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Efficacy Of Reactive Balance Training In Improving Balance And Quality Of Life In Post Stroke Patients

Prathamesh Santosh Kadam[1], Dr. Mandar Malawade[2]
[1](intern) Krishna College of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India.
[2]Assistant Professor, Department of Musculoskeletal Sciences, Faculty of Physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India

Abstract

Background: *Stroke survivors frequently have diminished quality of life and balance issues, which raises their risk of falling and reduces their functional independence. A new method that focuses on reactive postural control is called reactive balance training (RBT). This is essential for preventing falls.*

Methods: Participants with chronic stroke will be assigned RBT . Participants will complete 1 hour of exercise, three times/week for 4 weeks. The primary objective is to determine the effects of RBT on balance control and balance confidence. We expect that RBT improves balance control and balance confidence.

Result: *All 30 individuals in the research finished the pre- and post-assessments as well as the 4-week Reactive Balance Training (RBT) intervention. Improved postural control and functional balance were shown by the mean Berg Balance Scale (BBS) score, which rose from 31.6 ± 4.2 (pre-intervention) to 44.8 ± 3.9 (post-intervention). Likewise, there was a noticeable improvement in the Stroke-Specific Quality of Life Scale (SS-QOL). After the intervention, the overall mean score increased from 52.3 ± 6.1 to 69.7 ± 5.4.*

Conclusion: *Reactive Balance Training (RBT) enhances quality of life and balance in stroke patients in an effective way. Participants achieved notable improvements after 4 weeks, indicating the efficacy of RBT in conventional stroke rehabilitation programs.*

Keywords: *Reactive balance training, stroke rehabilitation, balance, quality of life, Berg Balance Scale.*

INTRODUCTION

Stroke affects millions of people annually and is a leading cause of long-term impairment globally. It frequently results in motor deficits that have a major influence on mobility and quality of life (QoL), such as muscle weakness, spasticity, and balance dysfunction [1]. One of the most frequent outcomes of stroke is balance impairment, which limits functional independence and raises the risk of falls [2]. Improving balance and avoiding secondary issues require effective rehabilitation techniques. Reactive Balance Training (RBT), one of several rehabilitation techniques, has drawn interest as a potentially effective way to improve postural control and lower the risk of falls in stroke survivors.

Balance Impairment in Stroke Survivors

To carry out regular tasks including walking, reaching, and changing positions, balance control is crucial. Asymmetrical weight distribution, muscle weakening, proprioception, and poor coordination all contribute to balance problems in stroke survivors [3]. According to research, people who have had a stroke tend to rely a lot on compensatory techniques, like bearing too much weight on the non-paretic leg, which can lead to instability and a higher risk of falling [4]. Weight shifting, standing on unstable surfaces, and controlled movements are among the static and dynamic activities that are the main focus of traditional balance training in stroke therapy. Despite their advantages, these exercises frequently lack the unpredictable elements found in real-world scenarios that need for quick, reactive balance responses [5]. Because of this drawback, RBT is being investigated as a potential substitute strategy that more closely resembles everyday balancing difficulties.

Concept of Reactive Balance Training

The goal of reactive balance training (RBT) is to help people recover from sudden loss of balance by using perturbation-based exercises. It focuses on reactive postural control, which is crucial for preserving stability when confronted with outside disruptions. RBT focuses on reflexive, quick balance reactions, which are essential for preventing falls, in contrast to traditional training that prioritizes voluntary balance control [6].

Recent research indicate that similar principles can be applied to stroke rehabilitation. Perturbation-based therapies have been used extensively to lower fall rates in older persons [7]. Typically, RBT includes tasks

like; abrupt changes in platform surfaces, such as disturbances from a treadmill. Pushes or pulls from the therapist when walking or standing. Unpredictable motions that call for quick stepping or gripping responses

By testing the central nervous system, these workouts improve postural reflex efficiency, which in turn increases functional stability and mobility confidence [8].

Effectiveness of Reactive Balance Training in Stroke Rehabilitation

The effectiveness of RBT in stroke therapy is being supported by new research. In contrast to those who received traditional balance training, stroke patients who received perturbation-based training demonstrated improvements in reactive stepping responses and balance recovery, according to a study by [5]. According to [6], post-stroke patients who participated in RBT performed better on functional tests for balance and experienced fewer falls.

The Berg Balance Scale (BBS), which measures functional stability through a variety of tasks like standing, reaching, and turning, is one of the most popular instruments for evaluating balance in stroke patients [9]. According to studies, RBT can enhance BBS scores over regular balancing exercises [7].

Along with impaired balance, stroke survivors often experience a lower quality of life because of limited mobility, a fear of falling, and a decreased ability to participate in everyday activities [10]. A popular tool for assessing how rehabilitation programs affect patients' well-being is the Quality of Life Measure Scale (QoLMS). According to research, RBT participants have higher QoL scores, most likely as a result of increased functional independence and movement confidence [2].

