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Effect of Mirror Therapy on Balance and Gait Velocity in Subacute Stroke Subjects

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Abstract:

Background: Stroke is an acute cerebrovascular event resulting from impaired cerebral blood flow or intracranial haemorrhage, leading to neurological deficits that commonly affect balance, gait, mobility, and functional independence. The subacute phase is an important period for rehabilitation and motor recovery. Mirror therapy is a simple, cost-effective intervention that provides visual feedback to facilitate motor recovery. However, evidence regarding its effectiveness specifically in individuals with subacute stroke remains limited. This study aimed to evaluate the effect of mirror therapy on balance and gait velocity and compare mirror therapy combined with conventional physiotherapy with conventional physiotherapy alone.

Methods: A randomized controlled trial was conducted among 30 individuals with subacute stroke. Participants were randomly allocated to two groups: an experimental group (n = 15) receiving mirror therapy combined with conventional physiotherapy and a control group (n = 15)

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receiving conventional physiotherapy alone. The intervention was provided for four weeks. Balance and gait velocity were assessed before and after the intervention using the Berg Balance Scale (BBS) and 10-Meter Walk Test (10MWT), respectively. Data were analysed using appropriate statistical tests.

Results: All 30 participants completed the study. The experimental group demonstrated greater improvements in balance and gait velocity than the control group after four weeks. BBS scores improved from 41.53 ± 5.58 to 53.40 ± 2.29 in the experimental group and from 38.73 ± 5.08 to 45.13 ± 4.73 in the control group. Gait velocity increased from 0.485 ± 0.086 to 0.943 ± 0.181 m/s in the experimental group and from 0.358 ± 0.080 to 0.528 ± 0.161 m/s in the control group. Between-group differences were statistically significant ($p < 0.001$).

Conclusion: Mirror therapy combined with conventional physiotherapy was associated with greater improvements in balance and gait velocity than conventional physiotherapy alone in individuals with subacute stroke. Mirror therapy may be a useful adjunct to conventional physiotherapy for improving balance and gait performance during subacute stroke rehabilitation. Further multicentre randomized controlled trials with larger sample sizes and prolonged follow-up are required to validate these findings and evaluate their long-term clinical significance.

Keywords: 10-meter walk test, balance, Berg Balance Scale, early neurorehabilitation, gait velocity, mirror therapy, physiotherapy intervention, randomized controlled trial, stroke rehabilitation, subacute stroke

Introduction

Stroke is a neurological deficit resulting from vascular injury that disrupts normal brain function. It is the second leading cause of morbidity and mortality [1]. The World Health Organization defines stroke as a clinical syndrome consisting of rapid development of clinical signs of focal or global impairment of cerebral function due to a vascular cause. These neurological symptoms persist for 24 hours or more or lead to death, with no apparent cause other than of vascular origin [2].

Globally, the increasing crude prevalence and incidence of stroke reflect changes in population demographics, especially population growth and ageing [3]. In India, stroke incidence rates have been estimated at 108–172 per 100,000 population, with age-standardized incidence ranging from 92 to 209 per 100,000. Sex-based estimates show a marginally greater incidence among males (102–173 per 100,000) than females (100–170 per 100,000). The reported crude prevalence of stroke varies considerably, ranging from 26 to 757 per 100,000 population, indicating substantial regional and population-level differences in the epidemiological burden of stroke [4].

Impairments in sensorimotor function following stroke frequently compromise balance and gait, contributing substantially to disability and a decline in quality of life [5]. Independent mobility

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during daily activities depends on the coordinated regulation of motor control, muscle tone, joint movements, and postural stability. Disruption of these interrelated processes can restrict a stroke survivor's ability to walk safely and perform functional activities independently. Furthermore, impaired balance increases the likelihood of falls and fall-related injuries, including hip fractures [6].

Alterations in lower-limb motor control are common after stroke and can significantly disrupt normal gait mechanics. These abnormalities may include insufficient hip and knee flexion during the swing phase, excessive ankle plantar flexion, and limited ankle dorsiflexion. Such deviations can impair foot clearance, disturb postural stability, and reduce the efficiency of walking. These functional limitations may increase the risk of falls, interfere with activities of daily living, and restrict participation in social, occupational, and community activities [7].

