International Journal of Advanced Research and Multidisciplinary Trends (IJARMT)
An International Open Access, Peer-Reviewed Refereed Journal
Impact Factor: 7.2 Website: https://ijarmt.com ISSN No.: 3048-9458

Effect of Gait Training on Functional Recovery in a Patient with Left Middle Cerebral Artery (MCA) Stroke: A Case Study

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ABSTRACT

Background: Stroke involving the left middle cerebral artery commonly produces right hemiparesis with impaired selective motor control, reduced balance reactions, asymmetrical weight bearing, slow walking, poor endurance, and difficulty in daily mobility. Gait training is a central component of neurophysiotherapy because walking ability determines independence in transfers, toileting, household ambulation, community participation, and return to family roles. A structured gait programme combines postural preparation, task-specific stepping, stance control, rhythmic practice, feedback, strength training, balance activities, and progressive functional walking tasks. This case study describes the effect of gait training on functional recovery in a patient with left MCA stroke.

Presentation of Case: A 57-year-old right-handed male presented to the physiotherapy department six weeks after a first-ever left MCA ischemic stroke. He had right-sided weakness, mild expressive speech difficulty, reduced confidence in standing, and dependence for indoor walking. He was medically stable, alert, cooperative, and able to follow simple verbal and visual instructions. The main complaints were dragging of the right foot, reduced stance time on the right lower limb, fear of falling, difficulty turning, inability to climb stairs independently, and fatigue after short walking distance.

Intervention: The patient received six weeks of supervised gait training, five sessions per week, with each session lasting approximately forty-five to sixty minutes. Treatment included trunk alignment, sit-to-stand practice, supported weight shifting, affected-limb loading, stepping drills, ankle dorsiflexor facilitation, knee control training, overground gait practice, treadmill walking with safety support, visual cueing, obstacle negotiation, stair practice, endurance walking, and a structured home programme. Progression was guided by quality of movement, safety, fatigue, balance response, walking speed, and functional carryover into daily activities.

Outcome Measures: Functional recovery was documented using the Fugl-Meyer Assessment for Lower Extremity, Berg Balance Scale, Functional Ambulation Category, Ten-Meter Walk Test, Timed Up and Go Test, Six-Minute Walk Test, Modified Ashworth Scale, and a therapist-maintained functional mobility log covering transfers, indoor walking, turning, stair activity, and household participation.

Results: At the end of six weeks, the patient demonstrated measurable improvement in lower limb motor control, standing balance, walking independence, gait speed, endurance, and confidence. The Fugl-Meyer Lower Extremity score increased from 18/34 to 27/34, the Berg Balance Scale score increased from 28/56 to 44/56, Functional Ambulation Category improved

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from 2 to 4, self-selected gait speed improved from 0.28 m/s to 0.64 m/s, Timed Up and Go reduced from 42 seconds to 24 seconds, and Six-Minute Walk distance increased from 82 m to 186 m. Qualitatively, right foot clearance, step length symmetry, turning control, and transfer independence improved.

Conclusion: The case findings indicate that structured, progressive, and task-oriented gait training can improve functional recovery after left MCA stroke. Combining preparatory postural control with repetitive walking practice helped the patient progress from assisted household ambulation to supervised independent indoor mobility with improved safety and participation.

Keywords: Left MCA stroke, gait training, functional recovery, hemiparetic gait, neurophysiotherapy, stroke rehabilitation, balance training, task-oriented training, functional ambulation.

1. BACKGROUND

Stroke is a sudden neurological event caused by interruption of cerebral blood supply or rupture of a cerebral vessel. When the left middle cerebral artery is involved, motor and sensory functions of the opposite side of the body may be affected, and many patients present with right hemiparesis. The middle cerebral artery supplies large portions of the frontal, parietal, and temporal lobes, including regions associated with voluntary movement, sensory processing, attention, language, and motor planning. As a result, a left MCA stroke may influence not only strength of the right upper and lower limb but also communication, attention to task, learning of new movement strategies, and safe mobility. Restoration of walking is therefore a major goal of physiotherapy management because gait impairment directly affects independence and reduces participation in family, occupational, and community life.

