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Effectiveness of Task-Oriented Gait Training in Post-Stroke Patients: Randomized Controlled Trial

Original Research

Muhammad Sohaib Azeem[1]*, Muzna Munir[2], Sidra Faisal[3]

[1]*Senior Physiotherapist, Pakistan Rehabilitation Center for Differently Abled (PSRD), Lahore, Pakistan*
[2]*Assistant Professor, Riphah International University, Lahore, Pakistan*
[3]*Senior Lecturer, Riphah International University, Lahore, Pakistan*

Corresponding Author: Muhammad Sohaib Azeem, dr.sohaib334@gmail.com, ORCID ID: 0009-0001-1429-0518, Senior Physiotherapist, Pakistan Rehabilitation Center for Differently Abled (PSRD), Lahore, Pakistan

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ABSTRACT

Background:
Stroke-related gait impairment is a major contributor to long-term disability and reduced community participation. Conventional gait rehabilitation often improves impairments but may not sufficiently translate into functional walking gains. Task-oriented gait training, grounded in motor learning and neuroplasticity principles, emphasizes repetitive, goal-directed walking tasks that resemble real-life mobility demands and may offer superior functional outcomes.

Objective:
To determine the effectiveness of task-oriented gait training compared with conventional rehabilitation in improving gait speed, balance, and functional mobility among post-stroke patients.

Methods:
A randomized controlled trial was conducted across tertiary care hospitals and rehabilitation centers in Lahore, Pakistan. Sixty post-stroke patients were randomly allocated to either a task-oriented gait training group or a conventional rehabilitation group. Both groups received intervention five days per week for six weeks. Outcome measures included gait speed assessed by the 10-Meter Walk Test, balance measured using the Berg Balance Scale, and functional mobility evaluated through the Timed Up and Go Test. Data were analyzed using paired and independent sample t-tests, with statistical significance set at $p < 0.05$.

Results:
Both groups demonstrated significant post-intervention improvements; however, the task-oriented group achieved greater gains across all outcomes. Mean gait speed increased from 0.46 ± 0.12 m/s to 0.72 ± 0.15 m/s in the task-oriented group compared with 0.48 ± 0.11 m/s to 0.60 ± 0.14 m/s in the conventional group ($p = 0.003$). Balance and functional mobility also improved significantly in favor of task-oriented training ($p < 0.01$).

Conclusion:
Task-oriented gait training was more effective than conventional rehabilitation in enhancing gait, balance, and functional mobility in post-stroke patients, supporting its integration into routine neurological rehabilitation practice.

Keywords:
Balance, Gait Training, Mobility, Rehabilitation, Stroke, Task-Oriented Therapy, Walking

Introduction

Stroke remains one of the leading causes of long-term disability worldwide, imposing a substantial burden on individuals, families, and healthcare systems. Survivors frequently experience persistent motor impairments that limit their ability to walk independently, participate in social roles, and regain an acceptable quality of life (1). Among these impairments, gait dysfunction is particularly disabling, as it restricts community mobility and increases dependence on caregivers. Even months after the acute event, many post-stroke individuals continue to demonstrate reduced walking speed, poor balance, asymmetrical step patterns, and decreased endurance. These limitations highlight the critical need for effective rehabilitation strategies that specifically target walking ability and functional mobility during the recovery process (2). Conventional physiotherapy approaches for post-stroke gait rehabilitation have traditionally focused on impairment-based interventions such as muscle strengthening, range of motion exercises, and facilitation techniques aimed at normalizing movement patterns. While these approaches play an important role in early recovery, growing evidence suggests that improvements at the impairment level do not always translate into meaningful functional gains. In recent years, there has been a paradigm shift in neurorehabilitation toward activity-based and task-specific training models, grounded in principles of motor learning and neuroplasticity. These models emphasize repeated practice of meaningful tasks in environments that closely resemble real-life situations, thereby promoting more effective cortical reorganization and functional recovery (3).