Physiotherapy is a key component of comprehensive stroke rehabilitation, with an emphasis on recovering motor function, improving mobility, and maximizing functional independence. Treatment commonly incorporates task-oriented exercises, gait retraining, balance and postural control activities, progressive muscle strengthening, aerobic conditioning, and motor relearning strategies. Through repetitive, goal-directed practice, these interventions aim to facilitate neuroplasticity, improve movement control, minimize disability, and prevent secondary complications. Improvements in physical performance may subsequently support greater independence in everyday activities, enhance community participation, and improve overall quality of life among stroke survivors [8].

Among the rehabilitation approaches used after stroke, mirror therapy has gained attention as a relatively simple, inexpensive, and evidence-supported intervention. The technique involves placing a mirror along the body's midsagittal plane so that the reflection of movements performed by the unaffected limb creates the illusion that the affected limb is moving normally. This visual illusion provides an alternative source of movement-related feedback and may help compensate, to some extent, for impaired proprioceptive information from the affected extremity. Observing the reflected movements is thought to engage several sensorimotor regions of the brain, including the contralateral primary motor cortex, bilateral somatosensory cortices, and supplementary motor areas. Activation of these neural networks may facilitate sensorimotor integration, cortical reorganization, and the recovery of motor function following stroke [1].

The potential benefits of mirror therapy extend to balance and gait, two closely associated aspects of functional mobility. Adequate postural stability is necessary for maintaining an upright position, transferring body weight, initiating steps, and walking safely. By providing enhanced visual feedback during movement practice, mirror therapy may facilitate motor planning and recruitment of neural networks involved in controlling the affected lower limb. These effects may help improve postural symmetry, weight-bearing ability, and coordination during functional tasks. Improved control of the affected limb may, in turn, support more efficient ambulation and contribute to increased walking velocity. Previous research has reported improvements in balance, gait

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performance, and motor function following lower-extremity mirror therapy compared with conventional rehabilitation approaches [9,10].

Evidence from previous clinical investigations and systematic reviews also suggests that lower-limb mirror therapy may contribute to improvements in motor recovery, postural control, and walking ability in individuals with stroke. However, the reported effects vary across studies because of differences in treatment protocols, intervention intensity, duration, participant characteristics, stroke stages, and outcome assessment methods [11-15]. These variations make it difficult to establish a uniform treatment protocol and determine the extent to which the reported benefits can be generalized to different stroke populations.

Despite the promising findings, certain limitations remain in the existing evidence. Differences in intervention dosage and treatment procedures, relatively small participant samples, and methodological shortcomings may affect the reliability and generalizability of reported outcomes. In addition, although mirror therapy has been investigated in various stroke populations, evidence specifically addressing its effects on balance and gait velocity in individuals with subacute stroke remains limited. This phase represents an important period for rehabilitation, during which spontaneous recovery and experience-dependent neuroplasticity may contribute to functional improvement. Evaluating rehabilitation interventions during this stage may therefore help clarify their potential role in optimizing recovery.

In view of these considerations, the present study was designed to investigate the effect of mirror therapy on balance and gait velocity in individuals with subacute stroke. It also aimed to compare the outcomes of mirror therapy combined with conventional physiotherapy against those of conventional physiotherapy alone, using standardized outcome measures to assess changes in balance and walking performance.

Materials and Methods

Study Design

A randomized controlled trial was conducted to evaluate the effects of mirror therapy combined with conventional physiotherapy compared with conventional physiotherapy alone on balance and gait velocity in individuals with subacute stroke. The study was designed and reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines. The study was conducted at the College of Physiotherapy, Sri Venkateswara Institute of Medical Sciences (SVIMS) University, Tirupati, Andhra Pradesh, India. The study duration was six months, and the treatment period was four weeks. Ethical approval was obtained from the Institutional Ethics Committee of SVIMS with Roc. No. AS/11/IEC/SVIMS/2017. Written informed consent was obtained from all participants before enrolment. The trial was registered with the Clinical Trials Registry of India (CTRI) with CTRI/2026/01/101729.

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Sample Size and Sampling Technique

Thirty individuals diagnosed with subacute stroke who met the predefined inclusion and exclusion criteria and provided written informed consent were recruited from the inpatient and outpatient physiotherapy services. The participants were randomly allocated into two equal groups (n = 15 each) using the lottery method of simple randomization, in which each participant was assigned a number and the group allocation was determined by drawing lots. Group A (experimental group) received mirror therapy along with conventional physiotherapy, while Group B (control group) received conventional physiotherapy alone. All 30 participants completed the required assessments and intervention protocol and were included in the final analysis.

