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Backward Walking Training versus Standing Balance Training on Balance and Mobility in Acute Stroke: A Comparative Study

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Abstract
Background: Stroke frequently leads to impairments in balance and mobility, limiting independence and increasing fall risk. Backward walking training (BWT) has been proposed as a more challenging and potentially more effective alternative to conventional standing balance training (SBT). **Objective:** To compare the effects of BWT and SBT on balance and mobility in patients with acute stroke.
Methods: Thirty acute stroke patients (age 40-60 years) were divided into two equal groups. Group A received BWT plus standard physiotherapy; Group B received SBT plus standard physiotherapy. Each group completed 30-minute sessions, twice weekly, for 4 weeks. Balance was assessed with the Berg Balance Scale (BBS), and mobility with the Performance-Oriented Mobility Assessment (POMA). Paired t-tests assessed within-group changes, and unpaired t-tests compared between-group differences.
Results: Both groups showed significant improvements in BBS and POMA scores ($p<0.05$). Group A achieved greater gains than Group B in BBS (mean change 4.93 vs. 2.40; $p<0.05$) and POMA (mean change 7.80 vs. 4.00; $p<0.05$).
Conclusion: BWT is more effective than SBT in improving balance and mobility among acute stroke patients. Incorporating BWT into early rehabilitation may accelerate recovery.

Keywords: Stroke rehabilitation, backward walking, balance training, Berg Balance Scale, POMA

Introduction
Stroke is described by the World Health Organization as a sudden onset of focal or global disturbance in brain function due to a vascular cause, lasting more than 24 hours or leading to death. In India, its occurrence is estimated at 119-145 cases per 100,000 people, and a large proportion of survivors continue to face long-term challenges with motor control, balance, and gait. Balance impairment after stroke is common, with studies indicating that over 80% of survivors have reduced stability, slower gait, and asymmetrical weight distribution. This contributes to a higher risk of falls and reduced independence.
While conventional rehabilitation often incorporates standing balance training (SBT) to restore postural control, backward walking training (BWT) is emerging as a promising alternative. By requiring unfamiliar movement patterns, BWT enhances proprioceptive feedback, challenges postural adjustments, and strengthens lower limb musculature.
The aim of this study was to compare the effects of BWT and SBT on balance and mobility in acute stroke patients. It was hypothesized that BWT would result in greater improvements in functional outcomes than SBT.

Materials and Methods
Study Design and Setting: This quasi-experimental study was conducted at the College of Physiotherapy, Sri Ramakrishna Institute of Paramedical Sciences, Coimbatore, over a period of 6 month.

Participants: Thirty acute stroke patients (within one month of onset), aged 40-60 years, who could stand with moderate disability and had a Berg Balance Scale score above 48 were recruited. Exclusion criteria included Mini-Mental State Examination score <24, inability to follow commands, cerebellar stroke, recent fractures, or severe comorbidities.

Participants were allocated into two groups

- **Group A:** BWT + conventional physiotherapy (n=15)
- **Group B:** SBT + conventional physiotherapy (n=15)

Interventions

Backward Walking Training (BWT): Patients walked backward on level ground under therapist supervision, progressing from assisted to unassisted walking. Training intensity increased by reducing assistance and increasing gait speed, step length, and distance.

Standing Balance Training (SBT): Patients performed static and dynamic standing tasks such as weight-shifting, tandem stance, and reaching activities. Task difficulty was increased by altering base of support, surface type, and visual input.

Both groups received 8 sessions (30 minutes each), in addition to standard physiotherapy including range-of-motion exercises and gait training.

Outcome-Measures

- **Balance:** Berg Balance Scale (BBS; 0-56 points)
- **Mobility:** Performance-Oriented Mobility Assessment (POMA; 0-28 points)

Evaluations were carried out at the start of the study and again after four weeks by an assessor who was unaware of group assignments.

