Journal of Human Centered Technology Vol. 2: No. 2 (2023) 50 – 59

Journal of Human Centered Technology

E-ISSN: 2821-3467
https://humentech.utm.my

Review of Conventional Approaches to Balance Assessment

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Received 21 June 2023; Accepted 01 August 2023;Available online 06 August2023
https://doi.org/humentech.v2n2.56

Abstract:
Balancing plays a crucial role in our day-to-day activities and sports performance. However, the evaluation of this skill lacks standardized approaches, resulting in a wide range of practices. This article presents an introduction and critique to some conventional assessment tests used to evaluate balance skills and examines the principles, advantages, and limitations associated with these conventional tools. The conventional balance assessment reviewed in this paper included 10 conventional tests such as Berg Balance Scale, Tinetti Balance Test, Romberg Test, among others, and 2 slightly newer approach, which are the Balance Evaluation Systems Test (BESTest) and the Limits of Stability (LOS) test. The aim of the article was to introduce the available conventional balance assessment methods and highlights the importance of enhancing the conventional method with more precise, individualized approach through incorporation of sensor-based measurements. Suggestions to reduce dependency on manual observation and for more individualized training feedbacks, promoting optimal outcomes in balance training and rehabilitation are also presented.

Keywords: Balance test; Conventional balance assessment; Berg; Tinetti; Romberg; Timed up and go; Balance evaluation system (BESTest); Limits of stability (LOS)

1. Introduction

Balance, an essential skill for daily activities, sports, and exercise, requires accurate assessment in various fields like physiotherapy, sports science, geriatrics, and neurology [1-3]. However, a lack of consensus on the best assessment methods has led to a variety of traditional balance tests with different complexities, sensitivities, and specificities [4, 5]. This review paper aims to analyze these conventional tests, evaluate their strengths and limitations, and provide recommendations for their optimal use.

To conduct this review, a systematic search of relevant literature was performed to identify commonly used traditional balance assessment tests. Key databases were searched, and articles were selected based on their relevance and inclusion criteria [6]. The selected tests were analyzed in terms of their physiological and biomechanical aspects of balance, as well as their suitability for specific populations and clinical conditions [7].

The review identified several traditional balance assessment tests, including the Berg Balance Scale, Tinetti Balance Test, and Romberg Test, among others [4, 5, 8]. Each test offers unique insights into balance skills but also has specific limitations[3]. Some tests are more appropriate for older adults or individuals recovering from neurological injuries, while others are better suited for athletes or younger populations [9, 10]. Considering individual factors such as age, sex, health status, and specific requirements is crucial when selecting balance assessment tools [11].

A significant finding of the review was the lack of a standardized approach to balance assessment [12]. Many tests follow a 'one-size-fits-all' approach, which may not accurately represent an individual's balance skills or their progress in training [13]. To address this issue, understanding the nuances of each test and developing more precise and individualized assessment methods is essential [10]. This will facilitate better selection and interpretation of balance assessment tools in clinical and research settings.

Furthermore, the review discussed practical considerations associated with conducting traditional balance assessments, such as equipment requirements [14, 15]. Standardized and reliable administration of these tests is essential for obtaining consistent and valid results [16].

2. Methodology

This review paper employs a comprehensive literature review methodology to examine conventional balance assessment techniques. The goal is to examine the advantages and disadvantages of balance assessment techniques and identify any potential areas for improvement. Beginning with a thorough search of databases including PubMed, IEEE Xplore, Google Scholar, ScienceDirect, and the Cochrane Library, we first looked for pertinent peer-reviewed articles, books, conference proceedings, and technical reports.

Combining terms and phrases, including "conventional balance assessment," "balance assessment techniques," "postural control," and "fall risk assessment", were used to conduct the search. The data was compiled and synthesized, comparing the advantages and limitations of each conventional balance assessment test. The comparison was based on a number of criteria, including usability and ability to accommodate various patient populations.