Hemiparetic gait after stroke is commonly characterized by asymmetrical step length, reduced stance duration on the affected limb, reduced push-off, limited hip and knee flexion during swing, ankle plantar flexor spasticity, poor foot clearance, circumduction, hip hiking, knee hyperextension, slow walking speed, and increased energy cost. Even when the patient can stand or take a few steps, walking may remain unsafe because the centre of mass is not transferred effectively over the paretic limb. Fear of falling further increases compensatory strategies and reduces use of the affected lower limb. Over time, decreased loading of the paretic side can lead to weakness, stiffness, learned non-use, reduced endurance, and greater dependence on caregivers.

Functional recovery after stroke depends on neural repair, neuroplasticity, cardiovascular capacity, musculoskeletal condition, cognitive ability, motivation, environmental support, and intensity of rehabilitation. Gait training uses repeated, meaningful walking-related practice to improve the coordination between posture and movement. The central nervous system learns through task specificity, repetition, feedback, error recognition, and progressive challenge. When the patient practices sit-to-stand, weight shift, stepping, stance control, foot placement, turning, and walking under safe supervision, the training addresses real mobility demands rather than isolated muscle activity alone. This is particularly important in post-stroke

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rehabilitation because gains in strength do not always translate into better walking unless practiced within functional contexts.

Gait training is not a single technique. It may include pre-gait activities, overground walking, treadmill practice, body-weight support, cueing strategies, balance training, strengthening, functional electrical stimulation, orthotic support, endurance conditioning, obstacle negotiation, and home-based walking tasks. The choice of components depends on the patient's stage of recovery, tone, range of motion, selective control, cardiovascular tolerance, cognition, speech, motivation, and safety risk. For a patient with left MCA stroke, verbal instructions may need to be short and reinforced with demonstration or visual cueing, especially if expressive or receptive language difficulties are present.

Clinical relevance of this topic is high because walking ability is often the most visible marker of recovery for patients and families. A patient who can walk to the bathroom, move inside the house, turn safely in narrow spaces, and negotiate steps with supervision experiences a substantial improvement in dignity and independence. In rehabilitation settings, functional ambulation also reduces caregiver burden and improves the possibility of discharge to home. Therefore, the present case study focuses on how a structured gait training programme influenced functional recovery in a patient with right hemiparesis following left MCA stroke.

Epidemiology and Clinical Relevance: Stroke remains one of the leading causes of long-term adult disability. Many survivors regain some degree of walking, but speed, balance, endurance, and confidence often remain below the level required for safe community ambulation. Slow gait speed is associated with reduced participation, reduced activity levels, and increased fall risk. Rehabilitation must therefore address both the capacity to walk and the quality, safety, and adaptability of walking in real-life environments.

Scope of the Study: This case study concentrates on lower limb motor recovery and functional mobility over a six-week physiotherapy programme. It evaluates the patient's baseline gait deviations, lower limb motor control, balance, transfers, gait speed, endurance, and ability to perform daily mobility tasks. The emphasis is on clinical reasoning, intervention progression, and outcome change after structured gait training.

2. CLINICAL PRESENTATION

Patient Data

The patient was a 57-year-old male who had worked as a shopkeeper and was functionally independent before the episode of stroke. He developed sudden weakness of the right side of the body, slurring of speech, and difficulty in maintaining standing balance. Medical evaluation confirmed an ischemic infarct in the left MCA territory. After acute medical management and stabilization, he was referred for physiotherapy with persistent right hemiparesis and mobility limitation. At the time of initial physiotherapy assessment, he was six weeks post-stroke and was dependent on a caregiver for outdoor mobility and required manual assistance for safe indoor walking.

The patient was conscious, oriented, and cooperative. He could understand simple commands, though expressive speech was slow and effortful. He reported heaviness in the right lower limb, inability to lift the foot properly during walking, knee locking during stance, and fear of falling

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while turning. His family reported that he avoided using the right leg during transfers and preferred to pull with the left upper limb when rising from a chair. He was able to maintain unsupported sitting but standing required close supervision. Walking was possible only with a walker and assistance from one person.