Inclusion Criteria

Individuals aged between 30 and 65 years, including both men and women; stroke confirmed by brain computed tomography or magnetic resonance imaging; subacute ischemic or haemorrhagic stroke; National Institutes of Health Stroke Scale score of 5–15; Functional Ambulation Category score of 1; and willingness to participate and provide written informed consent.

Exclusion Criteria

Participants with severe stroke (National Institutes of Health Stroke Scale score above 15), cognitive impairment, visual or auditory impairment, orthopaedic conditions, or other neurological conditions, recent lower-limb surgery or severe spasticity (Modified Ashworth Scale ≥1) limiting selective movement, and severe musculoskeletal pain preventing weight bearing or exercise participation were excluded.

Informed Consent

The study protocol was thoroughly explained to the participants. Written consent was obtained after confirming the participants' willingness as well as that of their relatives to participate in the study.

Intervention

Both groups underwent a progressive four-week physiotherapy intervention of 50 minutes per day, 5 sessions per week, for a period of 4 weeks. The conventional physiotherapy program, common to both groups, included range-of-motion exercises, lower-limb strengthening, balance training (static and dynamic), gait re-education, task-oriented functional mobility exercises, and activities aimed at improving weight transfer, postural control, and walking endurance. Sessions were supervised by qualified physiotherapists.

The principal difference between the groups was the addition of lower-extremity mirror therapy in the experimental group. Participants in the experimental group performed movements of the unaffected lower limb while observing the reflection in a mirror placed in the midsagittal plane,

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thereby creating the visual illusion that the affected limb was moving normally. The mirror therapy protocol was progressed across phases weekly and included activities such as ankle dorsiflexion–plantarflexion, knee flexion–extension in sitting, hip movements, sit-to-stand practice, weight shifting in standing, stepping activities, and functional tasks. Standardized dosage was applied with prescribed repetitions, hold times, and sets. The control group received conventional physiotherapy of comparable total session duration without the mirror therapy component.

The intervention was delivered over four weeks. Both groups received supervised sessions according to the prescribed treatment protocol. Participants were encouraged to maintain consistency in attendance and effort throughout the study period.

Experimental Group Protocol (Group A)

The protocol begins with a 10-minute warm-up that includes deep breathing exercises for relaxation (performed in a comfortable sitting or lying position without a mirror), toe tapping for lower-limb activation (sitting, with optional mirror feedback), knee extension to improve knee mobility (sitting, with a vertical mirror reflecting the unaffected limb), marching in place to enhance balance and lower-limb activation (standing, mirror at eye level), and calf stretching for flexibility (standing, mirror for postural feedback).

Phase 1 focuses on mobility exercises performed in semi-reclined or half-lying positions with the mirror placed vertically between the limbs to reflect the unaffected side. These include combined hip, knee and ankle flexion; hip medial and lateral rotation; and hip abduction with external rotation combined with adduction with internal rotation, all aimed at improving range of motion (ROM) and motor control of the lower limb (5–10 repetitions × 2 sets).

Phase 2 targets ankle mobility in sitting with the mirror reflecting the unaffected ankle: ankle dorsiflexion (to improve gait preparation and ankle ROM) and plantar flexion (to improve gait and ankle strength), each held for 5 seconds (5–10 repetitions × 2 sets).

Phase 3 emphasises functional training in standing with frontal mirror feedback: squatting for balance and flexibility, parallel-bar walking with mirror observation to improve gait stability, balance and weight symmetry (30 seconds per set), and weight shifting for balance (5 repetitions × 2 sets).

Phase 4 advances to balance and gait training: wobble-board exercises for postural control (30 seconds per set) and gait training with mirror observation to enhance walking ability, coordination and symmetry (30 seconds per set). The session concludes with conventional physiotherapy exercises (bridging, sit-to-stand, mini-squatting, heel-to-toe walking and step-symmetry practice) performed for 15–20 repetitions each to further improve trunk control, walking ability, coordination and symmetry. Throughout, the therapist provides verbal cues, manual guidance, alignment correction and safety support while the patient focuses on the mirror image of the unaffected limb.