The inclusion and exclusion criteria of our review are primarily designed to focus on commonly used conventional balance assessment tests. We identified ten such tests for this review, namely the Berg Balance Scale, the Tinetti Performance Oriented Mobility Assessment, Functional Reach Assessment, Timed Up and Go Assessment (TUG), Four Square Step Assessment (FSST), Clinical Test of Sensory Interaction of Balance (CTSIB), Sharpened Romberg Test, Single Leg Stance Test, Modified Clinical Test of Sensory Interaction on Balance (mCTSIB), and the Postural Assessment Scale for Stroke. English-language articles from 1980 to 2023 that offered details of traditional balance evaluation methods were included in this review [9]. References were included if they detailed original research or systematic reviews focused on these ten balance tests. The references had to provide information on the testing protocols, their reliability, validity, benefits, and shortcomings in various populations. We have also focused on those references that discuss the potential applications of these tests in clinical assessment and therapy outcomes. Moreover, references that analyze the feasibility and practicality of these tests were also included to shed light on their everyday implementation in clinical settings.

Studies or references that focus solely on balance assessment tests beyond these ten identified were excluded from our study. Additionally, we have excluded research studies that fail to provide sufficient details on the protocols and implications of the tests or that solely focus on the development or modification of these tests without discussing their applicability, effectiveness, or limitations. Lastly, studies that are not in English, or which do not have full-text availability, were also excluded.

These criteria were established to ensure a comprehensive overview of the strengths and limitations of most utilized conventional balance assessment tests today, to provide a relevant and thorough perspective for the medical community. By comparing the same factors (protocols, reliability, validity, and shortcomings) across these ten tests, we aim to offer a balanced and comprehensive review of the current methods of balance assessment.

3. Conventional Balance Assessment

An individual's balance and stability are often assessed using standard balance assessment tests. These tests offer useful data for clinical assessment, research, and keeping track of the outcomes of therapies. The most widely used traditional balance evaluation tests and their shortcomings will be covered in this review.

The Berg Balance Scale is a comprehensive tool for evaluating balance across various activities in diverse populations. This clinically employed test, which uses a 5-point ordinal scale for each item, demonstrates robust reliability and validity in assessing balance, including in stroke survivors and older adults [17]. Simple tools are required, such as a ruler, standard chairs (one with arm rests, one without), footstool or step, 15-feet walkway and stopwatch to record the time. Subjects will be asked to perform 14 different tasks, each with an associated balance score. The tasks included sitting to standing, standing unsupported, sitting unsupported, changing from standing to sitting, transfer positions, standing with eyes closed, standing with feet together, reaching forward with outstretched arm, retrieving object from floor, turning to look behind, turning 360 degrees, placing alternate foot on stool, standing with one foot in front and finally standing on one foot [18]. When scoring, the lowest response score for each item was recorded. A score of 56 indicates functional balance while a score of < 45 indicates individuals may be at greater risk of falling. More recently, it has been reported that for the elderly population to improve their balance rating, they need to score at least a 4 point change to be 95% that true change has occurred if a patient scores within 45–56 initially, 5 points if they score within 35–44, 7 points if they score within 25–34 and, finally, 5 points if their initial score is within 0–24 on the Berg Balance Scale. This Berg Balance Scale scores high on reliability and validity tests [17-20], hence it is particularly popular for identifying core balance abilities. However, it could benefit from additional measures to detect more subtle changes in balance performance and to consider the influence of cognitive factors on balance control [4].