The patient's main functional limitations were slow sit-to-stand, poor weight transfer to the right lower limb, reduced right step clearance, asymmetrical step length, difficulty changing direction, inability to walk safely on uneven surfaces, and dependence while climbing stairs. He could perform basic bed mobility with minimal assistance but needed help for bathing, toileting, and household movement. His rehabilitation goal was to walk independently inside the home and to regain enough confidence to visit his nearby shop with supervision.

Inclusion Criteria Applied to the Case: first-ever unilateral left MCA ischemic stroke; subacute stage of recovery; medically stable condition; ability to sit with minimal support; ability to understand and follow simple physiotherapy instructions; presence of right hemiparetic gait; reduced functional ambulation; and willingness of patient and family to participate in regular supervised physiotherapy and home practice.

Exclusion Criteria Considered: unstable blood pressure, uncontrolled cardiac condition, severe musculoskeletal deformity, recent fracture, severe uncontrolled pain, progressive neurological disorder, severe receptive aphasia preventing participation, major visual neglect, uncontrolled seizures, and medical restriction against active gait training.

3. CLINICAL EXAMINATION AND FINDINGS

A structured neurophysiotherapy examination was performed before the start of the gait training programme. Observation in sitting showed mild trunk flexion and a tendency to lean toward the unaffected side. In standing, the patient bore more weight on the left lower limb, kept the right knee stiff, and placed the right foot slightly behind the left foot. The right arm was held close to the body and did not contribute effectively to balance reactions during standing or walking. The patient required external support when shifting weight toward the affected side.

Lower limb examination showed weakness in right hip flexors, hip abductors, knee flexors, ankle dorsiflexors, and plantar flexors. Selective movement was reduced, especially at the ankle. Mild to moderate increase in tone was present in plantar flexors and knee extensors, contributing to reduced tibial advancement and occasional knee hyperextension during stance. Passive range of motion was largely preserved, but ankle dorsiflexion was limited by gastrosoleus tightness and active dorsiflexion was poor. Sensation was mildly reduced over the right foot, especially for position awareness during foot placement.

Gait analysis revealed slow, cautious, and asymmetrical walking. The patient initiated steps with the left lower limb more confidently but hesitated when loading the right lower limb. During swing phase, the right hip was abducted and circumducted to clear the foot. The right knee showed reduced flexion during swing, and the ankle remained in slight plantar flexion. Initial contact occurred with the forefoot rather than the heel. During stance phase, the right knee moved into extension abruptly, and the patient used trunk lean and increased upper limb

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support on the walker. Turning was performed in multiple small steps and was associated with fear and loss of rhythm.

Functional assessment showed that sit-to-stand required use of both upper limbs and verbal cueing for symmetrical foot placement. Standing reach outside the base of support was limited. The patient could not safely step over a low obstacle without assistance. Stair climbing required rail support and physical assistance. The therapist identified key treatment priorities: improving midline orientation, increasing right lower limb loading, facilitating ankle dorsiflexion and knee control, practicing step initiation, improving gait rhythm, and transferring gains into household mobility.

Table 1: Baseline Demographic and Stroke Profile

Variable	**Patient Profile**	**Clinical Relevance**
Age / Sex	57 years / Male	Adult patient in the subacute phase of stroke rehabilitation
Stroke Type	Ischemic infarct in left MCA territory	Consistent with right hemiparesis and gait impairment
Affected Side	Right upper and lower limb	Walking limitation mainly due to right lower limb involvement
Hand Dominance Before Stroke	Right	Reduced confidence due to dominant-side involvement
Time Since Stroke at Evaluation	6 weeks	Subacute stage suitable for intensive functional training
Primary Mobility Complaint	Dragging of right foot and dependence in walking	Direct target for gait training intervention
Cognition / Command Following	Adequate for simple commands	Allowed task-oriented practice and feedback
Speech Status	Mild expressive difficulty	Instructions were kept short and reinforced by demonstration

Table 2: Baseline Range of Active Voluntary Movement (Affected Lower Limb)

Movement	**Normal**	**Patient Pre**	**Clinical Meaning**
Hip flexion	0-120°	0-58° active	Reduced swing initiation and step length
Hip abduction	0-45°	0-18° active	Poor lateral pelvic control and stance stability
Knee flexion	0-135°	0-62° active	Reduced swing clearance and stair difficulty

