

EFFECTIVENESS OF CORE EXERCISE ON BALANCE AMONG STROKE PATIENTS – A SINGLE-CASE EXPERIMENTAL STUDY

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ABSTRACT

Background: Stroke is a major neurological condition that can result in motor impairment, muscle weakness, altered postural control, impaired coordination, and reduced functional mobility. Balance impairment is a common consequence of stroke and may affect standing, weight transfer, reaching, walking, and performance of activities of daily living. Core or trunk control plays an important role in maintaining proximal stability and regulating the position of the body during functional activities.

Objective: To determine the effectiveness of a structured core exercise programme on balance in an individual with stroke.

Case Presentation: A 45-year-old female with a history of ischemic stroke, affecting the left side, was selected for the single-case study. The participant was three months post-stroke at the time of the study. Balance was assessed using the Berg Balance Scale (BBS) at baseline and during follow-up assessments.

Intervention: The participant received a structured core exercise programme under physiotherapist supervision. The programme was conducted four days per week, with each session lasting approximately 30 minutes. The exercise programme focused on abdominal activation, pelvic control, bridging, trunk control, weight shifting, reaching activities, and functional core stabilization exercises.

Outcome: The Berg Balance Scale was used to assess balance. The BBS score was 20/56 on Day 1, 36/56 on Day 14, and 52/56 on Day 28. The score demonstrated an absolute improvement of 32 points from baseline to Day 28.

Conclusion: The present single-case study demonstrated improvement in BBS score following a structured core exercise programme in an individual with ischemic stroke. The findings suggest that core-focused exercise may have a beneficial role in improving balance following stroke. However, because this was a single-case study without a control condition, the observed improvement cannot be attributed exclusively to core exercise. Further studies involving larger samples and controlled designs are required.

Keywords: Stroke, ischemic stroke, core exercise, trunk control, balance, Berg Balance Scale, physiotherapy, single-case study.

1. INTRODUCTION

Stroke is a neurological disorder characterized by a sudden disturbance of cerebral function resulting from vascular causes. Depending on the area and extent of brain involvement, stroke can produce motor, sensory, cognitive, and functional impairments. Hemiparesis, abnormal muscle tone, weakness, impaired coordination, altered postural control, and reduced mobility are commonly observed following stroke.

Balance impairment is one of the major functional consequences of stroke. Individuals with stroke may experience difficulty maintaining a stable posture, transferring weight between the lower limbs, reaching outside the base of support, standing independently, and performing functional mobility tasks. These limitations can interfere with activities of daily

living and may increase dependence on caregivers.

Trunk control is an important component of postural stability following stroke. Adequate proximal control allows the individual to maintain the centre of mass within the base of support and provides a stable foundation for movements of the upper and lower limbs. Impaired trunk control may consequently affect sitting balance, standing balance, gait, and functional activities.

Core exercise is aimed at improving the activation, strength, endurance, coordination, and control of the muscles contributing to trunk stability. Core-focused rehabilitation may include abdominal activation, pelvic control, bridging, trunk rotation, reaching, weight-shifting, and functional stabilization activities.

A 2019 systematic review and meta-analysis reported improvements in trunk control, standing balance, and mobility following trunk training. A 2022 systematic review and meta-analysis of 29 randomized controlled trials involving 1,030 stroke patients also reported significant improvements in trunk function and balance following core training.

1.2 NEED OF THE STUDY

Stroke-related balance impairment can affect mobility, independence, and daily activities. Impaired trunk control may further reduce postural stability during functional movements. Core exercises may improve trunk and proximal stability following stroke. Therefore, this study evaluates the effect of structured core exercise on balance using the Berg Balance Scale. Therefore, this single-case experimental study is needed to evaluate whether a structured balance exercise programme can effectively improve these clinically important outcomes.

1.3 AIM OF THE STUDY

The aim of this study is to determine the effectiveness of core exercise on balance among an individual with stroke using a single-case experimental approach.