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Figure 1: PHASE 3 IN EXPERIMENTAL GROUP

Control Group Protocol (Group B)

Phase 1 (Mobility & Strengthening Training, 15 minutes) includes active-assisted hip, knee and ankle flexion (supine/semi-reclined), hip abduction and adduction, hip internal and external rotation (supine with knee flexed), and ankle dorsiflexion/plantar flexion against resistance (sitting). The therapist assists the affected limb, stabilises the pelvis and prevents compensatory movements.

Phase 2 (Strengthening & Weight-Bearing Training, 10 minutes) comprises bridging for hip strength and trunk stability (supine, knees bent), sit-to-stand training for functional strength and transfers (from a chair), mini-squatting for lower-limb strength and balance (standing), and weight-shifting exercises in all directions to improve balance and weight-bearing symmetry (standing).

Phase 3 (Balance & Coordination Training, 10 minutes) focuses on static standing balance (30–60 seconds), dynamic standing balance with reaching in different directions (5–10 repetitions), and wobble-board exercises for proprioception and balance (30 seconds × 2 sets).

Phase 4 (Gait & Functional Training, 5 minutes) consists of parallel-bar walking to improve gait stability and weight bearing, free gait training emphasising upright posture, heel-to-toe pattern and symmetry (30 seconds per set), and functional walking practice involving turning, stopping and

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direction changes (5 minutes). The therapist provides manual guidance, verbal cues, postural correction and continuous safety guarding, but without the visual feedback of a mirror.



Figure 2: PHASE 4 PARALLEL BAR TRAINING IN CONTROL GROUP

Outcome Measures

Berg Balance Scale (BBS): The BBS is a widely used, valid, and reliable 14-item performance-based measure of static and dynamic balance. Each item is scored from 0 to 4, yielding a total score ranging from 0 to 56, with higher scores indicating better balance performance. The BBS has demonstrated excellent reliability and is sensitive to change in individuals with stroke. It assesses tasks such as sitting unsupported, standing with eyes closed, reaching forward, turning, and transferring, providing a comprehensive evaluation of functional balance relevant to daily activities and fall risk[29].

10-Meter Walk Test (10MWT): The 10MWT is a standardized, performance-based assessment used to evaluate gait speed (gait velocity), an important indicator of functional mobility, balance, and community ambulation capacity. Participants are instructed to walk at a comfortable, self-selected pace over a 10-meter distance. Timing is typically started when the toes pass the 2-meter mark and stopped when the toes pass the 12-meter mark to allow for acceleration and deceleration. Gait velocity is calculated in metres per second (m/s) by dividing the distance walked by the time taken. Greater walking speed indicates better functional walking ability. Clinical interpretation commonly classifies speeds below 0.4 m/s as household ambulators, 0.4–0.8 m/s as limited community ambulators, and above 0.8 m/s as community ambulators[30].

Baseline assessments were conducted prior to the start of the intervention, and post-intervention assessments were performed after completion of the four-week program using the same standardized procedures.

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Statistical Analysis

Data were entered into Microsoft Excel, and the statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Chicago, USA). The collected data were initially entered into a Microsoft Excel spreadsheet, systematically tabulated, and then subjected to statistical analysis.

A total of 30 participants successfully completed the study protocol within the four-week intervention period. The demographic characteristics of the participants were analysed using the Chi-square test to determine the homogeneity between groups. The paired t-test was used for within-group comparisons to analyse pre- and post-intervention changes in both the experimental and control groups. The unpaired t-test (independent t-test) was used for between-group comparisons to determine differences in outcome measures between the experimental and control groups.

The effectiveness of the intervention was evaluated using the outcome measures Berg Balance Scale (BBS) and 10-Metre Walk Test (10MWT). Statistical significance was considered at a p-value < 0.05.

Results

Descriptive Statistics

A total of 30 participants with subacute stroke were included in the study and completed the intervention and assessments. The baseline demographic and clinical characteristics between Group A and Group B were compared. The mean age of participants in Group A was 44.7 ± 10.2 years, while Group B had a mean age of 50.3 ± 7.2 years. The difference in age distribution was not statistically significant ($p = 0.09$), indicating that both groups were comparable in terms of age. Gender distribution was equal in both groups (Group A: Male 10, Female 5; Group B: Male 10, Female 5), with no statistically significant difference ($p = 1.000$). The affected side distribution was also comparable between groups (Group A: Right 5, Left 10; Group B: Right 4, Left 11), showing no statistically significant difference ($p = 0.69$). Overall, the baseline variables showed no significant differences between Group A and Group B ($p > 0.05$), suggesting that both groups were homogeneous before the intervention as given in Table 1.