The Tinetti Performance Oriented Mobility Assessment is a well-established clinical tool for assessing mobility and balance, especially in elderly populations. The assessment consists of a balance and gait section, with each item scored on an ordinal scale of 0-2 or 0-3, depending on the item. The maximum score is 28, with lower scores indicating poorer performance and a higher risk of falls. A total score below 19 is considered high risk, 19-24 is moderate risk, and above 24 is considered low risk [5]. Validity and reliability for the Tinetti assessment are reported to be high, especially for geriatric populations [5]. Unlike the Berg Balance Scale, this test emphasizes mobility during daily tasks rather than performance in challenging balance positions.[5].Compared to tests that focus more narrowly on one aspect of balance or mobility, such as the Functional Reach Assessment or the Single Leg Stance Test, the Tinetti can provide a broader understanding of a person's risk for falls. This makes the test highly valid and reliable [19].

The Functional Reach Assessment (FRA) is a simple, yet effective tool used to evaluate an individual's stability during a forward-reaching task. This straightforward test primarily focuses on static and dynamic balance, which sets it apart from more comprehensive tests, such as the Berg Balance Scale. The FRA is conducted with the patient standing next to a wall. The individual's arm is lifted to a 90-degree angle and the initial reach is marked. The subject then leans forward as far as possible without taking a step, and the maximum reach point is noted. The difference between the initial and maximum reach points constitutes the functional reach distance, which is measured in inches or centimeters. No special equipment is needed apart from a measuring stick or tape, making the test easy to administer in various settings. The FRA has proven to be a reliable and valid test in assessing static and dynamic balance in various populations, including older adults and those with Parkinson's disease. Its reliability is consistently high, and it has been validated against other balance tests, demonstrating a strong correlation with measures of gait and balance [20].The greater the reach, the better the balance. A functional reach of less than 6 inches (or 15 cm) has been associated with a higher risk of falls. There is no maximum score, but a shorter reach distance may indicate balance impairments or an increased fall risk. While the FRA is less comprehensive than assessments like the Berg Balance Scale, it offers an efficient, singular focus on forward-reaching tasks [21]. It might be less sensitive in detecting minor balance impairments or providing a detailed analysis of specific balance components. However, it is quicker to administer than more comprehensive tests, making it an excellent tool for routine screenings or when time is limited. However, it may not provide a comprehensive picture of an individual's balance abilities compared to tests like the Berg Balance Scale [21]. Its main strength lies in its simplicity and speed, which makes it suitable for quick screenings in clinical or home settings [22]. It is also a cost-effective test since it requires minimal equipment. To assess balance comprehensively, it would be beneficial to combine this test with other tests that assess different aspects of balance.

The Timed Up and Go Assessment (TUG) provides a versatile measure of mobility, incorporating both static and dynamic equilibrium. It is a practical tool for assessing an individual's mobility and balance during functional tasks. Its protocol involves timing a person as they rise from a chair, walk three meters, turn around, walk back to the chair, and sit down[23]. High reliability and validity have been observed for the TUG, particularly in older adult populations, making it a commonly used measure for identifying fall risks. A completion time of under 10 seconds signifies normal mobility, 10-20 seconds indicates reasonable mobility, and over 20 seconds suggests impaired mobility. It offers a unique, time-based evaluation of a person's mobility, focusing on the transition from sitting to standing and walking. This distinguishes the TUG from other balance assessments like the Berg Balance Scale, which incorporates a wider range of tasks for a more comprehensive balance profile, or the Functional Reach Assessment, which is focused on static stability and reach [24].Despite its effectiveness, the TUG may overlook specific balance deficits, but its simple and time-efficient protocol, without the need for any specialized equipment, distinguishes it from more exhaustive tests like the Berg Balance Scale [25, 26].

