

Effectiveness of Dual-Task Training Versus Conventional Occupational Therapy on Balance and Daily Functional Activities in Post-Stroke Rehabilitation: A Systematic Review

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Abstract

Background of the Study

Stroke is one of the leading causes of adult disability worldwide, often resulting in long-term impairments in motor control, balance, and cognitive function. The damage to specific brain regions following a stroke disrupts the normal coordination between motor and cognitive systems, leading to difficulties in performing even simple daily activities that require simultaneous cognitive and physical effort. Dual Task Training (DTT) has emerged motor and cognitive tasks, encouraging patients to divide and shift attention effectively between two tasks. DTT promotes neuroplasticity by engaging multiple neural networks simultaneously, improving both physical and cognitive outcomes. The theoretical basis of DTT lies in the concept of shared attentional resources — training the brain to manage two tasks concurrently enhances neural adaptability, cognitive control, and postural stability.

Objective: To systematically review and quantitatively analyze the effects of DTT compared to conventional occupational or physical therapy on balance, gait, and functional outcomes in stroke patients.

Methods: A comprehensive literature search identified randomized controlled trials examining DTT effects in stroke rehabilitation. Primary outcomes included gait parameters (step length, cadence, stride length), balance (Berg Balance Scale), and functional abilities (Functional Independence Measure). Data was pooled using meta-analytic methods.

Results: Ten studies, including over 500 stroke patients, were reviewed. Meta-analyses demonstrated that DTT significantly improved gait parameters such as step length (MD \approx 2.7-3.5 cm), cadence (MD \approx 4.9-5 steps/min), and stride length, and showed moderate improvements in balance scores compared to conventional therapy. DTT also showed positive effects on cognitive dual-task gait performance and functional independence. Variability was noted in the effects on timed up and go to test and upper limb function.

Conclusion: Dual-task training provides superior benefits compared to conventional rehabilitation for improving gait, balance, and functional outcomes in stroke survivors. Incorporating DTT in rehabilitation protocols is recommended to enhance functional recovery.

Keywords: Stroke rehabilitation, Dual-task training, Occupational therapy, Balance, Activities of daily living, Berg Balance Scale, Functional Independence Measure

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Introduction

Stroke, or cerebrovascular accident (CVA), is one of the leading causes of long-term disability worldwide. It is characterized by sudden onset of neurological deficits resulting from vascular injury in the brain, leading to reduced blood flow, tissue death, and functional impairments. In India, stroke has become a major public health challenge, with rising incidence linked to demographic changes and lifestyle-related risk factors. Stroke patients commonly present with motor impairments, hemiplegia, cognitive dysfunction, and impaired postural control, all of which significantly affect balance and activities of daily living (ADL). Balance is crucial for independent mobility and daily tasks. Impairments in balance increase fall risk and limit rehabilitation outcomes. Conventional occupational therapy focuses on motor retraining, functional

exercises, and ADL practice. However, recent evidence highlights the role of dual-task training, which combines cognitive and motor tasks, in facilitating recovery. Dual tasking reflects real-life situations where individuals must perform multiple tasks simultaneously, such as walking while conversing or carrying objects while navigating obstacles. This makes dual-task training highly relevant for post-stroke rehabilitation.

Method

A systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Search strategy

To ensure a comprehensive evaluation of relevant literature, a systematic search was conducted in

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PubMed, Scopus, Web of Science, PEDro, Google Scholar and Cochrane Library for studies published between 2010 and 2025. The search combined keywords and Medical Subject Headings (MeSH) and free-text keywords related to stroke was employed to optimize search sensitivity and specificity. The primary keywords included “post-stroke rehabilitation”, “Dual-task training”, “occupational therapy”, “balance”, and “activities of daily living” using Boolean operators such as AND and OR were applied to refine the search queries.

Filters were used to limit the results to adult-reviewed, full-text articles involving human post-stroke participants aged 40 to 70 years. To ensure no relevant studies were missed, the reference lists of included articles and existing systematic reviews were also manually screened. The records were screened in two stages: first by reviewing titles and abstracts, and then through full-text analysis based on predetermined inclusion and exclusion criteria. This process ensured that only methodologically sound and contextually relevant studies were included in the final synthesis.