Task-oriented gait training has emerged as a prominent intervention within this framework. It involves structured practice of walking-related tasks such as stepping, obstacle negotiation, direction changes, and speed modulation, often performed under varying environmental and contextual demands. Rather than focusing solely on correcting impairments, this approach encourages active problem-solving, adaptability, and participation, which are essential components of functional walking. Experimental and clinical studies conducted in diverse populations have reported that task-oriented gait training may lead to improvements in walking speed, balance, endurance, and overall mobility in individuals with stroke (4). These benefits are thought to arise from the repetitive, goal-directed nature of training, which reinforces neural pathways associated with functional movement. Despite promising findings, the evidence base for task-oriented gait training remains heterogeneous. Variations in study design, intervention intensity, outcome measures, and patient characteristics have resulted in inconsistent conclusions regarding its superiority over conventional gait training. Furthermore, much of the existing literature originates from high-income countries, where rehabilitation resources, patient demographics, and healthcare delivery models differ substantially from those in low- and middle-income settings. As a result, the generalizability of these findings to regions such as South Asia remains uncertain. In Pakistan, and particularly in urban centers like Lahore, stroke prevalence is increasing due to aging populations and rising rates of vascular risk factors (5). However, locally generated evidence on effective, context-appropriate rehabilitation interventions is limited.

In clinical practice across Lahore, physiotherapists often manage high patient loads with constrained resources, making it essential to identify rehabilitation strategies that are not only effective but also feasible and scalable. Task-oriented gait training, which can be delivered with minimal equipment and adapted to different clinical environments, holds particular relevance in this context. Yet, there is a noticeable lack of randomized controlled trials conducted locally to evaluate its effectiveness on mobility outcomes among post-stroke patients. This gap limits evidence-based decision-making and may hinder the optimization of rehabilitation services tailored to the needs of the local population. Additionally, cultural, social, and environmental factors may influence patient engagement, adherence, and response to rehabilitation interventions (6). Walking in crowded streets, navigating uneven surfaces, and performing daily mobility tasks in community settings present unique challenges for stroke survivors in Lahore. Therefore, it is essential to examine whether task-oriented gait training, with its emphasis on functional and context-specific practice, can produce meaningful improvements in mobility outcomes when applied within this regional setting (3,5). Addressing this gap will contribute not only to the local evidence base but also to the broader understanding of how task-oriented approaches perform across different healthcare systems.

In light of these considerations, there is a clear need for a rigorously designed randomized controlled trial to evaluate the effectiveness of task-oriented gait training in post-stroke patients undergoing neurological rehabilitation in Lahore, Punjab. Such research is expected to provide high-quality evidence regarding its impact on gait and mobility outcomes, inform clinical practice, and support the development of standardized rehabilitation protocols suited to the local context. Therefore, the objective of this study is to determine whether task-oriented gait training is more effective than conventional rehabilitation approaches in improving gait performance, balance, and functional mobility among post-stroke patients, thereby rationalizing its integration into routine neurological rehabilitation programs.

Methods

This randomized controlled trial was conducted in Lahore, Punjab, Pakistan, across multiple neurological rehabilitation settings, including the Physiotherapy Departments of Mayo Hospital Lahore, Sheikh Zayed Hospital Lahore, and selected private rehabilitation centers affiliated with tertiary care facilities. The study was carried out over a period of eight months, from March 2022 to October 2022, allowing sufficient time for participant recruitment, intervention delivery, and outcome assessment. A parallel-group design was employed to compare the effectiveness of task-oriented gait training with conventional gait rehabilitation in post-stroke patients. Participants were recruited through outpatient and inpatient neurology and physiotherapy services using a non-probability consecutive sampling technique. Individuals of either gender aged between 40 and 70 years with a clinical diagnosis of first-ever ischemic or hemorrhagic stroke were screened for eligibility. Inclusion criteria required participants to be in the subacute to chronic phase of stroke recovery (≥3 months post-stroke), have residual gait impairment, and possess the ability to ambulate at least 10 meters with or without an assistive device (7). Participants were required to have a

Mini-Mental State Examination score of ≥24 to ensure adequate cognitive ability to follow instructions (8,9). Patients with severe cardiopulmonary conditions, musculoskeletal disorders affecting lower limb function, uncontrolled hypertension, recurrent stroke, cerebellar involvement, or other neurological disorders were excluded to minimize confounding effects.