Table 1: Demographic data – baseline characteristics

Variables	Group A (n=15) Mean ± SD	Group B (n=15) Mean ± SD	P-value
Age (years)	44.7 ± 10.2	50.3 ± 7.2	0.09
Gender (male:female)	10:5	10:5	1.000
Affected side (Right:Left)	5:10	4:11	0.69

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Inferential Statistics

Within-Group Analysis

The within-group analysis of the experimental group showed statistically significant improvements in both balance and gait velocity after the intervention. The BBS score increased from 41.53 ± 5.58 to 53.40 ± 2.29 (mean difference = 11.87, t = 7.90, $p < 0.001$). Similarly, 10MWT gait velocity improved from 0.485 ± 0.086 m/s to 0.943 ± 0.181 m/s (mean difference = 0.458 m/s, t = 13.03, $p < 0.001$). These findings indicate that mirror therapy combined with conventional physiotherapy significantly improved balance and gait velocity in subjects with subacute stroke as shown in Table 2.

Table 2: Within-group analysis of pre and post intervention mean values of BBS and 10MWT in Group A

Outcome	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Diff.	t-value	p-value
BBS	41.53 ± 5.58	53.40 ± 2.29	11.87	7.90	<0.001
10MWT	0.485 ± 0.086	0.943 ± 0.181	0.458	13.03	<0.001

BBS: Berg Balance Scale; 10MWT: Ten-Meter Walk Test

The within-group analysis of the control group showed statistically significant improvements in both balance and gait velocity following conventional physiotherapy. The BBS score increased from 38.73 ± 5.08 to 45.13 ± 4.73 (mean difference = 6.40, t = 4.10, p = 0.001). Similarly, 10MWT gait velocity improved from 0.358 ± 0.080 m/s to 0.528 ± 0.161 m/s (mean difference = 0.170 m/s, t = 7.18, $p < 0.001$). These findings indicate that conventional physiotherapy alone significantly improved balance and gait velocity in subjects with subacute stroke as given in Table 3.

Table 3: Within-group analysis of pre and post intervention mean values of BBS and 10MWT in Group B

Outcome	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Diff.	t-value	p-value
BBS	38.73 ± 5.08	45.13 ± 4.73	6.40	4.10	0.001
10MWT	0.358 ± 0.080	0.528 ± 0.161	0.170	7.18	<0.001

BBS: Berg Balance Scale; 10MWT: Ten-Meter Walk Test

Between-Group Analysis

An independent t-test was used to compare the post-test outcomes between the experimental and control groups.

For the Berg Balance Scale (BBS), the experimental group achieved a significantly higher mean score (53.40 ± 2.29) than the control group (45.13 ± 4.73). The mean difference was 8.27 points, and the difference was statistically significant (t = 6.12, $p < 0.001$), indicating that mirror therapy

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combined with conventional physiotherapy resulted in greater improvement in balance than conventional physiotherapy alone.

For the 10-Meter Walk Test (10MWT), the experimental group demonstrated a significantly higher gait velocity (0.943 ± 0.181 m/s) compared with the control group (0.528 ± 0.161 m/s). The mean difference was 0.415 m/s, and the between-group difference was statistically significant ($t = 6.63$, $p < 0.001$). This finding suggests that the addition of mirror therapy produced superior improvements in gait velocity compared with conventional physiotherapy alone.

Table 4: Between-group analysis of post-intervention mean values of BBS and 10MWT

Outcome	Experimental Group (Mean ± SD)	Control Group (Mean ± SD)	Mean Diff.	t-value	p-value
BBS	53.40 ± 2.29	45.13 ± 4.73	8.27	6.12	<0.001
10MWT (m/s)	0.943 ± 0.181	0.528 ± 0.161	0.415	6.63	<0.001

BBS: Berg Balance Scale; 10MWT: Ten-Meter Walk Test

Graphical Representation of Results

Figure 1 and Figure 2 present the pre- and post-intervention comparisons of Berg Balance Scale scores and gait velocity for the experimental and control groups.

