Intervention

3.1 Physiotherapy Program

For six weeks, the patient received physiotherapy with the goal of strengthening their core. The deep stabilizing muscles, which are crucial for balance and postural stability, were the focus of the exercises' selection. Three times a week, the patient attended 45-minute physiotherapy sessions.

The primary exercises included

- **Planks:** A full-body workout that helps to stabilize the spine and strengthen the core.
- **Bridges:** Promotes pelvic stability by targeting the glutes and lower back.
- **Pelvic tilts:** Improve pelvic control, which is essential for preserving equilibrium when moving.

Every session started with a mild aerobic warm-up, which was followed by three sets of ten to fifteen repetitions of core exercises. Depending on the patient's performance and capacity to maintain correct form, increasing levels of exercise difficulty were introduced every two weeks.

4. Outcomes

4.1 Post-Intervention Results

By the end of the 6-week session, the patient's functional mobility and balance had significantly improved.

BBS Score: The patient's score improved from 32 to 38, indicating that their balance has improved. According to Cattaneo *et al.* (2006) ^[1], a clinically significant gain of six points in the BBS score indicates improved postural control and a decreased risk of falls.

TUG Test Time: This indicates improved functional mobility as the patient's TUG time dropped from 14 to 11 seconds. Faster TUG times are linked to improved mobility and decreased impairment in MS patients, therefore this improvement is noteworthy (Whitney *et al.*, 2011) ^[9].

4.2 Subjective Feedback

The patient reported feeling more stable during daily activities, including walking, climbing stairs, and transitioning from sitting to standing. He expressed increased confidence in his ability to perform these tasks without fear of falling, which had been a primary concern prior to the intervention.

5. Discussion

The case study's findings support previous research by showing that people with Multiple Sclerosis (MS) can greatly enhance their balance by strengthening their core muscles. Subjective reports of increased confidence in daily activities, along with the observed improvements in the patient's Timed Up and Go (TUG) and Berg Balance Scale (BBS) test scores, indicate that core stability exercises may be an effective way to address the underlying neuromuscular deficits causing balance dysfunction in multiple sclerosis. This conversation explains the physiological processes by which strengthening the core may improve balance, contrasts results with earlier studies, and considers the wider ramifications for MS patients' recovery.

5.1 Core Stability and Neuromuscular Control in MS

Balance and functional mobility depend on postural stability, which is maintained in large part by core muscular strength. For the limbs to move efficiently, the core musculature—which includes the diaphragm, pelvic floor muscles, internal and external obliques, transverse abdominis, and multifidus—provides a stable platform. Demyelination in MS impairs postural control and coordination by interfering with the CNS's ability to communicate with muscles (Fjeldstad *et al.*, 2015) ^[12]. By enhancing neuromuscular control—the brain's capacity to synchronize muscle contractions and preserve balance throughout both static and dynamic activities—core strengthening helps the body make up for these deficiencies. Improvements in the BBS and TUG scores in this case study suggest that the patient's core strengthening program probably boosted neuromuscular activation. Planks, bridges, and pelvic tilts are examples of core workouts that target several muscle groups at once, improving the integration of sensory and motor pathways, which are frequently impaired in multiple sclerosis (MS). By using different neural circuits, this neuromuscular adaptation may enable the central nervous system to avoid some of the damaged pathways. This phenomenon is called neuroplasticity, and it has been found to be a crucial component of MS rehabilitation (Prosperini & Di Filippo, 2019) ^[8].

5.2 Comparison with Previous Research

Numerous studies have demonstrated how core strengthening helps people with MS improve their balance. After an 8-week intervention, Freeman *et al.* (2018) ^[3] found that Pilates-based core stability training significantly improved balance and functional mobility in MS patients in a randomized controlled experiment. Similar to the current case study, Freeman *et al.* discovered that specific core exercises decreased TUG times and improved BBS scores. The results of this case study support the notion that by improving control over the body's center of mass during movement, core-focused therapies can help address the balance issues typical of multiple sclerosis.

