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Synergistic Effects of 1 Hz Low Frequency rTMS Priming and Familiar Place Based Visual Cues During Robot Assisted Gait Training in Patients after Stroke: Two Case Reports

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This study investigated the effects of a multimodal intervention on spatiotemporal gait parameters and mobility outcomes in patients with subacute stroke. Using a three-phase, single-case design, two participants (6–12 months after onset) received robot-assisted gait training with Angel Legs M20 and 1 Hz low frequency repetitive transcranial magnetic stimulation to the contralesional primary motor cortex as a priming procedure, with Participant 2 additionally receiving familiar place-based visual cues. Cadence, gait speed, and step length were assessed alongside the Berg Balance Scale, Timed Up and Go test, and Functional Ambulation Category. Incorporation of familiar place-based visual cues was associated with improved cadence (42.33 ± 0.58 to 65.00 ± 0.00 steps/min; Δ = +53.5%) and gait speed (0.353 ± 0.006 to 0.540 ± 0.000 m/s; Δ = +52.9%), without altering the step length (Δ = −0.6%). These enhancements were accompanied by modest but clinically meaningful improvements in balance and functional mobility. These findings support further research into its applicability for community ambulation.

Keywords : repetitive transcranial magnetic stimulation, post-stroke rehabilitation, robot-assisted gait training, familiar place based visual cues, 1 Hz low frequency rTMS

1. Introduction

Cerebrovascular disease is a major cause of long-term disability, limiting community participation through gait disturbances and balance impairments and causing difficulty in performing daily activities. Gait dysfunction is a primary determinant of disability in activities of daily living [1]. In the era of the Fourth Industrial Revolution, rehabilitation paradigms have evolved beyond simple movement induction and the optimization of task-specific practice intensity toward maximizing the transfer of functional gains to real-world ambulation by integrating neuroplasticity-oriented interventions with advanced technologies [2]. Robot-assisted gait training (RAGT) delivers high-intensity, high-repetition, and task-specific stepping with adjustable body weight support and quantitatively controlled guidance (force/trajectory). This approach facilitates precise optimization of the therapeutic dosage (intensity × frequency × duration), which is difficult to achieve with conventional care [3]. The standardized framework of RAGT has been associated with improvements in walking independence, gait speed, and walking distance [4]. Furthermore, RAGT supports phase-specific retraining of joint–muscle coordination (e.g., ankle dorsiflexion, knee flexion, and hip extension) through assist-as-needed control across the gait cycle (stance/swing). Real-time, indexed feedback including knowledge of performance/results and symmetry metrics (step-time/step-length ratios) fosters error-based learning and systematic correction strategies [4, 5]. Consequently, RAGT allows more precise therapeutic dosing, which remains challenging to achieve through therapist-led gait training alone in conventional rehabilitation settings [5]. Prior studies have indicated that RAGT provides phase-specific assistance (stance/swing) for the targeted retraining of joint motion and muscle patterns such as ankle dorsiflexion, knee flexion, and hip extension based on patient-specific needs [6]. In addition, robotic systems can