Figure 1: Berg Balance Scale (BBS) Scores – Pre vs Post Intervention

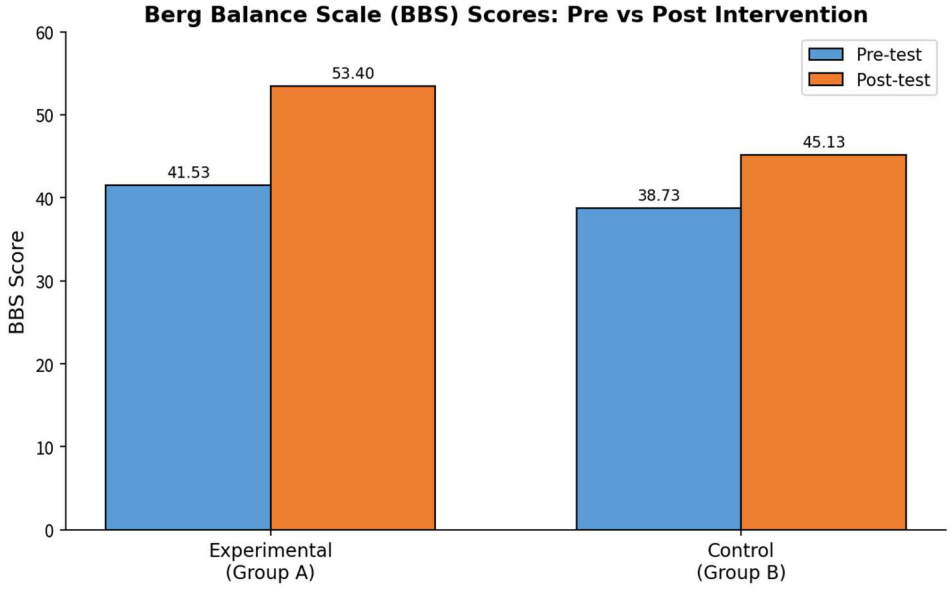
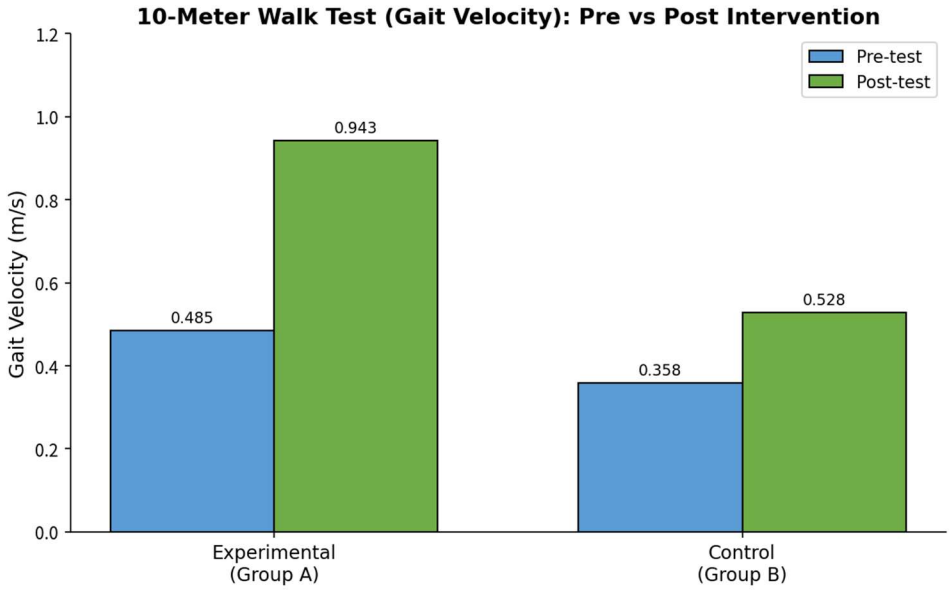


Figure 2: 10-Meter Walk Test (Gait Velocity) – Pre vs Post Intervention

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Discussion

Stroke remains one of the leading causes of mortality and long-term disability worldwide. Among its many sequelae, impairments in balance and gait velocity are particularly disabling because they limit independent mobility, increase the risk of falls, prolong functional dependence, and restrict participation in activities of daily living and community life [16]. During the subacute phase of recovery, spontaneous neurological recovery coincides with a period of heightened activity-dependent neuroplasticity, creating an optimal therapeutic window for interventions that promote cortical reorganization and motor relearning [17].