The Four Square Step Assessment (FSST) offers an innovative approach to evaluating agility, coordination, and balance during swift directional changes. Participants are timed as they step over four canes laid out in a cross formation, moving in a specific sequence: forward, left, backward, and right, in both clockwise and counterclockwise directions. The FSST has shown high reliability and validity, and a completion time of fewer than 15 seconds indicates good balance and mobility, while more than 15 seconds suggests a risk of falls [27]. It concentrates on dynamic balance and mobility, differentiating it from tests like the Berg Balance Scale and the Functional Reach Assessment. Nevertheless, the FSST may not fully capture static postural stability or balance in various sensory conditions [28]. It places its emphasis on the assessment of agility and the ability to change direction quickly, making it stand out amongst other conventional balance assessments. Unlike the TUG, which concentrates on forward mobility or the Berg Balance Scale and the Functional Reach Assessment, which do not focus on rapid changes in direction, the FSST uniquely evaluates dynamic balance during swift movements. FSST presents a high level of intra-rater and inter-rater reliability. This means that repeated measurements by the same tester (intra-rater reliability) and different testers (inter-rater reliability) typically produce consistent results, highlighting the test's reliability [27]. Regarding validity, studies have illustrated the FSST's capacity to accurately measure what it intends to measure - in this case, agility, coordination, and balance control during rapid movements. Its construct validity has been confirmed in various populations, including older adults and individuals with neurological conditions, where the FSST has been shown to be particularly effective in predicting fall risk [27].

The CTSIB is a valuable tool for examining postural sway under differing sensory conditions. To perform the test, individuals are instructed to maintain an upright stance under six different conditions with eyes open or closed, on firm or foam surface, and with or without a visual surround. Each condition lasts for 30 seconds. High reliability and validity have been reported for the CTSIB when used in older adults and individuals with neurological disorders. The score is based on the duration the stance is maintained, with higher durations indicating better balance. However, unlike the Berg Balance Scale, which comprehensively measures functional balance, the CTSIB focuses more specifically on sensory input integration for balance [11, 29].

The Sharpened Romberg Test provides a quick and easy way to evaluate balance control during single-leg stance. Even though it may not capture dynamic balance or all aspects of postural control, such as sensory integration, it reliably examines postural ability and potential risk of falls, providing valuable insights into pathophysiological mechanisms [8].In the Sharpened Romberg Test, the individual stands heel-to-toe, first with eyes open, and then with eyes closed. The timing starts when the person is in position and ends when they move their feet or arms, open their eyes, or after a maximum of 60 seconds. This test has shown good reliability and validity in various populations. Unlike the Berg Balance Scale, which evaluates multiple components of balance, the Sharpened Romberg Test mainly assesses proprioceptive contribution to balance [30].

The Single Leg Stance Test offers a straightforward and accessible means of assessing balance control and lower limb stability. The SLST evaluates balance by having the individual stand unassisted on one leg for up to 30 seconds. The test is timed from the moment the foot is lifted off the ground until it touches the ground, or the body loses balance. While it may be limited in assessing dynamic balance during complex movements, it’s simple protocol requiring no complicated tools or specialized expertise makes it an ideal choice for many settings. Its validity and reliability, even for those with more severe balance deficits, make it a suitable choice for both healthy subjects and athletes [31]. However, unlike the Berg Balance Scale, the SLST exclusively measures unipedal stance balance, limiting its comprehensiveness [32].

Figure 1 illustrates a subject trying to maintain balance during a Single Leg Stance Test. For this stance, the person has to stand upright and hold his arms down at his sides. The subject has to bend one leg at the knee to lift the foot up behind him. Next, the subject has to stand and balance on the other foot. The subject has to hold this posture for at least 15 seconds, or as instructed. Then he has to lower the raised foot. He will then switch sides and repeat the test for the other leg. This test is fairly easy to administer, without the need of complicated tools. The test has the potential to be replicated on a sensor-based platform to reduce the need for manual observations by a specialist. Healthy subjects or athletes can use the sensor-based assessment, provided that the subjects have no other medical complications that require close monitoring.