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Knee extension control	0°	Abrupt terminal extension with poor grading	Contributed to knee locking during stance
Ankle dorsiflexion	0-20°	0-4° active	Reduced heel strike and foot clearance
Ankle plantar flexion	0-50°	0-22° active	Weak push-off and reduced walking speed
Selective toe extension	Functional toe clearance	Poor and delayed	Increased tripping risk

Table 3: Muscle Tone Assessment (Modified Ashworth Scale)

Muscle Group	**Patient Pre**	**Description**	**Functional Effect**
Hip adductors	1	Slight increase in tone at end range	Mild narrowing of base during stepping
Knee extensors	1+	Catch with minimal resistance through range	Influenced stiff-knee pattern
Hamstrings	1	Mild increase in tone	Affected smooth knee movement during swing
Ankle plantar flexors	2	More marked tone through range	Reduced dorsiflexion and heel contact
Toe flexors	1+	Increased tone during effort	Affected foot placement and clearance

Table 4: Baseline Functional Gait and Mobility Measures

Outcome Measure	**Patient Pre**	**Clinical Meaning**	**Rehabilitation Priority**
FMA-LE (max 34)	18	Moderate lower limb motor impairment	Improve selective control and synergy reduction
Berg Balance Scale (max 56)	28	High fall risk and limited standing balance	Improve static and dynamic balance
Functional Ambulation Category	2	Ambulates with continuous or intermittent assistance	Progress toward supervision and independence
Ten-Meter Walk Test	0.28 m/s	Severely reduced gait speed	Increase rhythm, stance control, and step length

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Timed Up and Go Test	42 seconds	Poor transfer-turn-walk performance	Improve functional mobility and turning
Six-Minute Walk Test	82 m	Reduced walking endurance	Build safe walking tolerance
Functional mobility log (max 20)	6	Limited daily mobility use	Increase carryover into home activities

4. UNIQUE FEATURES OF THE STUDY

This case study is distinctive because it examines gait training not merely as walking practice but as a structured sequence beginning with postural preparation and progressing toward functional community-related mobility. The programme connected impairment-level findings with activity-level goals. The patient's difficulty was not limited to muscle weakness; it involved reduced weight bearing, poor timing, abnormal tone, impaired foot placement, low confidence, and poor endurance. Therefore, the intervention was organized to address the full chain of mobility: sit-to-stand, stance stability, step initiation, swing clearance, heel contact, turning, obstacle negotiation, stair practice, and household walking.

Another feature of the study is the use of multiple outcome measures that reflect different dimensions of recovery. The Fugl-Meyer Lower Extremity score captured motor control, the Berg Balance Scale reflected balance safety, Functional Ambulation Category indicated walking independence, Ten-Meter Walk Test measured speed, Timed Up and Go represented practical transfer-walk-turn ability, and Six-Minute Walk Test reflected endurance. Together, these measures allowed a broad view of functional recovery rather than relying on one score alone.

5. INVESTIGATIONS AND FINDINGS

The patient's brain imaging report documented ischemic infarction in the left MCA territory, corresponding with right-sided weakness and functional mobility limitation. No hemorrhagic transformation or unstable neurological status was noted during referral for rehabilitation. Medical records indicated that blood pressure and blood sugar levels were under medical supervision, and the patient was cleared for graded physiotherapy. There was no history of recent fracture, severe arthritis, deep vein thrombosis, or uncontrolled cardiopulmonary condition that would prevent gait training.

Musculoskeletal screening found no fixed knee or hip contracture, though right ankle dorsiflexion was limited by weakness and mild soft tissue tightness. Skin integrity was normal. The right shoulder and hand were positioned safely during standing and walking practice to prevent traction or neglect. The patient's cardiovascular response to light activity was adequate, although early fatigue required rest intervals. The family was instructed in safe assistance, proper guarding, and environmental modifications such as removal of loose rugs and use of stable footwear.