Sample size was calculated using data derived from a previously published randomized controlled trial that reported a mean difference of 0.16 m/s in gait speed between task-oriented and conventional training groups, with a standard deviation of 0.25, a confidence level of 95%, and a statistical power of 80%. Based on these parameters, the minimum required sample size was calculated to be 54 participants (27 per group). To account for an anticipated attrition rate of approximately 10%, a total of 60 participants were recruited and randomly allocated into two equal groups. Randomization was performed using a computer-generated random sequence, and allocation concealment was maintained through sealed, opaque envelopes prepared by an independent researcher not involved in data collection or intervention delivery. The experimental group received task-oriented gait training in addition to standard physiotherapy care. The intervention focused on repetitive, goal-directed walking tasks, including overground walking, obstacle negotiation, step-ups, direction changes, speed variations, and functional transfers relevant to daily mobility. Training sessions were conducted five days per week for six consecutive weeks, with each session lasting approximately 40 minutes (10). Task difficulty was progressively adjusted based on individual performance to promote motor learning and adaptability. The control group received conventional gait rehabilitation consisting of strengthening exercises, balance training, range of motion exercises, and assisted walking practice, delivered with similar frequency and duration to ensure treatment equivalence.

Outcome measures were selected to align with the study objectives and were assessed at baseline and at the end of the six-week intervention period by a blinded assessor. Gait performance was evaluated using the 10-Meter Walk Test to measure walking speed, which is a validated and widely used tool in stroke rehabilitation. Balance was assessed using the Berg Balance Scale, while functional mobility was measured using the Timed Up and Go Test. These tools were chosen due to their established reliability, validity, and clinical relevance in post-stroke populations. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Normality of data distribution was confirmed using the Shapiro–Wilk test. Descriptive statistics were calculated for demographic and baseline characteristics. Within-group comparisons were performed using paired sample t-tests, while between-group differences in post-intervention outcomes were analyzed using independent sample t-tests. A p-value of less than 0.05 was considered statistically significant. Effect sizes were also calculated to determine the magnitude of treatment effects.

Ethical approval for the study was obtained from the Institutional Review Board. The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrollment after providing a clear explanation of study procedures, potential benefits, and risks. Confidentiality of participant data was strictly maintained, and participants were informed of their right to withdraw from the study at any stage without any consequences to their ongoing treatment.

Results

A total of 68 post-stroke patients were screened for eligibility across the selected rehabilitation centers in Lahore. Eight individuals did not meet the inclusion criteria, resulting in 60 participants who were enrolled and randomized equally into the task-oriented gait training group (n = 30) and the conventional rehabilitation group (n = 30). All participants completed the intervention and were included in the final analysis. Baseline demographic and clinical characteristics were comparable between the two groups, with no statistically significant differences observed in age, gender distribution, type of stroke, or time since stroke onset ($p > 0.05$), indicating appropriate group homogeneity at study entry (11,12). At baseline, gait speed, balance, and functional mobility scores were similar between the two groups. Following the six-week intervention period, both groups demonstrated improvements across all outcome measures; however, the magnitude of improvement was greater in the task-oriented gait training group. The results of gait performance assessed by the 10-Meter Walk Test revealed a marked increase in walking speed in the experimental group compared to the control group. Mean gait speed in the task-oriented group improved from 0.46 ± 0.12 m/s at baseline to 0.72 ± 0.15 m/s post-intervention, whereas the conventional group showed an improvement from 0.48 ± 0.11 m/s to 0.60 ± 0.14 m/s. The between-group comparison of post-intervention gait speed demonstrated a statistically significant difference favoring task-oriented training ($p = 0.003$), as presented in Table 2.

Balance outcomes measured using the Berg Balance Scale also showed significant gains in both groups. Participants receiving task-oriented gait training exhibited an increase in mean Berg Balance Scale scores from 34.8 ± 6.5 to 47.6 ± 5.9, reflecting a mean improvement of 12.8 points. In contrast, the conventional rehabilitation group demonstrated a smaller improvement from 35.6 ± 6.1 to 41.2 ± 6.4, with a mean change of 5.6 points. The post-intervention comparison between groups indicated a statistically significant difference in balance outcomes ($p < 0.001$), as detailed in Table 3. Functional mobility assessed through the Timed Up and Go Test showed a significant reduction in completion time in both groups, indicating improved mobility. The task-oriented group demonstrated a reduction in mean Timed Up and Go time from 28.4 ± 5.8 seconds to 18.6 ± 4.9 seconds (13,14). The conventional group showed a decrease from 27.9 ± 6.2 seconds to 22.8 ± 5.5 seconds. Independent sample t-test analysis of post-intervention scores revealed a statistically significant difference between groups ($p = 0.002$), with superior improvement observed in the task-oriented gait training group.