METHOD

This pre-post interventional study was conducted to evaluate the efficacy of Reactive Balance Training (RBT) in improving balance and quality of life in post- stroke individuals. A total of 30 participants diagnosed with either ischemic or hemorrhagic stroke. Participants included in the study were between 35 to 70 years of age, had experienced a first-ever unilateral stroke between 6 months to 2 years prior; were medically stable, able to follow simple commands, and had moderate balance impairment as indicated by a Berg Balance Scale (BBS) score between 21 and 45. Individuals were excluded if they presented with severe cognitive impairment, additional neurological or musculoskeletal conditions affecting balance or mobility, visual or vestibular deficits, or cardiopulmonary instability that contraindicated active rehabilitation. All participants underwent a structured RBT program for a period of 4 weeks, comprising three sessions per week, each lasting approximately 45 to 60 minutes. Each session consisted of a warm-up phase with light aerobic and mobility exercises, followed by core balance training using therapist-induced perturbations, unstable surface tasks, elastic resistance challenges, and dual-task activities combining physical and cognitive loads, and concluded with a cool-down involving breathing and relaxation techniques. The intensity and complexity of perturbations were progressed based on individual capabilities, and safety measures including the use of gait belts and therapist supervision were ensured throughout. Out- come measures included the Berg Balance Scale (BBS) to assess balance and the Stroke-Specific Quality of Life Scale (SS-QOL), which evaluates twelve do- mains of post-stroke quality of life including energy, family role, mood, mobility, self-care, social participation, upper extremity function, vision, work, language, thinking, and personality. Data was complied and analyzed to compare pre and post-intervention scores.

RESULT

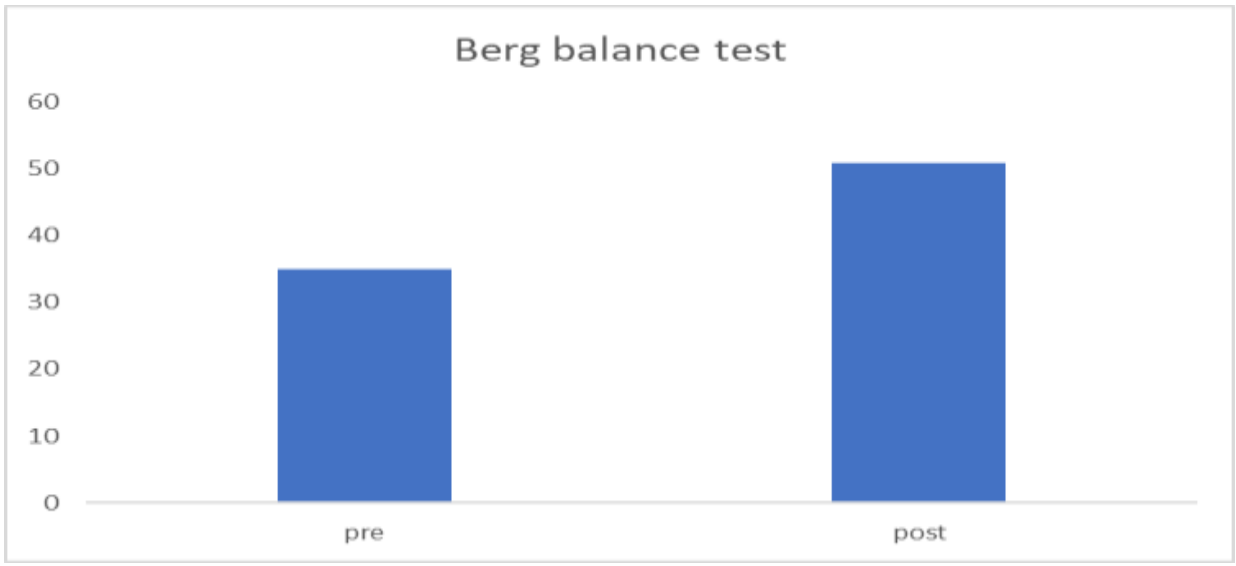
Out of the 30 participants enrolled in the study, all completed the 4-week Reactive Balance Training (RBT) intervention and both pre- and post-assessments. The participants were selected according to inclusion and exclusion criteria. The mean age of participants was 56.1 ± 8.7 years, with 60 percent being male. The data analysis revealed significant improvements in both balance and quality of life following the intervention.

The mean Berg Balance Scale (BBS) score increased from 31.6 ± 4.2 (pre- intervention) to 44.8 ± 3.9 (post-intervention), indicating enhanced postural control and functional balance. The improvement was statistically significant, demonstrating the positive impact of RBT on balance recovery in post-stroke individuals.