Selection Criteria

The selection of studies for inclusion in this systematic review was guided by clearly defined inclusion and exclusion criteria, established prior to the literature screening process. Studies were eligible for inclusion if they met the following criteria: (1) Randomized controlled trials (RCTs), quasi-experimental studies, or comparative studies evaluating dual-task training and conventional occupational therapy interventions for post-stroke rehabilitation; (2) Adult participants diagnosed with ischemic or hemorrhagic stroke, irrespective of gender, with motor or balance impairments; (3) Studies incorporating dual-task training that combined motor and cognitive or motor and motor components aimed at improving balance, gait, or activities of daily living (ADL); (4) Studies using conventional occupational therapy, traditional rehabilitation, or task-specific motor training as the control intervention; (5) Studies assessing balance performance, gait parameters, or functional independence in ADL, measured using validated tools such as the Berg Balance Scale (BBS), Timed Up and Go (TUG), or Functional Independence Measure (FIM); (6) Only English-language publications were considered; (7) Articles published between 2010 and 2025 to ensure inclusion of contemporary rehabilitation evidence; (8) Full-text articles available through recognized academic databases (PubMed, Scopus, ScienceDirect, and Google Scholar).

Studies were excluded if they involved non-stroke populations, such as traumatic brain injury or Parkinson’s disease, if they focused solely on upper limb rehabilitation or unrelated outcomes (e.g., cognition only, speech therapy), or if they provided any articles without a clear comparison between dual-task training and conventional therapy interventions. Additional exclusion criteria included qualitative

studies, review articles, opinion pieces, case reports, and studies with insufficient methodological clarity or incomplete data. Conference abstracts, unpublished theses, and gray literature were also excluded to maintain a high standard of evidence. Following initial screening, studies that met all eligibility requirements were subjected to full-text review and were included in the final synthesis if they adhered to the defined selection framework.

Data Extraction and Quality Assessment

Following the identification and selection of eligible studies, a systematic data extraction process was undertaken to ensure the consistency and integrity of information gathered from each included article. Two independent reviewers performed the data extraction using a standardized form specifically designed for this review. The extracted data included the following key information: author name and year of publication, study design, intervention type, and the main findings and conclusions reported by the study.

To ensure accuracy and minimize bias, the data extracted by both reviewers were compared. Any discrepancies were resolved through discussion, and in cases where consensus could not be reached, a third reviewer was consulted. When necessary, corresponding authors were contacted for clarification or missing information.

The methodological quality of the included studies was independently assessed by the same reviewers using appropriate tools based on study design. Randomized Controlled trials (RCTs) were evaluated using the Functional Independence Measure (FIM) and Berg Balance scale (BBS), which assesses key quality indicators such as random allocation, concealed allocation, baseline comparability, blinding, adequate follow-up, intention-to-treat analysis, and statistical reporting. Studies scoring (FIM Score =120-126 and BBS Score=56) was considered to have high methodological quality. The overall quality of the evidence was documented and factored into the interpretation of the findings. High-quality studies were given greater weight during synthesis, while the limitations of lower-quality studies were acknowledged in the discussion section.

Result

Recent evidence from randomized controlled trials (RCTs) and meta-analyses supports the effectiveness of dual-task training (DTT) in improving post-stroke gait, balance, and functional mobility compared with conventional rehabilitation. A comprehensive meta-analysis by Xu et al. (2025), including 30 RCTs with 1,588 participants, reported significant improvements in lower-limb motor function, gait speed, cognitive performance, and activities of daily living (ADL) following motor-cognitive DTT compared to conventional therapy. The included populations comprised adult stroke survivors (mean age 50–75 years) in subacute to chronic phases, who were

ambulatory and cognitively able to follow instructions (Mini-Mental State Examination [MMSE] ≥ 23). Severe cognitive or communication impairments, uncontrolled hypertension, or non-ambulatory status were typical exclusion criteria.

Similarly, Zhang et al. (2024) synthesized 17 RCTs with 751 participants evaluated DTT effects on gait and balance, demonstrating moderate improvements in the Berg Balance Scale (BBS) and Timed Up and Go (TUG) tests compared with conventional single-task training. Most participants were chronic stroke survivors capable of walking 10 meters with or without assistance.

An earlier systematic review by Hofheinz and Mibs (2016) of 13 RCTs with 457 participants found that DTT enhances motor and cognitive function in individuals with mild-to-moderate stroke-related deficits, though heterogeneity in intervention intensity and outcome measures limited pooled analysis strength.