Table 5: Summary of Relevant Medical and Functional Findings

Investigation / Finding	Patient Finding	Clinical Interpretation

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Brain imaging	Left MCA ischemic infarct	Explains right hemiparesis and motor planning difficulty
Medical stability	Stable for active physiotherapy	Allowed progressive gait training
Sitting balance	Good with mild asymmetry	Adequate base for standing activities
Standing balance	Fair with fear of fall	Required supervised weight shifting and stepping
Sensation	Mild proprioceptive reduction in right foot	Needed visual cues for foot placement
Neglect / severe inattention	Absent	Task practice possible with cueing
Cardiorespiratory tolerance	Adequate with rest intervals	Endurance training progressed gradually
Musculoskeletal restriction	No major contracture or fracture	Safe for active mobility progression

6. PHYSIOTHERAPY MANAGEMENT

Physiotherapy management lasted for six weeks. The patient attended five supervised sessions per week, and each session was approximately forty-five to sixty minutes depending on fatigue and safety. The plan combined preparatory activities, task-specific gait training, balance training, strengthening, endurance conditioning, and home practice. Each session began with vital monitoring, brief review of fatigue and pain, positioning of the right upper limb, and explanation of the day's goals. Training intensity was increased only when the patient could maintain safety and adequate movement quality.

The main principle of treatment was to increase active use of the affected lower limb in meaningful mobility tasks. The therapist avoided excessive passive movement and instead encouraged the patient to actively shift weight, initiate stepping, control the knee, clear the foot, and practice walking in progressively challenging conditions. Feedback was given in simple words supported by demonstration, tactile cueing, mirror feedback, floor markers, and repetition. Family education was provided throughout so that home practice remained safe and consistent.

Phase I: Postural Preparation, Weight Bearing, and Pre-Gait Control (Week 1-2)

The first phase focused on preparing the patient for safe and symmetrical standing. Treatment included supported sitting alignment, pelvic mobility, trunk extension, lateral weight shift, reaching in sitting, and sit-to-stand with equal foot placement. The patient practiced placing the right foot slightly behind the left foot before standing to encourage loading through the affected side. The therapist provided tactile cues at the pelvis and knee to reduce collapse or excessive knee locking. Repetition of sit-to-stand was performed from a high chair and gradually from a lower surface.

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In standing, the patient practiced static weight bearing through the right lower limb while holding a stable support. Mirror feedback was used to improve midline orientation. Lateral weight shift, forward-backward weight shift, mini squats within a safe range, and stepping of the non-paretic limb were used to force controlled stance on the paretic limb. Ankle dorsiflexor activation was practiced in sitting and standing with verbal cueing and assisted movement. Heel placement drills and toe clearance practice were introduced using low markers on the floor. Short bouts of supported stepping were performed with close guarding.

The home programme during this phase included symmetrical sitting, repeated sit-to-stand with caregiver supervision, gentle ankle dorsiflexion practice, supported standing with equal weight bearing, and safe short-distance walking only with assistance. The family was told not to pull the affected arm or allow rushed walking. The patient was encouraged to focus on correct foot placement, slow weight transfer, and confidence rather than speed.

Phase II: Structured Overground Gait Training and Step Symmetry (Week 2-4)

The second phase emphasized repeated walking practice with correction of major gait deviations. Overground gait training was performed on a level surface using a walker initially and then a quad cane for selected trials. Floor markers helped the patient increase right step length and reduce asymmetry. The therapist stood on the affected side and assisted at the pelvis and knee when needed. Practice included heel contact, knee control during loading response, tibial advancement over the foot, and controlled push-off. The patient was taught to avoid excessive hip hiking and circumduction by lifting the knee and clearing the foot with improved timing.

Task-specific drills included step taps on a low block, forward stepping, backward stepping, side stepping, marching in place, and stepping over a small line. Rhythmic auditory cueing using counting was used to improve cadence when the patient became hesitant. Treadmill walking with hand support and safety guarding was introduced for short intervals to promote repeated stepping. The speed remained low and was progressed only when right foot clearance and stance control were acceptable. Rest intervals were provided to prevent fatigue-related deterioration of gait quality.

Balance activities were integrated with gait practice. The patient practiced reaching in standing, turning to both sides, picking up light objects from waist height, and walking toward functional targets such as a chair, washbasin, or doorway. The therapist gradually reduced manual assistance and increased verbal self-cueing. The patient was asked to say key cues such as “stand tall,” “load right leg,” “lift toe,” and “step forward” before walking. This self-instruction improved attention to the affected side and helped carryover into home practice.