1.4 OBJECTIVE OF THE STUDY

The objective of this study was to assess the participant's baseline balance using the Berg Balance Scale, administer a structured core exercise programme, and reassess balance following the intervention. The study also aimed to compare the BBS scores obtained at baseline and during subsequent assessment periods and to document the participant's individual response to the core exercise programme.

1.5 HYPOTHESIS

1.5.1 Null Hypothesis

There will be no meaningful improvement in balance following a structured core exercise programme in an individual with stroke.

1.5.2 Alternate Hypothesis

There will be improvement in balance following a structured core exercise programme in an individual with stroke.

2. MATERIALS AND METHODS

2.1 STUDY DESIGN

A single-case experimental study.

2.2 STUDY SETTING

The study was conducted at the RVS College of Physiotherapy OPD.

2.3 STUDY DURATION

The study duration was three months.

2.4 CASE HISTORY

A 45-year-old female with a history of ischemic stroke was selected for the study. The stroke had resulted in left-sided involvement. At the time of commencement of the study, the participant was three months post-stroke. She attended the physiotherapy outpatient department at RVS College of Physiotherapy for rehabilitation.

The participant presented for physiotherapy rehabilitation with balance impairment following the stroke. Because post-stroke balance depends on adequate proximal control, a structured core exercise programme was selected as the principal exercise intervention.

The participant was assessed using the Berg Balance Scale before commencement of the exercise programme. Subsequent assessments were conducted on Day 14 and Day 28 to monitor changes in balance performance.

2.5 SUBJECT DESCRIPTION

The subject was a 45-year-old female with ischemic stroke and left-sided involvement. The participant was three months post-stroke at the beginning of the study.

The subject underwent a supervised core exercise programme four days per week. Each exercise session lasted approximately 30 minutes.

2.6 OUTCOME MEASURE

Berg Balance Scale (BBS)

The Berg Balance Scale was used to assess functional balance. The BBS consists of 14 functional balance tasks, with each item scored from 0 to 4, giving a maximum total score of 56. Higher scores indicate better balance performance.

The scale assesses functional activities involving sitting, standing, transfers, reaching, turning, and maintaining balance during different postural tasks.

The BBS has been investigated as a balance outcome measure in individuals following stroke, with studies demonstrating high reliability and validity for assessment of balance and mobility.

2.7 OPERATIONAL TOOLS

The following materials were used during assessment and exercise training:

- Exercise mat
- Plinth
- Stable chair
- Pillows/bolster as required
- Therapeutic exercise equipment as required
- Stable support for standing activities
- Berg Balance Scale assessment form

- Data recording sheet

2.8 PROCEDURE

After obtaining informed consent, the participant was assessed at baseline using the Berg Balance Scale. The initial BBS score obtained on Day 1 was recorded as the baseline measurement.

Following the baseline assessment, the participant underwent a structured core exercise programme under physiotherapist supervision. The exercise programme was conducted four days per week, with each session lasting approximately 30 minutes.

2.9 TREATMENT PROCEDURE

The participant underwent a structured core exercise programme focusing on activation and control of the trunk and proximal musculature.

Exercises were performed under physiotherapist supervision. The exercises were progressed according to the participant's ability and tolerance, with appropriate safety precautions during activities involving sitting, standing, weight shifting, and functional movements.

The programme consisted of core activation, pelvic control, trunk stabilization, bridging, trunk movement, weight shifting, reaching, and functional core exercises.

Each session lasted approximately 30 minutes and was performed four days per week.