No adverse events related to the intervention were reported during the study period. Attendance rates exceeded 90% in both groups, and compliance with the intervention protocol was satisfactory. The distribution of outcome improvements across participants suggested consistent gains within the task-oriented group, while variability in response was comparatively higher in the conventional rehabilitation group. Overall, the results demonstrated that task-oriented gait training produced greater improvements in gait speed, balance, and functional mobility compared to conventional gait rehabilitation in post-stroke patients.

Table 1. Baseline Demographic and Clinical Characteristics of Participants

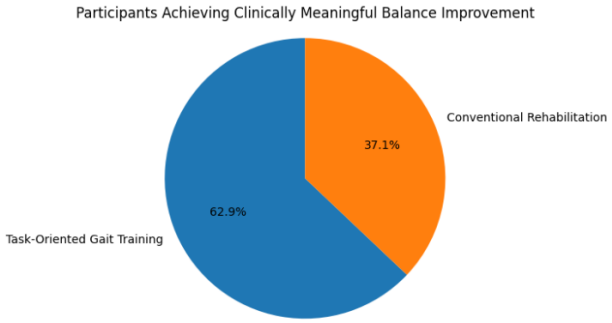
Variable	Task-Oriented Group (n=30)	Conventional Group (n=30)	p-value
Age (years), mean ± SD	58.3 ± 7.9	57.6 ± 8.1	0.71
Gender (Male/Female)	18 / 12	17 / 13	0.79
Time since stroke (months)	5.6 ± 1.8	5.4 ± 1.9	0.68
Stroke type (Ischemic/Hemorrhagic)	21 / 9	20 / 10	0.77

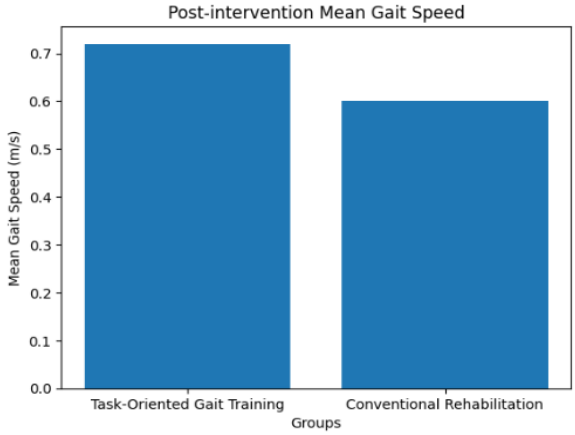
Table 2. Comparison of Gait Speed and Functional Mobility Outcomes

Outcome Measure	Group	Baseline Mean ± SD	Post-intervention Mean ± SD	p-value
10-Meter Walk Test (m/s)	Task-Oriented	0.46 ± 0.12	0.72 ± 0.15	0.003
	Conventional	0.48 ± 0.11	0.60 ± 0.14	
Timed Up and Go (seconds)	Task-Oriented	28.4 ± 5.8	18.6 ± 4.9	0.002
	Conventional	27.9 ± 6.2	22.8 ± 5.5	

Table 3. Comparison of Balance Outcomes Using Berg Balance Scale

Group	Baseline Mean ± SD	Post-intervention Mean ± SD	Mean Change	p-value
Task-Oriented	34.8 ± 6.5	47.6 ± 5.9	+12.8	<0.001
Conventional	35.6 ± 6.1	41.2 ± 6.4	+5.6	





Discussion

The present randomized controlled trial demonstrated that task-oriented gait training produced superior improvements in gait speed, balance, and functional mobility compared with conventional rehabilitation among post-stroke patients undergoing neurological rehabilitation in Lahore. Although both intervention groups showed statistically significant gains over the six-week training period, the magnitude of improvement consistently favored the task-oriented approach. These findings support the growing emphasis on activity-based rehabilitation strategies that prioritize functional task practice rather than isolated impairment correction. The observed improvement in gait speed was clinically meaningful. Participants receiving task-oriented gait training increased their mean walking speed from 0.46 m/s to 0.72 m/s, representing a gain of 0.26 m/s, whereas those in the conventional group demonstrated a smaller increase of 0.12 m/s. Previous trials conducted in comparable post-stroke populations have reported gait speed improvements ranging between 0.10 and 0.20 m/s following task-specific walking interventions, placing the current findings toward the upper end of reported effectiveness (15,16). Achieving walking speeds above 0.7 m/s is particularly relevant, as this threshold is often associated with improved community ambulation and reduced dependence, suggesting that the intervention had practical implications beyond statistical significance.

