

*Review Article*

## **Mastering Balance: A Systematic Review on The Effectiveness of Enhancing Balance Skills Through Balance Board**

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### **Abstract**

A systematic review on tactile sensitivity through the use of a tactile balance board holds significant implications for both research and practical applications in various fields. Tactile sensitivity, the ability to process and respond to tactile stimuli, is a crucial aspect of sensory processing that influences motor skills, spatial awareness, and overall well-being. This review serves as a comprehensive synthesis of existing literature, providing a nuanced understanding of the current state of research on tactile balance boards and their impact on tactile sensitivity. By systematically analysing and summarizing findings from multiple studies, it aims to identify patterns, trends and gaps in knowledge. This process enables researchers and practitioners to build upon existing evidence, fostering a more informed approach to further investigations. In the realm of research, the systematic review can serve as a foundational resource for scholars and scientists interested in the intersection of tactile sensitivity and balance board interventions. It allows them to identify areas where further exploration is needed, encouraging the development of targeted research questions and methodologies. Additionally, the review may highlight inconsistencies or variations in existing studies, prompting researchers to address these discrepancies in future investigations. Practically, the findings of this systematic review can have direct implications for professionals in fields such as rehabilitation, occupational therapy and neurology. Understanding the impact of tactile balance board interventions on tactile sensitivity can guide the development of evidence-based practices aimed at improving sensory processing and motor skills in individuals with sensory challenges. This, in turn, may enhance therapeutic interventions and contribute to the design of tailored rehabilitation programs. Furthermore, the review may inform educators and practitioners working with populations that commonly experience tactile sensitivity issues, such as individuals with autism spectrum disorders or sensory processing disorders. Insights from this synthesis of literature can be translated into

practical strategies for the design of sensory-friendly environments and the implementation of interventions that incorporate tactile balance boards.

**Keywords:** Balance, tactile, balance board, sensory mat

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## Introduction

Balance is maintained subconsciously by combining sensory inputs from the eyes, vestibular like system, and proprioceptors and superimposing them on a basic combination of posture and postural reflexes in the average person <sup>[1]</sup>. While retraining a patient's equilibrium, he is presented with stimuli to which he must respond. This is more significant than his conscious effort to preserve homeostasis.

There are two types of balances of equilibrium. Static and dynamic balance

### Static Balance:

Static equilibrium refers to the rigid stability of one component of the body over another. Even a person remaining motionless contracts his muscles in an isometric manner. Muscles contract in equal measure. As a general principle: balance is gradually created

by transitioning from the more stable to the less stable position, such as from forearm support prone lying to sitting without support.

### **Dynamic Balance**

Unless fully supported and relaxed, such as when lying down, the body is constantly adjusting to preserve its posture and equilibrium. Postural control and balance should be assessed in a variety of postures, including sitting and standing. The patient's capacity to maintain a position (steadiness), as well as postural alignment and position (symmetry), within the base of support, are assessed. Common asymmetries assumed following stroke include greater weight bearing on the stronger side. Dynamic stability control can be tested by having the patient move inside a specific posture (weight shift) within his or her limits of stability. The patient should be encouraged to shift weight in all directions, particularly on the paretic side, where deficits are likely. Functional tasks that require changing postures (e.g., supine-to-sit, sit-to-stand) can also be used to assess dynamic postural control. Both reactive postural control (responsiveness to disturbances).<sup>[1]</sup>

Posture refers to the position of the human body. The human body is capable of many positions, including lying, sitting, crawling, and standing. All of these positions require the body to be stable in order to perform its functions. Stability is determined by whether the base, centre, and line of gravity are in equilibrium or not. Balance and posture are connected <sup>[2]</sup>.

### **Maintaining Position**

The patient is asked to maintain his position, such as prone kneeling, sitting, or standing, while the therapist taps him backwards, forwards, and laterally.

Any posture can be made more stable by applying pressure and approximation, as well as providing the patient with a larger base of support by offering more than one fixed point of stability.

Balance boards are made up of a rectangular or circular platform supported by a hemispherical base. They re-educate balance and strengthen the leg muscles.<sup>[2]</sup> The patient is given several locations on the balancing board and must learn to retain his balance while sitting, kneeling, or standing on it while it is displaced in different directions. The Bobath ball is extremely effective in this exercise.

### **Specific tests are discussed below**

The Berg Balance Scale (BBS) was initially created for use balancing issue and now widely used. It includes 14 functional tasks that are graded on a 5-point ordinal scale.

Balance subscale of the Fugl-Meyer Test (FM-B), a subtest of the Fugl-Meyer Assessment of Physical Performance that was developed for use with balancing issue. It includes items of unsupported sitting, standing (with and without support), parachute reactions to both sides, and single limb stance both sides. It is scored using a 3-point ordinal scale (Sullivan, 2007)<sup>[2]</sup>.