Conventional physiotherapy forms the foundation of stroke rehabilitation and includes strengthening, stretching, balance training, gait re-education, and task-oriented practice. While these interventions effectively improve musculoskeletal function and functional performance, complete recovery of coordinated lower-limb movement often remains incomplete. Contemporary neurorehabilitation therefore emphasizes techniques capable of facilitating central nervous system reorganization in addition to peripheral training. Mirror therapy is a simple, inexpensive, and clinically feasible intervention that provides meaningful visual feedback. By reflecting movements of the unaffected limb, it creates the visual illusion that the paretic limb is moving normally, thereby modifying cortical perception and influencing motor output [18].

The neurophysiological basis of mirror therapy supports its use in lower-extremity rehabilitation. Observation of the mirrored movement activates the mirror neuron system together with the premotor cortex, supplementary motor area, and primary motor cortex. This leads to increased corticospinal excitability, enhanced interhemispheric connectivity, and recruitment of ipsilateral motor pathways [19]. Functional neuroimaging studies have confirmed that repeated mirror-

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induced visual feedback promotes adaptive cortical reorganization after stroke [20]. These mechanisms provide a strong rationale for incorporating mirror therapy during the subacute stage, when the brain is most responsive to sensory and motor input.

In the present randomized controlled trial, both groups demonstrated statistically significant within-group improvements in Berg Balance Scale (BBS) scores and 10-Meter Walk Test (10MWT) performance after four weeks of intervention. However, the magnitude of improvement was substantially greater in the experimental group that received mirror therapy combined with conventional physiotherapy. BBS scores improved from 41.53 ± 5.58 to 53.40 ± 2.29 in the experimental group compared with 38.73 ± 5.08 to 45.13 ± 4.73 in the control group. Gait velocity increased from 0.485 ± 0.086 m/s to 0.943 ± 0.181 m/s in the experimental group and from 0.358 ± 0.080 m/s to 0.528 ± 0.161 m/s in the control group. Between-group differences were highly significant ($p < 0.001$).

These superior outcomes can be explained by the dual peripheral and central effects of mirror therapy. Visual feedback compensates for impaired proprioceptive input, improves body schema, facilitates symmetrical weight transfer onto the paretic limb, and enhances motor planning and sensorimotor integration. Repeated observation of symmetrical lower-limb movement strengthens motor memory, improves the timing and sequencing of muscle activation, and promotes greater gait symmetry and efficiency [21,22]. While conventional physiotherapy primarily targets musculoskeletal impairments through repetitive physical practice, the addition of mirror therapy simultaneously stimulates higher cortical centres involved in motor imagery, attention, and cortical reorganization. The combined effect of peripheral training and central activation is the most plausible explanation for the greater gains observed in both balance and gait velocity.

The balance and gait findings of the present study are consistent with those reported in previous clinical trials. Sütbeyaz et al. demonstrated significantly greater improvements in lower-extremity motor recovery and functional ambulation among patients receiving mirror therapy compared with conventional rehabilitation alone [23]. Mohan et al. similarly reported superior improvements in balance, lower-extremity motor function, and mobility following mirror therapy [24]. Comparable results for gait velocity, stride symmetry, postural stability, and functional mobility have been reported by Ji and Kim, Salem et al., and several other investigators [25-27]. High-level evidence from systematic reviews and meta-analyses further confirms that mirror therapy, particularly when combined with conventional physiotherapy, significantly enhances lower-extremity motor recovery, balance, and walking ability after stroke [28].

An expected finding was that both groups improved. Conventional physiotherapy is an evidence-based approach that enhances muscle strength, joint mobility, endurance, coordination, and functional performance. In addition, participants were recruited during the subacute stage, a period characterized by spontaneous recovery that independently contributes to gradual functional gains. The significantly larger improvements in the experimental group, however, clearly demonstrate

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that mirror therapy confers additional therapeutic benefits beyond those achieved with standard exercise alone.

In clinical terms, the improvements observed in the experimental group are meaningful. Higher BBS scores translate into safer transfers, improved standing stability, reduced fall risk, and greater independence in daily activities. The near-doubling of gait velocity in the mirror-therapy group approaches speeds associated with more efficient community ambulation. Because mirror therapy requires minimal equipment, is safe, and can be easily integrated into existing physiotherapy sessions, it represents a practical and scalable adjunct for routine neurological rehabilitation.