2.10 INTERVENTION PROTOCOL

The core exercise programme consisted of the following components: Core activation exercises

- Diaphragmatic breathing
- Abdominal bracing
- Transversus abdominis activation
- Pelvic tilting
- Pelvic control exercises
- Trunk stabilization exercises
- Hook-lying trunk stabilization
- Bridging
- Progressive bridging
- Hook-lying marching with trunk control
- Controlled trunk rotation

Sitting balance and core exercises

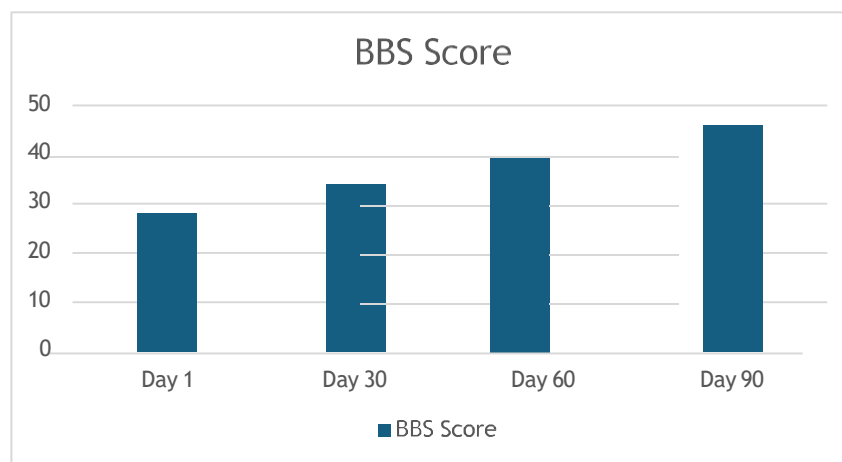
- Sitting weight shifting
- Anterior and lateral weight shifting
- Sitting reaching activities
- Controlled trunk flexion and extension
- Reaching outside the base of support
- Functional core exercises

- Sit-to-stand with trunk control
- Standing weight shifting
- Functional reaching
- Multidirectional weight transfer
- Dynamic postural control activities

Exercises were performed with appropriate supervision and progression according to the participant's functional ability.

S.No	Variable	Value
1	Age	45 years
2	Gender	Female
3	Height	168 cm
4	Weight	85 kg
5	BMI	30.1 KG/M ²

S.No	Assessment period	BBS Score
1	1 st day	28/56
2	30 th day	34/56
3	60 th day	40/56
4		90 th day



3.3 DISCUSSION

The present single-case study was conducted to determine the effect of a structured core exercise programme on balance in a 45-year-old female with ischemic stroke and left-sided involvement.

The participant's BBS score increased from 28/56 at baseline to 34/56 on Day 30 and 40/56 on Day 60.

The improvement in BBS suggests that the participant demonstrated better performance in functional balance activities following the intervention period. The core exercise programme incorporated

abdominal activation, pelvic control, bridging, trunk stabilization, weight shifting, reaching, and functional exercises. These activities were directed toward improving proximal stability and controlled movement during functional tasks.

4. CONCLUSION

The present single-case study demonstrated progressive improvement in balance following a structured core exercise programme in a 45-year-old female with ischemic stroke and left-sided involvement. The findings suggest that a structured core exercise programme may be a useful component of physiotherapy rehabilitation for improving functional balance following stroke.

LIMITATIONS

1. The study included only one participant.
2. There was no control group.
3. The study was conducted in a single clinical setting.
4. The participant may have received other rehabilitation interventions that could have contributed to improvement.
5. Natural neurological recovery following stroke may have influenced the outcome.
6. Only the BBS was used as the reported outcome measure for balance.
7. The available BBS data extend only to Day 28, although the overall study duration was reported as three months.
8. Long-term follow-up BBS data were not available for inclusion in the present analysis.

RECOMMENDATIONS

1. Future studies should include larger sample sizes.
2. Randomized controlled trials should be conducted to compare core exercise with conventional physiotherapy.
3. Future studies should investigate different frequencies, intensities, and durations of core exercise.
4. Trunk-specific outcome measures such as the Trunk Impairment Scale may be included along with the BBS.
5. Future studies should include longer-term follow-up assessments.
6. Studies may compare core exercise alone with core exercise combined with conventional neurological rehabilitation.
7. Future research should investigate the effects of core exercise on gait, functional mobility, activities of daily living, and quality of life in stroke survivors.

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