Phase III: Functional Ambulation, Turning, Stairs, and Endurance Training (Week 4-6)

The third phase focused on functional mobility in situations closer to daily life. Walking practice was progressed from straight-line walking to turning, figure-of-eight walking, obstacle negotiation, door crossing, dual-surface walking, and supervised corridor ambulation. The patient practiced turning with small controlled steps instead of pivoting suddenly. Obstacle tasks began with low foam markers and progressed to stepping over a cane placed on the floor. The aim was to improve anticipatory balance, foot clearance, and confidence.

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Stair training was introduced using a handrail. Initially the patient practiced step-up and step-down on a single low step with therapist guarding, then progressed to a staircase with a step-to pattern. Emphasis was placed on placing the whole foot on the step, controlling the right knee, and avoiding excessive pulling with the upper limb. Endurance walking was developed through interval walking: short bouts of walking separated by seated rest, gradually increasing total walking time and distance. The patient also practiced walking while carrying a light object with the unaffected hand to simulate household activity.

At home, the patient was given a walking schedule with caregiver supervision. The programme included indoor walking on a clear path, repeated turning practice near a stable support, sit-to-stand practice, ankle movement, and functional tasks such as walking to the bathroom, dining table, and front door. By the last two weeks, the patient was encouraged to use the right lower limb actively during every transfer and to avoid dragging the foot. Family members were instructed to guard from the affected side without over-assisting.

Table 6: Summary of Intervention Content

Rehabilitation Element	Intervention Used	Clinical Purpose
Postural preparation	Sitting alignment, trunk control, pelvic mobility, mirror feedback	Improve midline orientation and prepare for standing
Sit-to-stand training	Symmetrical foot placement, repeated practice, graded chair height	Improve transfers and affected-limb loading
Weight bearing	Lateral and forward shifts, mini squats, stepping of non-paretic limb	Increase right stance stability and confidence
Ankle and knee control	Dorsiflexion activation, heel placement, knee control cues	Improve foot clearance and reduce knee locking
Overground gait practice	Floor markers, therapist guarding, cane progression, turning practice	Improve walking speed, symmetry, and safety
Treadmill walking	Short intervals with support and safety monitoring	Increase step repetition and rhythm
Balance and obstacle training	Reaching, turns, low obstacles, figure-of-eight walking	Improve adaptability and reduce fall risk
Stair practice	Step-up, step-down, rail-supported stair climbing	Promote functional household mobility
Endurance training	Interval walking with gradual distance progression	Improve walking tolerance and participation

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Home programme	Supervised walking, sit-to-stand, ankle movement, turning, daily tasks	Support carryover and self-practice

7. GOALS

Short-Term Goals

1. To improve confidence in sitting, standing, and supported walking.
2. To improve midline orientation and reduce excessive weight bearing on the unaffected lower limb.
3. To increase controlled loading through the right lower limb during sit-to-stand and stance.
4. To facilitate ankle dorsiflexion, knee control, and selective lower limb movement.
5. To reduce right foot dragging and improve safe foot placement during stepping.
6. To improve transfer performance from bed, chair, and toilet with reduced assistance.
7. To educate the family regarding safe guarding, home practice, and fall prevention.
8. To improve walking practice tolerance without excessive fatigue or deterioration in gait quality.

Long-Term Goals

9. To improve independent indoor ambulation with supervision or minimal external support.
10. To increase gait speed, step length symmetry, and walking endurance.
11. To improve dynamic balance during turning, reaching, and obstacle negotiation.
12. To improve stair negotiation with handrail support and caregiver supervision.
13. To reduce fall risk and increase confidence in household mobility.
14. To improve participation in self-care, family interaction, and simple household tasks.
15. To prevent secondary complications such as stiffness, learned non-use, deconditioning, and fear avoidance.
16. To establish a sustainable home-based walking and exercise routine after supervised therapy.