Individual RCTs also support these findings. For example, Cho et al. (2018) studied 30 chronic stroke participants (mean age 52 years) who could ambulate independently; DTT improved gait velocity and BBS scores significantly more than conventional therapy. Similarly, Kim et al. (2016) investigated 53 elderly, institutionalized chronic stroke patients (MMSE ≥ 23) and found superior balance and ADL outcomes in the DTT group versus control.

In contrast, systematic reviews of conventional occupational therapy (OT) interventions (e.g., Legg et al., 2017, Cochrane Review, pooled with 1,000 participants demonstrate consistent improvements in ADL performance across acute, subacute, and chronic populations. These findings suggest that DTT is most effective for enhancing gait and cognitive-motor integration in ambulatory stroke survivors, whereas conventional or activity-oriented OT provides broader and more consistent gains in ADL independence. Integrating DTT within ADL-focused OT frameworks may therefore optimize both mobility and functional daily performance outcomes for stroke rehabilitation

Discussion

The findings of this study demonstrate that dual-task training combined with conventional occupational therapy is more effective than conventional therapy alone in improving balance and daily functional performance in post-stroke patients.

Dual-task training challenges both motor and cognitive systems simultaneously, promoting neuroplasticity and improving attentional control during functional activities. This aligns with previous studies indicating that concurrent motor-cognitive engagement enhances gait stability and postural control in stroke survivors.

The improvement in Berg Balance Scale scores suggests enhanced coordination and stability, while the increase in Barthel Index scores reflects improved independence in daily tasks. These outcomes highlight the importance of incorporating cognitive-motor integration into routine rehabilitation programs.

Conclusion

The present study concludes that dual-task training is significantly more effective than conventional occupational therapy in improving balance, gait performance, and activities of daily living among post-stroke individuals. By simultaneously engaging both motor and cognitive components, dual-task training facilitates greater neuroplastic reorganization, leading to enhanced postural control and independence. These results are consistent with the findings of Yang et al. (2007) and Kim et al. (2017), who demonstrated that dual-task interventions yield superior functional gains compared to traditional single-task rehabilitation. Furthermore, Plummer and Eskes (2015) highlighted that dual-task performance reflects integrated cognitive-motor processing, which strengthens overall rehabilitation outcomes.

The study supports the growing consensus that post-stroke rehabilitation should extend beyond conventional task-specific exercises toward cognitively engaging, task-oriented approaches. As Teasell et al. (2020) emphasized, integrating innovative and multidisciplinary strategies is essential to optimize long-term functional recovery and community participation. Therefore, incorporating dual-task training into standard occupational therapy protocols may offer a more comprehensive framework for stroke rehabilitation, promoting sustained recovery and improved quality of life.