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analyze individual gait patterns and deliver real-time feedback, including symmetry indices, knowledge of performance/results, thereby enhancing the efficiency and precision of gait training [7, 8]. RAGT also facilitates early upright positioning and gait practice for patients with acute stroke and those requiring substantial support during gait training, reducing the risk of falls and ensuring the safe clinical applications [3, 9]. Nonetheless, RAGT presents with inherent limitations. Contemporary RAGT systems predominantly rely on treadmill and guidance based devices, which reduce ecological validity and restrict contextual transfer to real-world ambulation an environment that involves irregular surfaces, obstacle negotiation, dual task demands, and multimodal sensory inputs. Moreover, excessive mechanical guidance can dampen voluntary movement. Recently, noninvasive transcranial magnetic stimulation (TMS), when integrated with robotic therapy, has emerged as a neuromodulatory strategy capable of addressing these limitations. Repetitive TMS (rTMS), a noninvasive variant of TMS, modulates interhemispheric imbalances between the lesioned and contralesional hemispheres, thereby facilitating motor relearning, functional recovery, and neuroplasticity after stroke [10]. Prior studies have reported that rTMS is associated with significant improvements in upper limb function, gait speed, balance, and activities of daily living, with greater treatment responsiveness frequently observed during the subacute phase (≤ 6 months post-stroke) [11]. The therapeutic effects of rTMS during rehabilitation depend on factors such as the stimulation site, frequency, and intensity. Strategically, low frequency (≤ 1 Hz) rTMS applied over the contralesional primary motor cortex (M1) reduces excessive transcallosal inhibition, thereby restoring cortical excitability in the lesioned hemisphere. When used as priming prior to motor task practice, it has been reported to increase the motor evoked potential (MEP) amplitude, shorten MEP latency, enhance corticospinal excitability, and improve motor performance [12]. These benefits extend to the gait domain, where contralesional low frequency protocols have been suggested to yield significant gains in gait speed and balance [13, 14]. Modern neurorehabilitation must advance beyond increasing the capacity for repetitive, identical movements through robotic therapy and confining gait practice to clinical settings. Instead, it should emphasize strategies that strengthen motivation, reinforce task-oriented approaches, and enhance perception action pathways necessary for real world ambulation. In this context, gait training incorporating virtual reality and augmented reality has been reported to deliver individualized, task-oriented practice while increasing immersion and motivation through visual feedback [15]. Accordingly, this study aimed to evaluate the effects of integrating familiar, environment related visual cues represented by neighborhood-specific walking videos into RAGT to facilitate the transfer of learned movements to real-world walking and enhance motor relearning. Specifically, this multimodal approach aims to pair corticomotor prim in (1 Hz low frequency rTMS) with context relevant visual information to strengthen perception–action coupling and motivation during high-repetition, task-specific training with the Angel Legs system, thereby promoting the transfer of gait patterns to real-world ambulation.

2. Materials and Methods

2.1. Participants

The subacute phase was defined as 6–12 months after the onset of stroke, and two patients with cerebrovascular disease within this period were enrolled in the study. Participant 1 was a 64-year-old male (onset: December 30, 2024), 173 cm in height and weighing 80 kg, who presented with right hemiparesis secondary to a subdural hematoma in the left temporoparietal cortex. Participant 2 was a 52-year-old male (onset: December 25, 2024), 177 cm in height and weighing 75 kg, who exhibited right hemiparesis resulting from a left basal ganglia intracerebral hemorrhage accompanied by subarachnoid hemorrhage. This study was conducted at the C Rehabilitation Hospital in Seoul, Republic of Korea. The inclusion criteria of this study were as follows: Adults with cerebrovascular disease (ischemic or hemorrhagic) presenting with unilateral hemiparesis. Time since onset: 6–12 months. Sufficient cognitive capacity for following instructions: Mini-Mental State Examination ≥ 24. Eligibility for TMS: ability to safely undergo rTMS and establish a resting motor threshold. Eligibility for robotic gait therapy: ability to train safely with body-weight support within the device. Functional ambulation level compatible with robotic training (e.g., Functional Ambulation Category [FAC] score: 2–4). The exclusion criteria included the following: Contraindications to TMS (e.g., history of epilepsy, seizures, or magnetic intracranial implants). Conditions precluding safe robotic gait training (e.g., severe lower limb contracture or uncontrolled pain, marked spasticity that prevents device fit, and height/weight outside the device limits).

2.2. Intervention

A single-case, repeated-measures A–B–A′ design was employed, comprising three phases: Baseline (A), Intervention (B), and Follow-up (A′). The Baseline phase included at least three assessments to establish within-participant stability. The intervention phase spanned 3 weeks, and the Follow-up phase was conducted 2 weeks after the intervention to evaluate short-term retention. Participant 1 underwent robotic gait training using the Angel Legs M20 system combined with 1 Hz low frequency rTMS. Participant 2 received the same robotic gait training and 1 rTMS protocol, with the addition of familiar place-based visual cues. These intervention components constituted the independent variables. Visual cues were administered immediately before and during the robot-assisted walking sessions. In accordance with the rehabilitation prescription, both participants received identical interventions comprising 30 min of RAGT and 20 min of 1 Hz low frequency rTMS per session.