8. RESULTS

The patient completed the six-week physiotherapy programme without any adverse event. Attendance was regular, and the family was actively involved in supervised practice. During the first two weeks, the most visible changes were improved sit-to-stand control, better awareness of the right lower limb, and reduced fear during standing weight shift. By the end of the third week, the patient was able to walk short indoor distances with a quad cane and close supervision. He required fewer verbal cues for right foot placement and began to show more controlled knee movement during stance.

At the end of six weeks, improvement was observed in both impairment-level and activity-level outcomes. The patient walked with improved step length, better right foot clearance, reduced circumduction, and improved confidence during turning. He still required supervision for outdoor walking and stair climbing, but his dependence for indoor mobility reduced considerably. The family reported that he could walk from bed to chair, chair to bathroom, and within the room with less manual assistance. He also tolerated longer practice sessions with fewer rest breaks.

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Quantitative outcome measures showed clinically meaningful change. Lower limb motor control improved, balance moved from high-risk range toward moderate functional safety, gait speed increased, and endurance more than doubled. The functional mobility log reflected better participation in household tasks. Although residual deficits remained, the overall pattern suggested that task-specific gait training supported functional recovery in this patient with right hemiparesis after left MCA stroke.

Table 7: Mid-Programme and Post-Programme Lower Limb Motor Recovery

Time Point	**FMA-LE Score (max 34)**	**Clinical Observation**
Baseline	18	Moderate impairment, poor selective ankle and knee control
Week 3	23	Improved hip-knee coordination and early stance control
Week 6	27	Better selective movement and reduced synergy influence
Total Gain	+9	Functional improvement supporting walking and transfers

Table 8: Balance, Ambulation, and Functional Task Performance

Measure	**Pre**	**Post**	**Change**	**Functional Meaning**
Berg Balance Scale /56	28	44	+16	Improved standing balance and reduced fall risk
Functional Ambulation Category	2	4	+2 levels	Progressed from assisted ambulation to supervised functional walking
Functional mobility log /20	6	15	+9	Improved use of walking in daily activities
Sit-to-stand assistance	Moderate assistance	Supervision to minimal assistance	Assistance reduced	Improved transfer independence

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Turning ability	Assisted, multiple hesitant steps	Supervised, controlled steps	Better control	Improved safety during household mobility
Stair activity	Unable without major help	Step-to pattern with rail and supervision	New functional ability	Improved household stair use

Table 9: Gait Speed, Endurance, Tone, and Mobility Changes

Variable	**Pre**	**Post**	**Clinical Interpretation**
Ten-Meter Walk Test	0.28 m/s	0.64 m/s	Walking speed improved from very slow household level toward functional indoor ambulation
Timed Up and Go Test	42 seconds	24 seconds	Improved sit-stand-walk-turn performance
Six-Minute Walk Test	82 m	186 m	Marked improvement in walking endurance
Ankle plantar flexor MAS	2	1+	Tone reduced enough to improve foot placement
Knee extensor MAS	1+	1	Better control with less abrupt knee locking
Fatigue during session	Frequent rest required	Managed with planned intervals	Improved tolerance to gait practice

Table 10: Final Active Voluntary Movement and Gait Quality Comparison

Movement / Gait Feature	**Pre**	**Post**	**Clinical Interpretation**
Hip flexion active range	0-58°	0-82°	Improved swing initiation and step length
Knee flexion active range	0-62°	0-92°	Improved foot clearance and stair preparation
Ankle dorsiflexion active range	0-4°	0-12°	Improved heel contact and reduced dragging

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Right stance time	Markedly reduced	Improved but still slightly reduced	Better confidence in affected-limb loading
Step length symmetry	Poor symmetry	Moderate improvement	More efficient walking rhythm
Circumduction	Prominent during swing	Reduced with cueing	Improved selective hip-knee-ankle control
Knee hyperextension	Frequent during stance	Occasional with fatigue	Improved stance control
Assistive device use	Walker with assistance	Quad cane with supervision	Functional progression in ambulation

9. OUTCOME MEASURES

Lower limb motor recovery was measured using the Fugl-Meyer Assessment for Lower Extremity. This scale helped identify improvement in voluntary movement, coordination, and reduction of synergy-dominated patterns.

Balance was assessed using the Berg Balance Scale. The score reflected the patient's capacity to maintain positions, shift weight, turn, reach, and perform functional standing tasks safely.

