

## A review on effectiveness of core strength training for trunk control and balance in geriatric stroke population

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### Abstract

**Background:** Stroke is a common global health problem that could disrupt the central neural pathways and associated with significant motor, sensory, balance, trunk stability, functional impairment that reduce independence, participation in daily activities and quality of life. Core strength training refers to exercises designed to improve strength, endurance and neuromuscular control of trunk and pelvic stabilizing muscles. The addition of core strength training to conventional therapy can significantly improve trunk mobility, balance, functional performance, ambulation, quality of life in stroke patients compared with conventional therapy alone.

**Objective:** To review the effect of core strength training on trunk control and balance in geriatric stroke population.

**Methods:** Literature review was conducted using PubMed, google scholar, research gate databases. Studies published between 2017 and 2025 were analyzed. Study includes geriatric population with sub-acute and chronic stroke. Participants received a structured core strength training in addition to conventional physiotherapy. Trunk control is assessed before and after the intervention using Trunk impairment scale (TIS).

**Result:** Reviewed studies demonstrate that core strength training has greater improvement in trunk control, balance, gait speed, functional performances compared to conventional physiotherapy alone. Trunk impairment scale (TIS) showed better post-treatment scores in patients receiving core strength training.

**Conclusion:** Based on the reviewed evidences, it can be concluded that core strength training is an effective and clinically relevant intervention for improving trunk control, balance.

**Keywords:** Core strength training; Trunk control; Balance; Postural stability; Geriatric population; Stroke rehabilitation

### 1. Introduction

Stroke is a common global health problem that could disrupt the central neural pathways and associated with significant motor, sensory, balance, trunk stability, functional impairment that reduce independence, participation in daily activities and quality of life<sup>1</sup>. Among stroke survivors, geriatric population are more vulnerable to persistent disability due to age-related reductions in muscle strength, coordination, postural reactions, sensory integration.

Core musculature includes the superficial and deep muscles of abdomen, back, pelvis which works together to stabilize the spine and pelvis during static and dynamic activities. Core stability is the biomechanical foundation for coordinated

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movements, where the adequate proximal stability allows effective distal limb function and contributes to improve posture and movements efficiency<sup>2</sup>.

Trunk impairment is considered a major factor contributing, reduced sitting balance, impaired weight shifting, mobility limitations in individuals with stroke<sup>3</sup>.

These impairment of trunk may affect a patient's ability to perform activities such as unsupported sitting, sit-to-stand transfers, standing, walking, turning and reaching, which in turn can become reason for fall<sup>4</sup>.

Falls are one of the most common and serious complications after stroke and may leads to fractures, reduced confidence, prolonged hospitalization, dependency in activities of daily living. Balance impairment after stroke is multifactorial, but trunk instability and impaired core muscle coordination are recognized as one of the primary factor for poor postural control and fall risk<sup>5</sup>.

In geriatric stroke population, even small deficits in trunk control or dynamic balance can substantially increase the risk of falls during transfers, gait and daily activities.

For this reason, core strength training is incorporated into stroke rehabilitation program. Core strength training refers to exercises designed to improve strength, endurance and neuromuscular control of trunk and pelvis stabilizing muscles<sup>2</sup>.

Core strength training includes variety of trunk exercises performed on both stable and unstable surfaces.

Trunk exercises performed on unstable surfaces produce significant improvements in trunk control, balance and functional performance by increasing trunk muscle activation and enhancing postural responses. Incorporating unstable surface trunk training into conventional physiotherapy provides better functional benefits than conventional therapy alone<sup>3</sup>.

Many researches have reported that the addition of core strength training to conventional therapy can significantly improve trunk mobility, balance, functional performance, ambulation, quality of life in stroke patients compared with conventional therapy alone<sup>5</sup>. Recent randomized controlled trials have further strengthened the evidence supporting core strength training in stroke rehabilitation.

Therefore, the present review examines the available literature on the effectiveness of core strength training for trunk control and balance in geriatric stroke population, with particular attention to sitting balance, trunk performance, postural control, mobility and fall related functional outcomes.

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## 2. Materials and methods

- **Study design:** A literature review was conducted to review the effectiveness of core strength training for trunk control and balance in geriatric stroke population.
- **Search strategy:** Databases such as PubMed, Google scholar, Research gate were searched using the following key words: Core strength training, trunk control, balance, postural stability, geriatric population, stroke rehabilitation. Relevant articles published between 2017 and 2025 were identified and screened for eligibility.