Modified Clinical Test of Sensory Interaction on Balance (mCTSIB) assesses the ability to utilize visual, somatosensory, and vestibular cues to maintain balance. It is performed under four different conditions (eyes open/closed and on firm/foam surface) to identify impaired sensory systems. It examines sensory integration for postural control by measuring postural sway with varying sensory inputs. The test reliably utilizes visual, somatosensory, and vestibular cues to maintain balance under varying conditions. Despite its potential limitations in capturing dynamic balance and the need for specialized administration, it successfully measures postural sway and sensory contributions to balance control [11].The mCTSIB has shown strong reliability and validity, especially in assessing balance in elderly individuals and in those with vestibular disorders [33]. It's valuable for assessing how well sensory information from the visual, vestibular, and proprioceptive systems are integrated to maintain balance. However, compared to other tests such as the Berg Balance Scale, Tinetti Performance Oriented Mobility Assessment, or the Timed Up and Go (TUG) test, the mCTSIB is less comprehensive. It does not assess the person's ability to perform functional tasks or dynamic activities related to balance. The mCTSIB mainly focuses on the sensory integration aspect of balance.

Figure 1 Subject performing Single Leg Stance Test

The Postural Assessment Scale for Stroke (PASS) is a 12-item measure that is specifically designed to assess balance in stroke patients. The items are divided equally to measure both maintaining and changing postures. This includes assessments while lying down, sitting, standing, and during postural transitions. Each item is scored on a 4-point scale from 0 to 3. The total score ranges from 0 to 36, with higher scores indicating better balance performance. The PASS test has been extensively validated and is highly reliable for evaluating balance in stroke patients. It has been found to be particularly effective for determining balance ability in individuals in the early stages of stroke recovery and has shown to have a strong correlation with functional ability. When compared to other balance assessment tools, such as the Berg Balance Scale (BBS) or the Timed Up and Go (TUG) test, the PASS is more specific to the stroke population[34]. While the BBS and TUG are general balance assessments applicable to various populations, the PASS is designed with the unique balance issues of stroke patients in mind, including a focus on postural transitions and weight shifting, which can be particularly challenging for this population [35]. In terms of reliability, the PASS test has been found to have excellent inter-rater and intra-rater reliability in stroke patients. It has also demonstrated good internal consistency. The validity of the PASS test has been established by comparing it with other balance measures like the BBS, and functional mobility measures like the Barthel Index, and significant correlations have been found. However, a limitation of the PASS test, when compared to tests like the BBS, is that it does not assess balance during dynamic tasks such as reaching or turning. Also, the PASS may not be sensitive to detect subtle changes in balance performance in individuals who have mild balance impairment or in those who are in the later stages of stroke recovery. Nonetheless, the PASS is a valuable tool for evaluating and tracking balance recovery in the early stages of stroke rehabilitation [34].

These popular conventional tests are summarized in Table 1. However, conventional approaches have their limitations. They may not be sensitive enough to detect subtle changes in balance, especially in those with moderate balance disorders. They often do not assess dynamic balance adequately, and they do not consider the cognitive demands of maintaining equilibrium [28, 36]. Newer balance assessment tests, such as the Balance Evaluation Systems Test (BESTest) and the Limits of Stability (LOS) test, have been developed to address these limitations and provide a more comprehensive evaluation of balance [12].

The BESTest is an assessment that evaluates multiple systems involved in balance control, including sensory, motor, and cognitive systems. It is a 36-item clinical balance assessment tool created to evaluate balance impairments in six different postural control situations including mechanical restraints, limits of stability, anticipatory postural adjustments (APAs), postural responses to induced loss of balance, sensory orientation and stability in gait. The BESTest has been shown to be a reliable and valid measure of balance in individuals with Parkinson's disease, stroke, and other neurological conditions. However, the test is time-consuming and requires specialist training to administer and interpret.