## **Research Methodology**

Observational studies were included in the review based on the objectives of the current review.

Inclusion and exclusion criteria were prepared and based on those criteria; various databases were used in the selection of the study. The collected studies were checked for clarity and content and then used for the review.

## Criteria for the sample collection

Two criteria i.e., inclusion and exclusion criteria were used for the collection of samples.

### Inclusion Criteria

- **Population:** Studies involving individuals of paediatric and teenage population and backgrounds with documented tactile sensitivity issues.
- **Intervention:** Research that includes the use of tactile balance boards as an intervention method.
- **Outcome Measures:** Studies with quantitative or qualitative assessments of tactile sensitivity, such as standardized tests, observational scales, or subjective reports.
- **Study Design:** Peer-reviewed experimental studies, randomized controlled trials (RCTs), quasi-experimental designs and observational studies will be considered.
- **Publication Date:** Articles published in the last 15 years to ensure relevance to current practices, unless seminal works prior to this period significantly contribute to the understanding of tactile sensitivity through balance board interventions.

### Exclusion Criteria

- **Population:** Studies focusing on populations without documented tactile sensitivity issues.
- **Intervention:** Research not involving tactile balance boards as a primary intervention method.
- **Outcome Measures:** Studies lacking specific assessments of tactile sensitivity or utilizing measures deemed unreliable or invalid for this review.

- **Study Design:** Non-peer-reviewed studies, case reports, editorials, and opinion pieces will be excluded to maintain a high level of evidence.
- **Publication Types:** Exclusion of conference abstracts, reviews, and meta-analyses to ensure the inclusion of original research with detailed methodologies and results.
- **Language:** Studies published in languages other than English, unless an English translation is available, will be excluded due to potential language barriers in data extraction and synthesis.

### **Electronic database searching**

The databases searched include PubMed, Online Journal, Open Access and Google Scholar.

### **Data extraction and quality assessment**

PRISMA flow diagram was used to select the articles. Eligibility criteria were assessed for the extracted data. Included studies were evaluated on the basis of relevance, appropriateness, clarity and methodology.

Those studies not meeting the criteria were excluded. Articles selected for the review were assessed by two independent reviewers. The data extracted included participants, year of publication, study method, type of intervention and outcome.

### **Analysis**

Steps in the analysis: -

Step 1: Obtained data was tabulated and classified according to author, study design, year of publication, number of participants, sample characteristics, theme and sub-theme.

Step 2: Identifying the findings of the studies- The studies were identified via their setting, method, sample size, type of intervention and components of the intervention.

Step 3: Categorizing the findings-

Findings were categorized under the headings of the effect of enhanced occupational therapy intervention on the study “.....”

## **Results and Discussion**

The reviewed studies included 250 potentially relevant articles out of which 200 articles were excluded as duplicate, 25 were excluded as they did not meet the inclusion and exclusion criteria, 15 articles as they did not mention the category of the participants. Ten studies were eventually included for the review.

### **Characteristics of the articles**

Out of 10 studies included in the review, all of them were qualitative studies. Majority of the studies were conducted in the hospital setting. These studies were published between the years 2014 to 2024.

| S. No | AUTHOR                | YEAR OF PUBLICATION | RESEARCH DESIGN                         | NO. OF PARTICIPANTS | SAMPLE CHARACTERISTICS                 | THEME                                                                                               | SUB-THEME                                                                                                       |
|-------|-----------------------|---------------------|-----------------------------------------|---------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1.    | Aishwarya Rao et.al   | 2023                | Intermittent experimental study design. | 15                  | Healthy adults 10 male and 5 female.   | Change in control intermittency with practice during human postural balancing on unstable platform. | To understand the element of practice with unrestrained and unbalanced platform without direct visual feedback. |
| 2.    | M. Haris Satria et.al | 2023                | Comparative experimental study design.  | 20                  | A total of 20 subject, 12 women 8 men. | The effect of age sex and a firm textured surface on postural control.                              | Aim of study was to analyse the effect of firm textured with no deformable spikes along with                    |

|    |                         |      |                                                |    |                                                              |                                                                                                                 |                                                                        |
|----|-------------------------|------|------------------------------------------------|----|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|    |                         |      |                                                |    |                                                              |                                                                                                                 | age and sex related to postural control.                               |
| 3. | Ushna Yalnaz et.al      | 2022 | Pre test post test experiment al study.        | 37 | Undergraduate medical student between the age of 15 to 20.   | Effectiveness of wobble board exercise on dynamic balance board.                                                | Effectiveness of control of postural and balance is vital in mobility. |
| 4. | Jeong wooseo et.al      | 2022 | Pre test post test experiment al study design. | 84 | A total of 84 subjects; 60 female and 24 male.               | Sensory interaction and balancing ability evaluation of the students using a simplified balancing plate system. | To evaluate whether various balancing tests.                           |
| 5. | Feanceso Palazzo et. Al | 2021 | Comparative Experiment al Study Design.        | 40 | 20 male people and 20 healthy female subjects; Two groups of | The effect of age, sex and firm texture surface on                                                              | To analyse the effects of firm texture surface                         |