### 2.1. Eligibility Criteria

#### 2.1.1. Inclusion Criteria

- Clinically diagnosed stroke patients (sub-acute, chronic)
- Studies with age group more than 65years
- Studies published between 2017-2025
- Full text articles

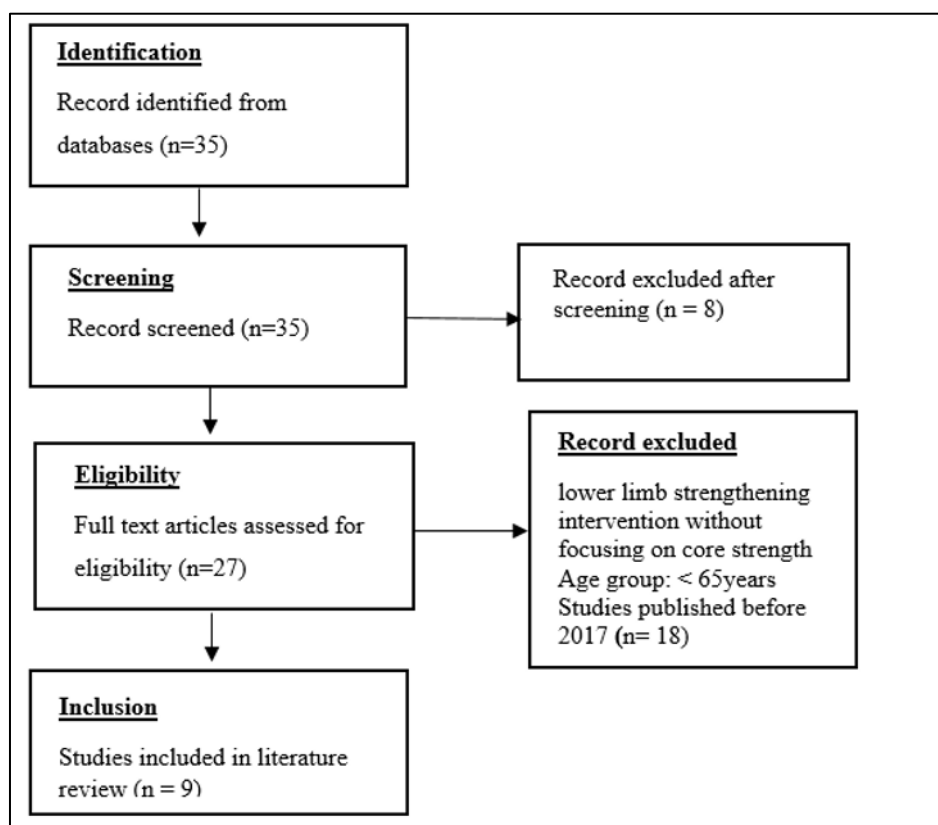
#### 2.1.2. Exclusion criteria

- Subjects with conditions like Parkinson's disease, vestibular disorder
- Severe cognitive impairment
- Studies includes lower limb strengthening intervention without focusing on core strength

- Subjects with balance issues prior to onset of stroke.

## 2.2. Study Selection

The study selection process followed a structured screening procedure. A total of 35 records were identified through database searching. All 35 articles were screened based on their titles and abstracts. Following screening, 8 records were excluded because they were not relevant to the review topic or did not meet the publication criteria. The remaining 27 full-text articles were assessed for eligibility. Of these, 18 articles were excluded due to studies involved lower limb strengthening intervention without focusing on core strength, age group less than 65years, studies published before 2017. Finally, 9 studies were included in the literature review.



**Figure 1** Flow diagram showing the study selection process for the literature review

## 2.3. Data Extraction

Data from the included studies were extracted systematically. The extracted information included the author(s), year of publication, study design, interventions, outcome measure (particularly Trunk impairment scale). The findings were then summarized and compared to identify common patterns and associations across the included studies.

## 3. Results

Analysis of the studies included in the review highlights that the core strength training, when used either independently or in combination with conventional physiotherapy leads to significant improvements in balance, trunk control, gait speed, mobility and functional performance in stroke patients.

Outcome measure Trunk impairment scale (TIS) showed better post-treatment scores in patients receiving core strength training.

Compared to routine rehabilitation alone, core strength training demonstrated greater improvements in trunk function, balance, mobility, gait-related performance, suggesting that strengthening the core muscles contributes to better postural control and safer mobility.

Overall, the reviewed literatures confirm that core strength training is an effective and clinically beneficial intervention for improving trunk control and balance in geriatric stroke population.