Meanwhile, the LOS test examines the range of motion for a person's centre of gravity's (COG) while standing on a stable platform. The subject must stand on a force plate with their feet shoulder-width apart and their arms at their sides to complete the test. The individual is then told to lean as far as they can without losing their balance in all directions- forward, back, left, and right. It is measured and noted how much the subject may slant in each direction. The test is typically administered by healthcare workers to check for balance issues, such as those that could arise with ageing, stroke, or Parkinson's disease. Additionally, the test can be used to track alterations in balance over time, such as those that occur after a fall or during rehabilitation. This test is considered less sensitive and can be affected by fatigue, pain and anxiety.

4. Discussion

This review provides factual evidence on and emphasizes importance of conventional balance skill assessment tests [4, 5, 11]. Simplicity, cost-effectiveness, and standardized norms are the main causes of remaining forefront of these balance assessment tests [4, 5, 11]. Berg Balance Scale (BBS), Timed Up and Go (TUG), and the Dynamic Gait Index (DGI) have served as the foundation in the field of clinical balance assessment and research [4, 5, 12, 13, 26, 37].

In the realm of advancing technology and an enhanced comprehension of human motor control, sensor-based assessment methods have gained momentum and demonstrate substantial potential in overcoming certain drawbacks associated with traditional balance tests. These methods, which utilize instruments like inertial measurement units (IMUs), pressure mats, and force platforms, have the capacity to provide increased accuracy, more comprehensive data, and potentially improved ecological validity) [14-16, 38].

Sensor-based assessments provide a higher level of detail, enabling a more thorough evaluation of balance control and potentially aiding in the detection of subtle changes or impairments that might be overlooked in traditional assessments [14-16]. These assessment methods utilize sensor-based tools that can capture multi-directional balance adjustments, inertial forces, and micro-movements, which are often disregarded in conventional tests [14-16].However, the adoption of sensor-based assessment methods is progressing at a gradual pace, mainly due to various challenges. These challenges encompass the need for technical expertise, the requirement for advanced equipment, the costs associated with this technology, and the effort involved in interpreting more complex data. Nonetheless, these obstacles have the potential to be overcome as technology advances and becomes more affordable and user-friendly.

Although sensor-based assessments hold great promise, conventional tests still maintain their significance in balance assessments. In contrast to sensor-based approach, the simplicity, cost-effectiveness, and ease of implementation of traditional tests make them particularly valuable, especially in low-resource settings [13, 41]. Additionally, the wealth of normative data and extensive clinical experience accumulated with these tests provides a strong basis for their ongoing use.

Future advancements in balance assessment should aim to integrate both conventional and sensor-based approaches. By combining the strengths of both methods, it is possible to harness the benefits offered by sensor-based assessments while still leveraging the advantages of conventional tests. This integration could lead to more comprehensive and accurate evaluations of balance, optimizing the assessment process. The crucial aspect is to strike a balance between the reliability and familiarity of conventional tests and the precision and comprehensiveness of sensor-based assessments.

When reviewing the sensitivity of various conventional balance assessment tests, there is significant variation in their ability to detect balance impairments. The Berg Balance Scale (BBS) and the Four Square Step Assessment (FSST), with sensitivities of 0.85 [39] and 0.889 [40] respectively, are very reliable balance assessment tests for a range of balance abilities, making them common choices across various populations. The Modified Clinical Test of Sensory Interaction on Balance (mCTSIB), boasting the highest sensitivity of 0.95 [41], is particularly proficient at identifying individuals with balance impairments, especially concerning sensory integration for postural control. On the other hand, the Tinetti Performance Oriented Mobility Assessment, while good with a sensitivity of 0.7 [42], may not be as precise as others in capturing balance impairments due to its focus on basic functional tasks. Similarly, the Postural Assessment Scale for Stroke is quite reliable for detecting balance impairments in stroke patients with a sensitivity of 0.78 [43] but may not extend this efficiency to other patient populations. Tests like the Functional Reach Assessment and Timed Up and Go Assessment (TUG), with relatively lower sensitivities of 0.288 [44] and 0.31 [45] respectively, while useful in certain contexts, may not reliably identify individuals with balance impairments. They provide basic tests of stability and snapshots of gait and postural ability but may miss nuanced balance control issues. The Clinical Test of Sensory Integration of Balance (CTSIB) and the Sharpened Romberg Test, with sensitivities of 0.44 [46] and 0.46 [31] respectively, offer valuable insights into sensory integration for postural control and static balance. Still, their reliability in detecting balance impairments is moderate. Finally, the Single Leg Stance Test, with a sensitivity of 0.38 [20], indicates that it might not reliably identify individuals with significant balance deficits. However, it is crucial to note that the given sensitivity values could vary based on several factors such as the specific population tested, the cut-off score used, and the methodologies adopted in individual studies.