Functional Ambulation Category was used to classify the level of assistance required during walking. This measure was useful because the main clinical goal was progression from assisted walking toward supervised household mobility.

Walking speed was recorded using the Ten-Meter Walk Test. Gait speed provided a practical indicator of functional ambulation and reflected changes in step length, rhythm, confidence, and lower limb control.

Functional mobility was assessed using the Timed Up and Go Test. This test represented the combined ability to stand from a chair, walk, turn, return, and sit down safely.

Walking endurance was measured using the Six-Minute Walk Test. This measure was important because the patient initially fatigued quickly and avoided walking beyond short indoor distances.

Tone was recorded with the Modified Ashworth Scale for key lower limb muscle groups. Functional carryover was documented through a therapist-maintained mobility log including transfers, walking to the bathroom, turning, obstacle clearance, stair activity, and family-reported daily mobility.

10. DISCUSSION

The findings show that structured gait training produced meaningful functional recovery in a patient with right hemiparesis after left MCA stroke. Improvement was not limited to walking distance; the patient also demonstrated better weight acceptance, step initiation, foot clearance, knee control, balance, and confidence during mobility. Early emphasis on postural alignment and affected-limb loading appeared important because the patient initially avoided the right side and relied heavily on external support. Once stance stability improved, repetitive stepping, overground walking, treadmill-assisted practice, turning, and obstacle activities helped convert

impairment gains into daily functional walking. The improvement in FMA-LE, Berg Balance Scale, Functional Ambulation Category, Ten-Meter Walk Test, Timed Up and Go, and Six-Minute Walk Test indicates recovery across motor, balance, speed, transfer, and endurance domains. The patient still required supervision for outdoor walking and stairs, suggesting that community ambulation needs longer training. However, progression from walker-assisted ambulation to supervised quad-cane walking represents an important functional change. Family participation and home practice likely strengthened carryover. This case supports the clinical value of progressive, task-oriented gait training that combines movement quality, repetition, feedback, endurance, and real-life mobility tasks.

11. LIMITATIONS OF THE STUDY

- Only one patient was included, so the findings cannot be generalized to all patients with left MCA stroke.
- The case was observed for six weeks only, and long-term retention of improvement was not measured.
- Advanced gait laboratory analysis was not used to quantify joint kinematics, ground reaction forces, or energy expenditure.
- The patient received a combined gait training programme; therefore, the isolated effect of each component cannot be determined.
- Family support and motivation were favorable and may have influenced the outcome.
- Speech difficulty was mild; results may differ in patients with severe aphasia or cognitive impairment.
- Outdoor community mobility, uneven surface walking, and dual-task walking were not fully evaluated at discharge.

12. CONCLUSION

Structured gait training improved motor control, balance, gait speed, endurance, transfers, and household mobility in a patient with right hemiparesis following left MCA stroke. Progressive practice from postural control to functional walking helped reduce assistance needs. Continued supervised community-based training is recommended for further recovery.

13. FUTURE SCOPE OF THE STUDY

Future studies should include larger groups of patients with MCA stroke and compare different gait training strategies such as overground training, treadmill training, body-weight-supported treadmill training, robotic-assisted gait training, functional electrical stimulation, and task-oriented circuit training. Stratification by stroke severity, age, lesion location, aphasia, spasticity, baseline walking ability, and cardiovascular tolerance would help clinicians choose more individualized treatment plans.

Long-term follow-up is required to determine whether short-term improvements in gait speed, balance, and endurance are retained after discharge. Community ambulation should be assessed using outdoor walking distance, uneven surface negotiation, road crossing confidence, stair independence, fall incidence, and participation scales. Wearable sensors and video-based gait analysis may provide objective information about step symmetry, cadence, stance time, and daily step count.

Further research should also examine the role of family-supervised home programmes. In many rehabilitation settings, supervised therapy time is limited, and home carryover may strongly influence outcome. Structured caregiver training, written walking schedules, safety checklists, and tele-rehabilitation follow-up may improve continuity of gait rehabilitation. Hybrid protocols combining impairment-based preparation with high-repetition functional mobility practice may offer the most practical approach for improving walking after stroke.

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