2.2.1. Angel Legs M20 device

The Angel Legs M20 system (Angel Robotics Inc.) provides device-embedded spatiotemporal metrics during overground exoskeleton sessions (Fig. 1). It is a wearable robotic exoskeleton designed to assist lower-body movement by supporting the waist, hip joints, and knee joints, thereby improving muscle strength and mobility [16, 17]. Unlike treadmill-based systems, Angel Legs M20 delivers assist-as-needed, torque-assisted stepping during overground walking. According to the manufacturer, Angel Legs M20 supports the entire lower limb during gait rehabilitation [17]. Depending on the training goals and functional status of the participant, various training modes on the Angel Legs M20 system were selected and applied, including weight-bearing and weight-shifting training, prolonged standing, endurance training, repetitive sit to stand practice, stair-climbing training, and level walking. Donning of the exoskeleton was performed by a robot-trained physical therapist, who adjusted the pelvic width, depth, and thigh and shank lengths to match the participant's body dimensions. The therapist assisted the participants in donning the device and verified proper joint alignment between the participant and the robot. During each session, the therapist selected the level-walking mode and initiated motion analysis. In this study, spatiotemporal gait parameters walking speed (m/s), step count, session duration (min), and assistance mode/level were recorded during RAGT. Data were obtained from the motion analysis report of the device. All records were collected using the Angel Legs M20 system for both participants, ensuring consistency.

2.2.2. rTMS

To attenuate post-stroke interhemispheric imbalance, 1 Hz low frequency rTMS was applied to the contralesional M1. Specifically, 1 Hz stimulation was employed as an inhibitory protocol intended to attenuate excessive trans-callosal inhibition from the non-paretic hemisphere, thereby facilitating excitability of the ipsilesional corticospinal tract during subsequent gait training [18]. rTMS was delivered using a MagPro R30 stimulator (MagVenture, Denmark), which enables precise control of the stimulation frequency, train structure, and output intensity to modulate corticospinal excitability (Fig. 2). A standard figure-of-eight coil was positioned tangentially to the scalp, with the handle oriented posterolaterally to target the leg representation area of M1. Both participants were seated comfortably in a chair or on a bed with trunk support and instructed to remain fully relaxed throughout stimulation. Their heads were stabilized to minimize

Fig. 1. (Color online) Photograph of the Angel Legs M20 system.

Fig. 2. (Color online) Photograph showing the transcranial magnetic stimulation device.

motion, and their upper limbs were positioned alongside the torso with the forearms pronated. Low frequency rTMS was delivered to the contral lesional M1 at a frequency of 1 Hz and an intensity of 120% of the resting motor threshold (RMT) [19]. Stimulation was administered for 20 min as a priming intervention immediately before RAGT. Coil stability and relaxation were continuously monitored, and the session was paused in case of any discomfort or adverse effects [19].

2.2.3. Familiar-Place-Based Visual Cues (Neighborhood-Specific Video)

2.2.3.1. Experimental Intervention (Independent Variable)

The independent variable in this study was the use of familiar place-based visual cues presented through neighborhood-specific walking videos played during RAGT (Fig. 3).

For Participant 2, the intervention consisted of (i) contralesional low frequency rTMS (1 Hz, 20 min, 120% RMT) administered immediately prior to gait training as a priming procedure to facilitate excitability of the lesioned hemisphere and (ii) concurrent presentation of 4K walking footage depicting the participant's neighborhood while training with the Angel Legs M20 wearable overground exoskeleton. The visual cues were designed to enhance task engagement and ecological validity, providing a clinical experience that approximates community ambulation. The videos were displayed at eye level in front of the overground path. The audio was muted to minimize distractions. Prior to use, the footage was reviewed to remove any identifying information (faces and license plates). Symptoms—including dizziness, nausea, and headache were monitored, with testing immediately discontinued upon the onset of moderate symptoms (Fig. 3).

2.3. Assessment Methods

2.3.1. Berg Balance Scale (BBS)

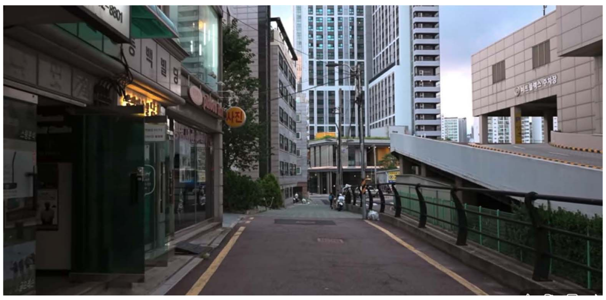

Fig. 3. (Color online) Familiar place-based visual cues (neighborhood-specific videos).