**Table 1** Summary of studies included in the literature review

| SL. NO | Year | Author(s)        | Study type          | Interventions                                                                                     | Outcome measure         | Key findings                                                                                                    |
|--------|------|------------------|---------------------|---------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1      | 2023 | Thijs L          | Systematic review   | Sitting-reaching training, unstable surface training, weight shifting training                    | TIS, Barthel index, BBS | Trunk training in addition to conventional rehabilitation can improve trunk function                            |
| 2      | 2022 | Mahmood W        | RCT                 | Conventional therapy vs core strength +conventional therapy                                       | TIS, FAC                | Addition of core strength improves trunk mobility, ambulation, QOL                                              |
| 3      | 2021 | Cabanas-Valdes R | RCT study protocol  | Dynamic sitting balance task, trunk strengthening, proximal control                               | TIS, BBS                | Additional core strength training may improve dynamic balance, gait, functional recovery                        |
| 4      | 2021 | Pilkar R el      | Pilot study         | Trunk control exercises, sitting balance, dynamic reaching activities                             | TIS BBS                 | Trunk training improves trunk control, sitting balance and functional mobility                                  |
| 5      | 2021 | Ahmed U          | RCT                 | Dual task training, multiplanar trunk training                                                    | TIS, TUG test           | Intensive multiplanar trunk training with dual task training is more effective than conventional therapy alone  |
| 6      | 2021 | Olczak A         | Observational study | Trunk control postural alignment, proximal stabilization                                          | TIS                     | Core strength is essential for coordinated movements, postural control and effective limb function during rehab |
| 7      | 2020 | De luca A        | Pilot study         | Upper limb motor task on stable and unstable surface, trunk rotations, perturbation exercises     | TIS, BBS                | Core strength and balance training improves trunk and mobility functions                                        |
| 8      | 2020 | Lee P Y          | RCT                 | Exercises on unstable surfaces- weight shifting, reaching, trunk movements, postural control task | TIS, BBS, TUG test      | Exercises on unstable surface improved trunk control balance and functional activities                          |
| 9      | 2017 | Harayuma K       | RCT                 | Bridges, reaching activities, ADIM, trunk rotation exercises                                      | TIS, TUG test, FAC      | Core strength training is beneficial for trunk performance, balance                                             |

#### 4. Discussion

The reviewed studies demonstrate that core strength training is effective intervention in stroke rehabilitation.

Core strength training resulted in better outcomes in terms of balance, trunk control, gait and functional activities.

During sitting, standing and walking, anticipatory postural adjustments activate the deep trunk muscles before limb movement to maintain center of gravity within the base of support. Following stroke, delayed activation of core muscles

reduces trunk control, balance and increase risk of fall. Core strength training improves anticipatory postural adjustment, enhances trunk control and allows efficient transmission of force from trunk to the limbs.

Chen et al. demonstrated increased transverses abdominis muscle thickness after core strength training indicates improved trunk control. The reason is transverses abdominis primarily produces trunk stiffness/stabilization via increased intra-abdominal pressure which is actually needed to create a stable base for balance tasks. Training on unstable surfaces requires continuous activation of deep abdominal and paraspinal muscles to control multidirectional perturbations. This increases proprioceptive input from muscle spindle and joint mechanoreceptors, develops better trunk control and balance during functional activities.

Findings from the studies provide strong evidence that core strength training significantly improve trunk control and balance-related impairments in geriatric stroke population.

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## 5. Conclusion

Based on the reviewed evidence, it can be concluded that core strength training is an effective and clinically relevant intervention for improving balance, trunk control and fall-related impairments in stroke patients. The evidence consistently demonstrates that core strength training produce significant improvement in trunk control, postural stability, balance, gait speed, ambulation and overall functional performance.

Overall, the reviewed literature confirms that the core strength training is an effective and evidence-based rehabilitation approach that enhances both postural control and functional mobility in geriatric stroke population.

Therefore, it can be concluded that core strength training can be considered as an essential component of comprehensive physiotherapy rehabilitation program.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interest.

### *Statement of ethical approval*

Not applicable. This study is a literature review based on previously published studies and did not involve human or animal subjects.

### *Statement of informed consent*

Not applicable. This study is a literature review based on previously published studies and did not involve human participants.

### *Author contributions*

- **Amrutha T J:** Conceptualization, literature search, study selection, data extraction, manuscript preparation, and final approval.
- **Aravindan T:** Study supervision, critical review, and manuscript revision.

- **Manjunatha H:** Administrative support, manuscript review, and final approval.

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