Statistical Analysis

Data analysis was performed using SPSS version 26. Within-group differences between pre- and post-intervention scores were assessed using paired t-tests, while independent t-tests were applied to compare post-intervention outcomes between the two groups. Statistical significance was set at $p < 0.05$

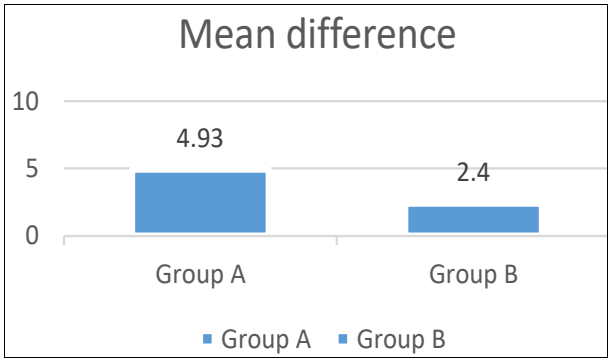
Results

Berg Balance Scale (BBS)

- **Group A:** Mean BBS increased from 49.00 ± 1.73 to 53.93 ± 1.73 (p<0.05).
- **Group B:** Mean BBS increased from 49.00 ± 1.17 to 51.40 ± 1.17 (p<0.05).

Between-group comparison showed a significantly greater improvement in Group A (mean change 4.93) than Group B (mean change 2.40) (p<0.05

Group	Pre mean, ± SD	Post Mean,± SD
A	49.00±0.89	53.93±0.88
B	49.07±0.80	51.40±0.74

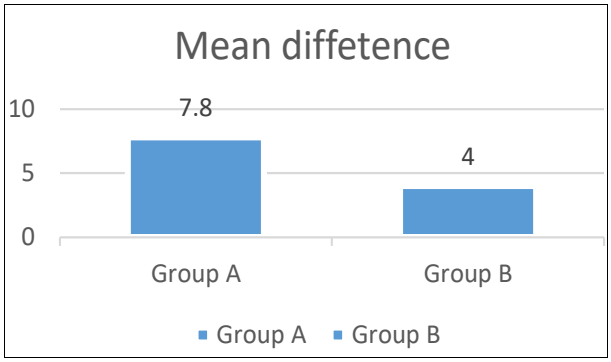


Performance-Oriented Mobility Assessment (POMA)

- **Group A:** Mean POMA increased from 18.00 ± 1.28 to 25.80 ± 1.28 (p<0.05).
- **Group B:** Mean POMA increased from 18.00 ± 1.27 to 22.80 ± 1.27 (p<0.05).

Between-group comparison revealed a significantly greater improvement in Group A (mean change 7.80) compared to Group B (mean change 4.00) (p<0.05)

Group	Pre Mean, ± SD	Post Mean,± SD
A	18.00±0.85	25.80± 0.86
B	18.00±0.85	22.00±0.85



Summary: Improvements were seen in both groups; however, the BWT group achieved greater enhancements in balance and mobility.

Discussion

This study demonstrates that backward walking training is more effective than standing balance training for improving balance and mobility in acute stroke patients. These findings align with previous research indicating that BWT enhances postural stability, gait performance, and proprioceptive control. The superior results in the BWT group may be attributed to increased neuromuscular engagement, greater proprioceptive demands, and the novelty of the backward movement, which stimulates adaptive neuroplastic changes. This supports motor learning principles, where unfamiliar, challenging tasks promote functional recovery.

Clinical Implications

BWT is a simple, cost-effective intervention that can be implemented in diverse rehabilitation settings, including those without access to advanced equipment. Early incorporation into acute stroke rehabilitation could improve functional outcomes and potentially reduce fall risk.

Limitations

This study was limited by its small sample size, short intervention period, and single-center design. Only acute stroke patients were included, so findings may not generalize to chronic stroke populations.

Future Research

Larger, multicenter trials with longer follow-up are recommended to confirm these results and evaluate the sustainability of improvements.

Conclusion

Backward walking training proves to be more beneficial than standing balance training in enhancing balance and mobility among individuals with acute stroke. Introducing BWT during the early stages of rehabilitation may speed up recovery and promote greater independence.

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