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Berg Balance Is Weakly Related To Biodex Stability System In Egyptian Patients With Multiple Sclerosis

Fatma Ibrahim, PhD[1], Adel ME Zedan, PhD[2], Amr Mohammed Mohie Saffan, PhD[3]
[1]Phyical therapist at outpatient clinic from Shebin Elkom Teaching Hospital and Menoufia University hospital, Menoufia, Egypt.
[2]Lecturer at department of physical therapy for musculoskeletal disorders and its surgery, faculty of physical therapy, Benha University, Qaluybia, Egypt.
[3]Lecturer at department of physical therapy for musculoskeletal disorders and its surgery, faculty of physical therapy, South Valley University, Qena, Egypt.

Corresponding author: Amr Mohammed Mohie Saffan; amrmohie416@yahoo.com
ORCID: 0000-0003-1358-532X
Fatma Ibrahim , fatmaibrahim0@gmail.com ORCID: 0009-0006-1066-7046
Adel ME Zedan, adel.zidan@fpt.bu.edu.eg ORCID: 0000-0002-0639-9775

Abstract
Background: *Multiple sclerosis (MS) is a prevalent neurological disorder that causes significant balance impairment and disability. Several measures of balance (dynamic, functional) are present in literature for this population. However, there is little literature about relation between these measures with no consistency.*
Objective: *This cross-sectional study aimed to explore the relation between Berg balance scale (BBS; functional balance) and Biodex stability system (BSS; dynamic balance) in Egyptian patients with MS.*
Methods: *Ninety patients with MS were included in this crosss-sectional study that was conducted at outpatient clinic from Shebin Elkom Teaching Hospital and Menoufia University hospital. Patients were assessed for balance using BBS and BSS. Pearson correlation coefficient was calculated.*
Results: *A weak negative association was founded among BBS and BSS (r=-0.236, p=0.026).*
Conclusion: *BBS and BSS do not measure the same thing, so they can be taken together as outcome measure during assessment of various physical therapy interventions for patients with MS.*
Keywords: *Multiple sclerosis; Balance; Biodex; Berg; Egypt*

INTRODUCTION

Multiple sclerosis (MS) is a continuing, advanced, inflammatory autoimmune illness of the central nervous system (CNS) causing functional disability [1]. It has unclear pathogenesis, but genetic, environmental, hormones have been implicated leading to immune dysregulation [2]. It negatively affects equilibrium, synchronization, sensitivity, muscular tone and strength, eyesight, and thought processes causing imbalance, impaired postural and gait control, and frequent falls affecting life quality [3,4]. Imbalance affects up to 94% of people with MS. causing falls in up to 71% [5] that limit their activities [6].

A person's ability to maintain balance allows them to move physically and perform other daily tasks. There are two types of balance: static and dynamic. The center of gravity of the body remains inside the base of support when in static balance. When moving in dynamic balance, the center of gravity is kept inside the base support while in movement [7]. Sensorimotor systems work to keep the body balanced when standing up straight. Data regarding the body's position in space and the surrounding setting is provided by sensory inputs, including proprioceptive, optical, vestibular, and dermal impulses from the bottom of the foot [8]. When in a still position, the force platform records very little body shift approximately the size of a 10-cent euro piece [9]. For a number of reasons, assessing the degree of control of posture deficits are practically important involving sooner fall risk identification, comprehension of the fundamental pathophysiology, and objective recording of treatment effectiveness [10].

The extensive and diverse pattern of CNS injury in MS patients can lead to a lack of neuronal connection, which can also impair postural control and the capacity to keep equilibrium. Either impairment to peripheral organs that provide sensory data to the CNS or related to motor production due to multiple

sclerosis can compromise controlling posture [10]. In fact, poor control of posture is frequently seen in MS patients; in fact, almost two-thirds of MS patients indicate that their primary complaint limiting their movement in everyday life is an absence of coordination and equilibrium. Imbalance impairs general quality of life, causes slips and accidents, and limits movement and freedom. In addition, impairing proper balance, tiredness, muscular weakness, and spasticity can put patients at risk for unintentional falls [11].resulting in damages and/or fractures[12].