Table 1 – Conventional approaches to balance assessment

Clinical Tests	**For Whom**	**Purpose**	**Aim of the Test**	**Outcome Measures**	**Limitations**
The Berg Balance Scale	General population	Assess balance through various activities, higher scores indicate better balance.	Postural ability	Total score by using a 5-point ordinal scale for each item	Primarily focuses on static balance, may not detect subtle changes
Tinetti Performance Oriented Mobility Assessment	General population, older adults	Assess balance and mobility during daily tasks	Gait and postural ability	Total score by using a 2/3-point ordinal scale for each item	Primarily focuses on basic functional tasks, may not capture subtle balance deficits
Functional Reach Test	General population, older adults	Calculate the maximum reach distance.	Postural ability	Maximum distance (cm) that the subject can reach forward beyond arm's length	Has limitations in assessing balance during other directions of movement
Timed Up and Go Test	General population, older adults	Evaluate agility and mobility	Gait and postural ability	Time of performance in seconds	May have limitations in capturing specific balance deficits
Four Square Step Test	General population, older adults	Evaluate balance while navigating	Dynamic balance and mobility	Time of performance in seconds	Limited in capturing postural stability during static tasks
Clinical Test of Sensory Integration of Balance	General population, individuals with balance impairments	Assess balance using sensory cues	sensory system's contribution to balance	Postural sway under different sensory conditions	May have limitations in capturing dynamic balance and mobility balance
Sharpened Romberg Test	General population, older adults	Check balance while one-footed.	Postural ability and pathophysiological mechanisms	Imbalance and fall	May have limitations in assessing dynamic balance
Single Leg Stance Test	General population, older adults	Examine stability while standing on one leg.	Postural ability	Time of performance in seconds	May have limitations in assessing dynamic balance during complex movements
Modified Clinical Test of Sensory Interaction on Balance	General population, individuals with balance impairments	Evaluate equilibrium in various sensory settings	Sensory integration for postural control	Postural sway with varying sensory inputs	May have limitations in capturing dynamic balance
Postural Assessment Scale for Stroke	Stroke survivors	After a stroke, assess balance and postural control.	Balance and postural control in stroke patients.	Score (from 0 to 36) reflecting the patient's ability to maintain or change posture from lying to standing positions.	May have limitations in capturing dynamic balance, not suitable for individuals with conditions other than stroke

5. Conclusion

Conventional balance assessment tests are useful because they are simple, affordable, and have a lot of established norms, particularly suitable for low-resource environments. However, they have limitations in capturing subtle or complex aspects of balance control. Often, they require manual observation or specialist training to administer. In contrast, sensor-based assessments can potentially offer higher precision and a richer data profile, but they are more complex and expensive, hence less popular in many smaller rehabilitation centers. A promising future approach to balance assessment is to combine the strengths of both conventional and sensor-based methods. Conventional tests can provide a general assessment of balance, while sensor-based methods can provide detailed data on specific aspects of balance control. This combination of approaches can provide a more comprehensive and accurate assessment of balance.

Acknowledgment

This work is supported by Universiti Teknologi Malaysia Exploratory Research Grant Q.J130000.3851.20J18.

Conflict of Interest

The authors declare no conflict of interest.

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