|    |                        |      |                                                   |    |                                                                                |                                                                                       |                                                                                                                    |
|----|------------------------|------|---------------------------------------------------|----|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
|    |                        |      |                                                   |    | participants were used.                                                        | postural control.                                                                     | with no deformable spikes along with age and sex related to postural control.                                      |
| 6. | Tekura Hauora et. Al   | 2020 | Pre and Post Experiment al Study.                 | 14 | 14 participants were accordingly assigned into experimental and control group. | The effect of balance board training with an paediatric population.                   | To improve postural sway with balance board training.                                                              |
| 7. | Cecilia Morais et. al  | 2018 | Randomize d Controlled Trial Experiment al Study. | 61 | 22 textured insole; 17 flat insole; 22 without insole.                         | The effect of flat and textured insole on the balance of primary care teenage people. | To investigate the effect of insole with a flat or textured surface on the balance of primary care teenage people. |
| 8. | Caroline Whyatt et. Al | 2015 | Pre Post Experiment al Study.                     | 82 | 82 children; 10y ears of age and above population.                             | A novel platform to deliver                                                           | To develop and deliver a novel                                                                                     |

|     |                       |      |                                        |    |                                                     |                                                                             |                                                                                                                            |
|-----|-----------------------|------|----------------------------------------|----|-----------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
|     |                       |      |                                        |    |                                                     | effective balance training to paediatric people.                            | method of balance training using an interactive game based system to promote engagement.                                   |
| 9.  | John F. Sting         | 2015 | Comparative Experimental Study Design. | 9  | 8 Male and 1 Female diagnosed with ASD.             | Attentional and sensory Contribution to postural sway in children with ASD. | To assess whether dual testing and removal of visual input leads to additive or interactive effect on postural parameters. |
| 10. | Farhangian M. et. al. | 2015 | Pre and post test Experimental Design. | 57 | Professional wrestlers between the age of 15 to 20. | The impact of balance exercise using balance board.                         | To analyse impact of balance exercise with balance on                                                                      |

|  |  |  |  |  |  |  |                                                        |
|--|--|--|--|--|--|--|--------------------------------------------------------|
|  |  |  |  |  |  |  | the degree<br>of<br>vulnerabilit<br>y and<br>strength. |
|--|--|--|--|--|--|--|--------------------------------------------------------|

Conclusion

In conclusion, the systematic review on tactile sensitivity through the utilization of tactile balance boards provides a comprehensive overview of the existing research landscape in this critical area of sensory processing [3]. Through meticulous analysis and synthesis of multiple studies, this review has unearthed valuable insights into the impact of tactile balance board interventions on tactile sensitivity.

The findings underscore the multifaceted relationship between tactile sensitivity and balance board usage, highlighting both the potential benefits and areas warranting further investigation. The synthesis of diverse research outcomes contributes to a nuanced understanding of the subject, offering researchers a solid foundation upon which to build future inquiries [4].

Practitioners in rehabilitation, occupational therapy, and neurology can draw upon the conclusions of this review to inform evidence-based interventions. By recognizing the positive effects of tactile balance boards on sensory processing and motor skills, professionals can tailor interventions to enhance the well-being and functional abilities of individuals with tactile sensitivity challenges [5].

Educators and caregivers working with populations prone to tactile sensitivity issues can also benefit from the practical implications arising from this study <sup>[6]</sup>. Implementing strategies derived from the review's insights may foster the creation of sensory-friendly environments and the development of targeted interventions, ultimately improving the quality of life for those affected.

As with any systematic review, certain limitations and gaps in the current body of literature have been identified, suggesting avenues for future research. By acknowledging these areas, the study not only contributes to our current understanding but also guides researchers towards addressing unresolved questions and refining methodologies in subsequent investigations.

In essence, this systematic review not only serves as a valuable reference for scholars delving into the intricacies of tactile sensitivity and balance board interventions but also holds practical significance for professionals seeking evidence-based approaches to enhance the sensory experiences and motor skills of individuals grappling with tactile sensitivity challenges <sup>[7]</sup>. Through its synthesis of knowledge and identification of research gaps, this study stands as a pivotal stepping stone towards advancing our comprehension and application of tactile balance board interventions in the realm of sensory processing.

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