Force platforms and clinical scales can be used to quantify balancing deficiency. Clinical methods to assess balance include questionnaires that are self- administered, stop-watch tests, and physician-rated scales. Various clinical scales are simple and quick to utilize, but its subjectivity grading methodology and inconsistent implementation make them problematic [13]. Clinical scales have low sensitivity and moderate–good specificity [14]. It is necessary to perform many tests in order to correctly detect individuals who fall [15]. A test to assess balance that has excellent reliability and accuracy is the Berg Balance Scale. Furthermore, the dynamic equilibrium is evaluated using the Biodex stability system. The dynamic equilibrium and dynamic limitations of stabilization are evaluated and trained using it. It centers on the proprioceptive neuromuscular processes that seem to influence upright and kinetic joint stabilization [16].

Multiple sclerosis is diagnosed based on diagnostic criteria [1]. Physical therapy, logopedics, occupational therapy, sociotherapy, and psychotherapy are examples of non-drug therapies [17]. Exercise is a useful and affordable way for MS sufferers to enhance a variety of activities [18].

Reviewing literature, only two studies were found to address the relation between Berg balance and Biodex stability system scores. However, they were limited by addressing the relation on stroke patients [19].and small sample and lack of clinical significance [20].

METHODS

The purpose of the study was to look at the relationship among dynamic and functional balance in ataxic multiple sclerosis patients from Egypt. 90 individuals with decreased balance who were identified with multiple sclerosis. They were chosen out of the outpatient clinics of Menoufia University Hospital and Shebin Elkom Teaching Hospital. All patients signed informed consent. The study was authorized by Benha University's faculty of physiotherapy's ethics committee and registered under the numbers PT.BU. EC.10.

The patients were included if they; aged from 20 and 40 years old, were in the illness's stable stage, with no deterioration or recurrence during the previous three months, had moderate level of balance impairments, according to Berg balance scale. Patients excluded if they had; problems that limit their ability to undergo and tolerate the testing, complete blindness, psychiatric disorders and cognitive impairment, severe motor impairments, motor power less than three, been in acute relapse stage.

Instrumentation:

1- Berg balance scale: BBS evaluates the execution of functional activities to determine equilibrium for those with impaired balance function. It uses 14 tests (a 14-item mobility scale) to assess both dynamic and static balance [21]. A ruler, 2 regular chairs (one with and one without arm rests), a footstool or step, a timer or wristwatch, and a fifteen-foot pathway are required. It requires fifteen to twenty minutes to finish. It is graded from 0 to 4 on a five-point scale. "0" denotes the function's lowest level, while "4" denotes its greatest level. 56 is the total score. Scores are interpreted as follows; 41-56 = low fall risk (can walk independently), 21-40 = medium fall risk (need aid), and 0 –20 = high fall risk (need wheelchair) [22,23]. It is valid and reliable [24].

2- Biodex stability system: BSS assesses the capacity of the patient to sustain dynamic unilateral or bilateral postural stability in either a static or dynamic condition. It is measured in a closed-chain, multi-plane examination to assess neuromuscular regulation. The BS is a multi-axial instrument that tests and documents a person's capacity to maintain the affected joint beneath dynamic load in an objective manner. It uses a round platform that can turn freely in both the medial-lateral and anterior-posterior directions at the same time [25]. It has been used as an assessment and training of balance and postural stability in different neurologic diseases [26].

It is made of a moveable balancing platform that can lean the surface up to 20 degrees in a 360-degree arc. The technology offers a variety of stability stages, from a very unsteady surface (stability level 1) to a

perfectly hard surface (stability level 8) [27]. It can be changed by varying the amount of resistance provided by the platform's springs. The platform becomes less stable as the resistance degree decreases. The system's microprocessor-based actuator regulates the level of surface instability. The methodology, stability level, and examination length are chosen by the clinician. Support handle position, monitor height, and monitor tilting are the three changes that must be made to fit every patient. Software controls every other aspect of the exam and workout. The display on the device may be raised or lowered to accommodate different patient heights. A cruiser that depicts the patient's posture and execution while attempting to stand and keep his balance is displayed on the monitor.

The Anterior posterior (AP) stability index (SI), which measures the individual's capacity to regulate their balance from front to back, is one of the dynamic balance test parameters. The patient's capacity to regulate their balance from one side to another is shown by the mediolateral (ML) stability index, while the patient's capacity to maintain their balance in all directions is indicated by the whole stability index. High numbers indicate less stability across the entire system metrics [27]. Inadequate balance is indicated by a high overall stability index (OSI) score. The OSI score is thought to be the most accurate representation of the individual's total platform balancing capability.