In a similar vein, Cattaneo *et al.* (2006) ^[1] investigated the impact on MS patients of a balance training program that included core stability exercises. According to the Dynamic Gait Index (DGI) and other clinical evaluations, the study found that dynamic balance had significantly improved (Cattaneo *et al.*, 2006) ^[1]. According to the findings of the current case study and Cattaneo *et al.*, strengthening the core muscles enhances dynamic control during activities requiring direction changes or posture transitions, which is

crucial for daily functioning, in addition to improving static balance.

5.3 Psychological and Functional Impacts

The patient in this case study reported feeling more confident when walking and climbing stairs, among other everyday activities, in addition to the noticeable improvements in balance. Given that MS patients frequently experience a crippling dread of falling, which frequently results in decreased activity levels and additional physical deconditioning, this psychological benefit is substantial (Finlayson *et al.*, 2017) [11]. The decrease in TUG duration from 14 to 11 seconds indicates improved functional mobility, which is essential for MS patients to preserve their independence and lower their risk of falling. Faster TUG times are linked to improved functional outcomes and reduced degrees of disability in MS patients, according to Huisinga *et al.* (2014) [4]. As a result, strengthening the core not only increases physical ability but also aids in removing psychological obstacles to mobility, resulting in a positive feedback loop whereby heightened confidence motivates more exercise.

5.4 Implications for MS Rehabilitation

The results of this case study highlight how crucial it is to include core strengthening exercises in MS patients' rehabilitation regimens, especially for those who struggle with balance and coordination. Early intervention with core strengthening may be able to slow the decline in mobility and lower the risk of falls because MS is a progressive disease. Furthermore, the very brief 6-week intervention period shows that significant improvements in balance can be made in a condensed amount of time, indicating that core strengthening may be an economical and efficient part of MS rehabilitation.

Furthermore, the benefits of core stability exercise can go beyond just enhancing balance. According to study, for instance, MS patients' posture, walking, and general functional independence may all be improved by strengthening their core. Integrating core exercises into a thorough rehabilitation program could enhance several aspects of mobility and lessen the overall impact of MS on patients' everyday lives, as balance and gait abnormalities are among the most incapacitating symptoms of the condition.

5.5 Limitations and Future Directions

Although this case study's results are encouraging, the findings' generalizability is constrained by its single-subject methodology. The efficacy of core strengthening in a wider and more varied sample of MS patients requires greater investigation. Furthermore, the patient in this case study had moderate balance dysfunction and was relatively young; it is unknown if older patients or those with more severe balance impairments would see comparable outcomes. Future research should look into whether the balance gains observed in this instance can be sustained over time, as well as whether core strengthening can eventually reduce MS-related impairment and avoid falls.

Investigating differences in core exercise forms and intensities may potentially yield important information about how to best tailor the intervention for various MS patient subgroups. For instance, adding balance-challenging components, including unstable surfaces, or dynamic core

exercises could improve neuromuscular control and postural stability in individuals with more advanced disease (Karimi *et al.*, 2018) [13]. Furthermore, there may be synergistic effects when core strengthening is combined with other therapy modalities like aerobic exercise or cognitive rehabilitation, which could improve outcomes for MS patients even more.

6. Conclusion

This case study demonstrates how core strengthening exercises might help a patient with relapsing-remitting multiple sclerosis (MS) with their balance and functional mobility. Core stability training may be a useful intervention for treating balance impairment in MS, as seen by the noted improvements in BBS scores, TUG times, and the patient's confidence in day-to-day activities. Although these results are in line with earlier research, more investigation is required to verify their generalizability and examine the long-term advantages of core strengthening in wider MS patient populations. A multidimensional approach to addressing the physical and psychological issues of living with multiple sclerosis may be provided by incorporating core exercises into complete rehabilitation programs, which may enhance balance as well as gait, posture, and general quality of life.

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