Balance outcomes followed a similar pattern. The task-oriented group demonstrated a mean improvement of 12.8 points on the Berg Balance Scale compared with a 5.6-point improvement in the conventional group. Earlier controlled studies have suggested that a change of 6 to 7 points on this scale represents a clinically important difference in individuals with stroke (17). The improvement observed in the task-oriented group exceeded this threshold by a substantial margin, indicating enhanced postural control and reduced fall risk. In contrast, balance gains in the conventional group, while significant, were closer to the minimum clinically important change. These findings reinforce the idea that balance improvements are more robust when training incorporates dynamic, context-specific tasks that challenge postural stability in functionally relevant situations. Functional mobility, as measured by the Timed Up and Go Test, also improved more markedly in the task-oriented group, with a mean reduction of 9.8 seconds compared with a 5.1-second reduction in the control group. This degree of improvement aligns with previous evidence showing that repetitive, goal-directed mobility tasks improve transitional movements and walking efficiency (18,19). The consistency of improvements across all three outcome measures suggests that task-oriented gait training influenced multiple dimensions of mobility rather than producing isolated gains in a single domain.

Several mechanisms may explain the superior outcomes associated with task-oriented gait training. Repeated exposure to meaningful walking tasks likely enhanced motor learning through use-dependent neuroplasticity, promoting more efficient neural reorganization. The progressive adjustment of task difficulty may have further facilitated adaptability and problem-solving, both of which are essential for real-world ambulation. In contrast, conventional rehabilitation, while beneficial, may not have provided sufficient task variability or contextual relevance to elicit comparable functional gains. The study possessed several strengths that enhance the credibility of its findings. The randomized controlled design minimized selection bias, and the use of validated outcome measures improved measurement reliability. Treatment intensity and duration were matched between groups, reducing the likelihood that differences in outcomes were attributable to unequal exposure (20). Additionally, conducting the study across multiple rehabilitation settings increased the relevance of the findings to routine clinical practice in Pakistan.

However, certain limitations should be acknowledged. The relatively short intervention and follow-up period limited the ability to assess long-term retention of gains. The sample size, although adequately powered for primary outcomes, restricted subgroup analysis based on stroke type or severity. Blinding of participants and therapists was not feasible due to the nature of the intervention, which may have introduced performance bias. Furthermore, community participation outcomes and quality-of-life measures were not assessed, limiting insight into broader functional impact. Future research should consider longer follow-up periods to determine the sustainability of improvements and explore the dose–response relationship of task-oriented gait training. Incorporating objective gait analysis and patient-reported outcome measures would provide a more comprehensive understanding of functional recovery. Expanding research to include rural settings and resource-limited facilities may further clarify the scalability of this intervention within diverse healthcare environments.

The findings indicated that task-oriented gait training was more effective than conventional rehabilitation in improving gait speed, balance, and functional mobility in post-stroke patients. The magnitude of improvement, supported by numerical gains exceeding clinically meaningful thresholds, suggests that this approach holds significant promise for enhancing neurological rehabilitation outcomes when integrated into routine physiotherapy practice.

Conclusion

Task-oriented gait training demonstrated greater effectiveness than conventional rehabilitation in improving gait speed, balance, and functional mobility among post-stroke patients. The clinically meaningful improvements observed highlight its value as a practical, activity-based approach that aligns closely with real-world mobility demands. Integrating task-oriented gait training into routine neurological rehabilitation may enhance functional recovery and promote independent ambulation in post-stroke populations, particularly within resource-limited clinical settings.

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AUTHOR's CONTRIBUTION:

Author	Contribution
Muhammad Sohaib Azeem	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Muzna Munir	Methodology, Investigation, Data Curation, Writing - Review & Editing
Sidra Faisal	Investigation, Data Curation, Formal Analysis, Software