Procedures:

1-Berg balance scale: the researcher asked each patient to score the 14-item scale (14 tasks) on 5-point scale (0-4), higher score is better. He also calculated the times of the required tasks using stopwatch.

2- Biodex stability system:

All patients had verbal comprehension of the Balance System before using the apparatus with footwear removed. Testing was begun with the device is in the looked position. Following three minutes if the equipment is not being used, the Balance System autonomously locks the platform into the "locked" or fixed position. Regarding patient security and ease, the biofeedback screen and support rail were modified. An instructor was on hand to help patients who are working while their eyes closed in case, they lose their balance or need to utilize the patient aid stand, if available. In the middle of the platform stood the patient. From "hands-on" to "hands-off" the support handle, patients advanced. The individual was able to gaze directly at the screen because of its placement. Prior the analysis began; the patient's height and weight were recorded since the software needs this information. The platform was unlocked and determine the zero point of the patient (feet coordinates). It started by performing a familiarity trial to minimize the effect of learning. Of the three indices measured with the Biodex stability system measure, MLSI and APSI are combined to create the (OSI), which is highly responsive to alterations in the two directions.

Statistical Analysis:

SPSS for Windows, edition 24, was used to do data analysis. (SPSS, Inc., Chicago, IL). Pearson correlation coefficient was calculated between BBS and BSS, as the information was delivered properly. With the initial alpha level set at 0.05.

RESULTS

The basic features for each subject were displayed in a table. ().

Table (1): Baseline characteristics of all patients (N=90)

Baseline characteristics	Mean (Standard deviation)
Age (years)	31 (6)
BMI (kg/m^2)	24 (2)

Mean (standard deviation) for Berg balance scale scores was 31 (4) and for Biodex stability system scores was 0.92 (0.02), as displayed in the table (2).

Table (2): Means (standard deviation) of Berg balance scale and Biodex stability system (n=90)

Variable	Mean (Standard deviation)
Berg balance scale	31 (4)
Biodex stability system	0.92 (0.02)

According to table (3), the relationship among the Berg balancing scale and the Biodex stability system was determined using the Pearson correlation coefficient, which showed a statistically weak negative correlation (r=-0.236, p=0.026)

Table (3): Pearson correlation coefficient between Berg balance scale and Biodex stability system (n=90)

Correlation Between berg balance scale and	r	p
Biodex stability system	-0.236	0.026

DISCUSSION

This cross-sectional study aimed to explore the relation among Berg balance scale (BBS; functional balance) and Biodex stability system (BSS; dynamic balance) in ninety Egyptian patients with ataxic MS.

Finding of the current research displayed a weak negative relationship among Berg balance scale and Biodex stability system scores. This comes in agreement with **Parsa et al. (2019)** and **Atteya et al. (2019)** who found weighty moderate negative association among BSS and BBS scores [19,20]. **Parsa et al. (2019)** found a weighty moderate negative association in stroke patinets (r=-0.68), suggesting that participants' dynamic balance state is a relative reflection of their functional balance level [19].

Atteya et al. (2019) found significant differences between faller and non-faller groups (based on Berg balance scale) and Biodex stability in the three directions [20].

Patients with MS frequently exhibit problems in their ability to manage their balance, which, when combined with additional risk elements, can raise the probability of falling. When combined with other disorders and impairments, these anomalies frequently make it impossible for persons to carry out their everyday tasks. The recovery of elderly for their balance has received a lot of focus in the last 10 years. The medical profession is now increasingly interested in evaluating and treating walk and balance abnormalities associated with MS. **(Brichetto et al., 2015)** [28].

Therefore, it is crucial to evaluate patients' perceptions of how they balance as well as their ability to balance in various related activities (such as standing and walking). Since balance awareness can directly affect the actions of a patient, it may play a significant role in describing the degree of impairment. **(Shanahan et al., 2017)** [29].

CONCLUSION

BBS and BSS do not measure the same thing, so they can be taken together as outcome measure during assessment of various physical therapy interventions for patients with MS.

Disclosure statement

There is no financial gain or stake in the study's findings for any of the authors.

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