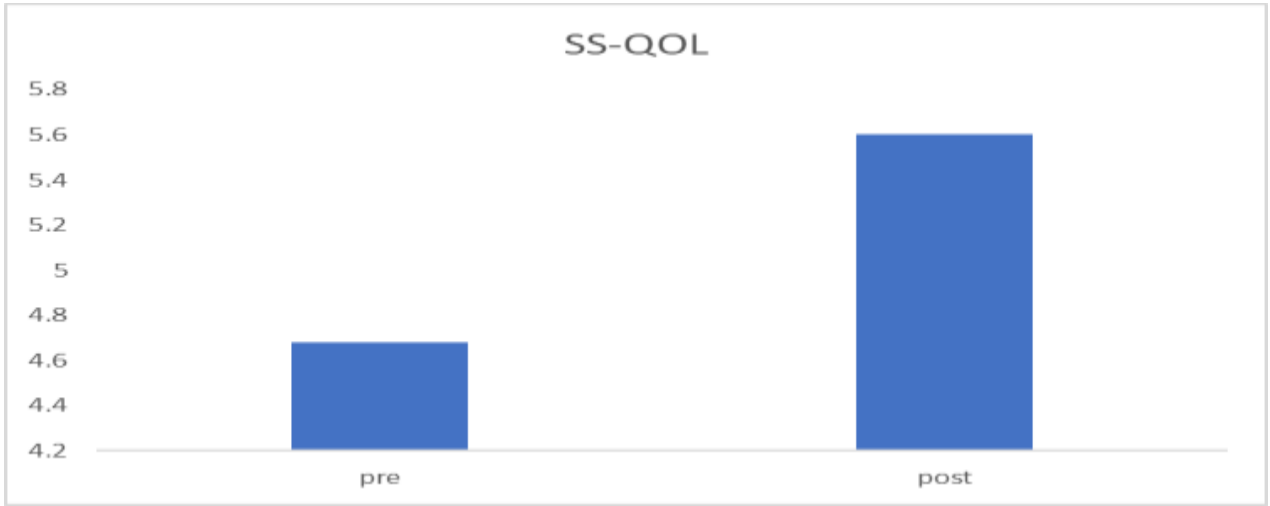
Similarly, the Stroke-Specific Quality of Life Scale (SS-QOL) showed marked improvement. The total mean score improved from 52.3 ± 6.1 (pre-intervention) to 69.7 ± 5.4 (post-intervention), with statistically

significant differences observed across key domains such as mobility, mood, self-care, and social participation. These results suggest a substantial enhancement in the overall quality of life of participants following RBT.

STATISTICAL ANALYSIS



The bar chart represents the Berg Balance Test scores measured before (pre) and after (post) intervention.
Pre-intervention score: ~35
Post-intervention score: ~51
The increase from 35 to 51 points indicates a substantial improvement in balance ability following the intervention. A Berg Balance Test score below 45 is generally associated with a higher risk of falls. Since the pre-score was 35, the individual was in the high fall-risk category initially. After intervention, the post-score improved to 51, which crosses the threshold of 45, suggesting the individual moved into a lower fall risk category.



The bar chart shows the Stroke-Specific Quality of Life (SS-QOL) scores before (pre) and after (post) intervention.
Pre-intervention score: ~4.7
Post-intervention score: ~5.6

INTERPRETATION

There is a clear improvement in quality of life following the intervention, as reflected by the increase in SS-QOL scores. The improvement of nearly 0.9 points suggests that the individual experienced meaningful gains in domains such as physical function, mobility, energy, social roles, and emotional well-being. This indicates that the rehabilitation or therapeutic program not only enhanced functional outcomes but also contributed positively to the overall life satisfaction and daily living experience of the

patient. Together with improved balance (as shown in the Berg Balance Test results you shared earlier), this suggests a holistic positive impact on both functional independence and quality of life.

DISCUSSION

The findings of this study support the hypothesis that Reactive Balance Training (RBT) is an effective intervention for improving both balance and quality of life in post-stroke individuals. The significant improvements observed in BBS scores post-intervention highlight that RBT can effectively target and enhance postural stability, reduce fall risk, and improve confidence in functional mobility tasks. These outcomes align with previous research emphasizing the role of perturbation-based training in activating neuromuscular responses essential for maintaining balance during sudden environmental challenges.

Furthermore, the improvement in SS-QOL scores reflects the broader benefits of balance recovery on psychological well-being, independence in daily living activities, and social engagement. The positive changes in mood, mobility, self-care, and social roles suggest that enhanced balance capabilities translate into greater autonomy and perceived quality of life.

Unlike traditional balance exercises that focus mainly on static or anticipatory postural control, RBT specifically targets reactive control, which is critical in real-life scenarios where unexpected perturbations occur. The individualized and progressively challenging nature of the RBT protocol used in this study likely contributed to its effectiveness. The absence of adverse effects and full adherence of all participants further demonstrate the practicality and acceptability of the intervention. These results contribute to the growing evidence supporting task-specific and reactive training strategies in neurorehabilitation.

CONCLUSION

Balance impairment is a major concern for stroke survivors, affecting mobility, independence, and QoL. This study demonstrated that Reactive Balance Training (RBT) is a safe and effective intervention for improving balance and enhancing the quality of life in individuals recovering from stroke. Statistically significant improvements were observed in both the Berg Balance Scale and the Stroke-Specific Quality of Life Scale following a 4-week RBT program, indicating that targeted, perturbation- based balance training can significantly improve postural control, functional independence, and psychosocial well-being in post-stroke populations. These results support the integration of RBT into routine stroke rehabilitation pro- grams to address balance impairments and improve overall recovery outcomes. This study will provide valuable insights into the role of RBT in stroke rehabilitation, potentially influencing clinical practices and rehabilitation strategies.

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