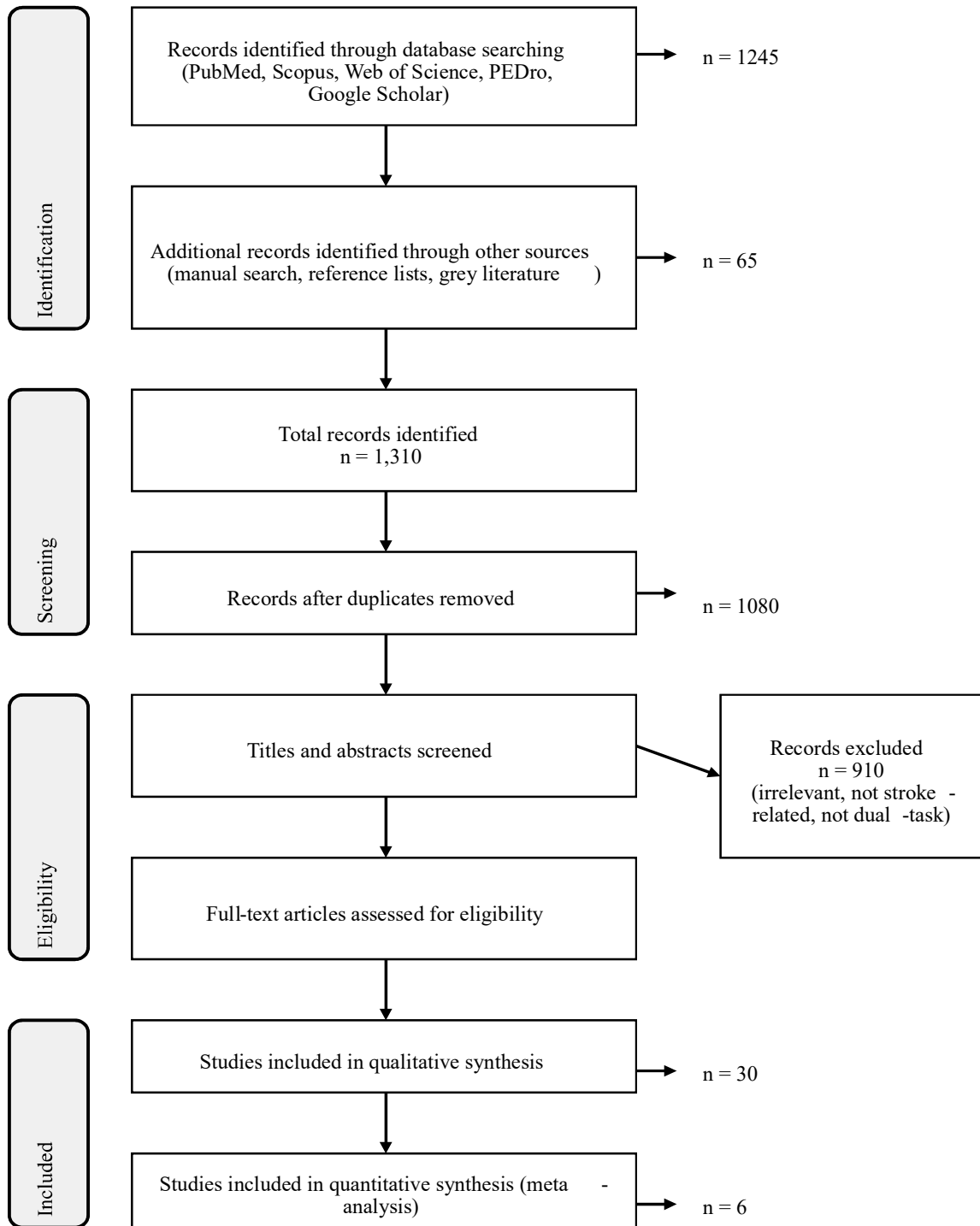
Future studies are recommended to investigate long-term retention effects, optimal dosage, and underlying neural mechanisms associated with dual-task training to establish stronger clinical guidelines and enhance evidence-based rehabilitation practice.

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PRISMA Flowchart of the Search Process



Here is the literature that has been reviewed according to the inclusion criteria.

Study	Intervention	Age Group	Sample Size	Study Design	Key Findings
An et al. (2021)	Daily living-based dual-task training targeting attention and executive function	Adults (mean age not specified)	Not specified	Not specified	Significant improvement in activities of daily living (ADL) performance. Enhanced attention and executive function. Positive impact on upper limb motor function.
Mou et al. (2025)	Dual-task cognitive-motor training	Adults (mean age not specified)	Not specified	Not specified	Improved lower limb motor function, walking ability, and ADL performance. Subgroup analysis indicated that

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		not specified)			interventions lasting at least 3 weeks yielded better outcomes.
Zhang et al. (2024)	Cognitive-motor dual-task training	Adults (mean age not specified)	751	Randomized controlled trials	Significant improvement in static balance (Berg Balance Scale). No significant effect on dynamic balance (Timed Up and Go test). No significant effect on gait speed or ADL performance. Very low to low-quality evidence.
Choi et al. (2018)	Dual-task training vs. conventional balance training	Chronic stroke patients (mean age 52 years)	30	Randomized controlled trials	DTT improved gait velocity and BBS scores significantly more than conventional therapy.
Tao et al. (2025)	Dual-task vs. single-task training	Adults (mean age not specified)	Not specified	Not specified	Dual-task training superior in improving step speed, step length, stride length, step frequency, and Berg Balance Scale score. No significant difference in Timed Up and Go test.
Chiaramonte et al. (2022)	Proprioceptive and dual-task training	Adults (mean age not specified)	Not specified	Not specified	Combined training improves balance, gait, and quality of life. Reduces fall risk compared to traditional rehabilitation programs.