The present study findings demonstrate that mirror therapy combined with conventional physiotherapy is more effective than conventional physiotherapy alone in improving balance and gait velocity among individuals with subacute stroke. By simultaneously addressing peripheral musculoskeletal deficits and promoting cortical reorganization, mirror therapy enhances the effectiveness of standard rehabilitation and supports its inclusion as an evidence-based adjunct during the subacute phase of stroke recovery.

Strengths

This randomized controlled trial employed validated and widely accepted outcome measures—the Berg Balance Scale for balance and the 10-Meter Walk Test for gait velocity—ensuring reliable and clinically meaningful assessment. The intervention protocol was clearly structured, progressive, and applied consistently over four weeks, with complete participant retention and no dropouts. By specifically targeting the subacute phase of stroke, a period of heightened neuroplasticity, the study addressed a critical window for recovery. The use of mirror therapy, a simple, low-cost, and easily reproducible technique, further enhances the practical applicability and transferability of the findings to routine clinical settings, including resource-limited environments.

Limitations

The study was limited by a relatively small sample size recruited from a single centre, which may restrict generalizability to the wider stroke population and different healthcare settings. The four-week intervention duration was comparatively short, and the absence of long-term follow-up prevents conclusions about the sustainability of improvements after therapy ends. Only balance and gait velocity were evaluated; other important outcomes such as lower-limb motor recovery, functional independence, activities of daily living, quality of life, muscle strength, and spasticity were not assessed. Additionally, blinding of participants and therapists was not feasible due to the nature of the intervention, introducing a potential risk of performance bias.

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Clinical Implications

The findings indicate that adding mirror therapy to conventional physiotherapy yields significantly greater improvements in balance and gait velocity than conventional physiotherapy alone in individuals with subacute stroke. These gains are clinically meaningful, as better balance reduces fall risk and higher gait velocity supports more efficient community ambulation and greater independence in daily activities. Because mirror therapy is inexpensive, safe, requires minimal equipment, and can be readily integrated into existing rehabilitation sessions, it offers a practical and scalable adjunct that physiotherapists can implement to enhance functional outcomes during the subacute phase of stroke recovery.

Future Scope

Future research should involve larger, multicentre randomized controlled trials with longer intervention periods and extended follow-up assessments to confirm the durability of benefits across diverse populations and settings. Studies examining the effectiveness of mirror therapy in acute and chronic stroke stages, as well as its combination with other evidence-based modalities such as functional electrical stimulation, virtual reality, or task-oriented training, would help optimize treatment protocols. Inclusion of broader outcome measures (functional independence, quality of life, motor recovery) and the use of neuroimaging techniques would further clarify the underlying mechanisms and cost-effectiveness of this approach.

Conclusions

The present randomized controlled trial was conducted to evaluate the effectiveness of mirror therapy on balance and gait velocity among individuals with subacute stroke. A total of 30 participants diagnosed with subacute stroke were included and allocated into experimental and control groups. The experimental group received mirror therapy along with conventional physiotherapy, whereas the control group received conventional physiotherapy alone. Treatment outcomes were assessed using the Berg Balance Scale for evaluation of functional balance and the 10-Meter Walk Test for assessment of gait velocity.

The findings of the present study demonstrated statistically significant improvement in balance and gait velocity within both groups following the intervention period. However, the experimental group receiving mirror therapy combined with conventional physiotherapy showed significantly greater improvement compared with the control group receiving conventional physiotherapy alone. These findings indicate that mirror therapy provides additional therapeutic benefits and may enhance the effectiveness of conventional rehabilitation approaches in improving functional outcomes among individuals recovering from subacute stroke.

The present study supports the incorporation of mirror therapy as an effective adjunct intervention during the subacute phase of stroke rehabilitation, when spontaneous neurological recovery and

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neuroplastic adaptations are more prominent. Mirror therapy complements conventional physiotherapy by providing additional sensory stimulation and promoting active engagement of the patient during rehabilitation. Therefore, mirror therapy can be recommended as an effective adjunct rehabilitation strategy to facilitate motor recovery, enhance functional mobility, improve independence, and contribute to better quality of life in stroke survivors.

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