Balance was assessed using the 14-item BBS. It is one of the most commonly used clinical assessment tools for evaluating both static and dynamic balance in patients with stroke [20]. Assessments were conducted in a quiet physical therapy room with a non-slip floor using the same standard armless chair (seat height: 43-45 cm). A physical therapist administered the BBS by following standard instructions from the official manual. Each item was attempted up to two times, and the higher score was recorded. During testing, the therapist maintained a protective anterolateral guarding position on the weaker side and intervened as necessary to prevent loss of balance. Items were rated on a scale of 0–4 (0 = unable/ unsafe; 4 = independent with criteria met), and the total score was summed to yield a value between 0 and 56. In patients with stroke, the BBS demonstrates excellent interrater and test–retest reliability. Interrater reliability has been consistently found to be excellent in neurological/stroke cohorts, with intraclass correlation coefficients (ICC) values ≥0.90 [20].

2.3.2. Functional Ambulation Category (FAC)

Ambulatory independence was indexed using the FAC. The FAC is a six-level ordinal scale (0-5) used to quantify the degree of human assistance required for safe ambulation. In this study, walking independence was assessed using the FAC. The two participants walked 15 m along a flat walkway in the treatment area, while a therapist provided guarding and manual assistance only when necessary. Scoring followed the standard descriptors and reflected the lowest level of independence required to ensure safety. The FAC is an appropriate measure of independent walking in patients with neurological conditions and serves as a practical clinical decision-making tool for guiding stepwise progression toward community ambulation after discharge. FAC has demonstrated excellent interrater (κ=0.905) and test–retest (κ=0.950) reliability in stroke cohorts, with modified FAC studies reporting high ICCs ranging from 0.98–0.99 [21, 22].

2.3.3. Timed Up and Go (TUG) Test

Functional mobility in patients with stroke was assessed using the TUG test on a 3-m walkway, employing a standard chair with armrests (seat height: 46 cm). Following one practice trial, two timed trials were performed under the supervision of a physical therapist. The time was measured from "Go" to back-contact with the backrest, and the mean time (seconds) was analyzed. The TUG test is widely utilized in neurological rehabilitation as a brief index of mobility, balance, and fall risk [23]. It demonstrates excellent reliability in patients with stroke. In those with chronic stroke, test–retest reliability is typically under standardized conditions (ICC > 0.95) [24].

2.3.4. Spatiotemporal gait parameters (Angel Legs M20)

For both participants, the cadence, step length, and gait speed were derived from device-embedded logs of the Angel Legs M20 wearable lower-limb robot during gait training conducted under therapist supervision. The same device was used across all sessions by both participants, with footwear and fit parameters maintained constant. Raw data were exported and summarized using Windows.

2.4. Statistical Analysis

In a single-case design with two participants, results were plotted in an A–B–A′ sequence and summarized using phase-specific means and standard deviations. The visual analysis focused on phase-specific levels and trends, between-phase level changes, and variations in slope across phases.

3. Results

3.1. Comparison of cadence between the two participants

Participant 1 exhibited a slight increase in cadence from baseline (52.33 ± 0.58) to post-test phase A′ (54.00 ± 0.00), with a change of Δ = +1.67 steps/min (+3.2%). The intervention-phase mean was 55.00 ± 1.58, indicating a modest upward shift during phase B with partial retention at A′. Participant 2 demonstrated a marked improvement from 42.33 ± 0.58 (baseline) to 65.00 ± 0.00 at A′ (Δ= +22.67; +53.5%). An intervention phase mean of 57.44 ± 8.41 reflected an early positive shift accompanied by elevated variability, followed by stabilization during the A′ phase (Table 1, Fig. 4).

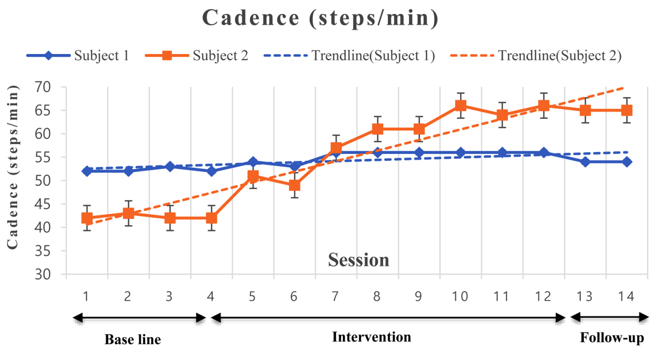

Fig. 4. (Color online) Comparison of cadence (steps/min) between the two participants.

3.2. Comparison of Gait Speed

Participant 1 demonstrated an increase in gait speed from 0.433 ± 0.006 at baseline to 0.450 ± 0.000 at A′ (Δ = +0.017 m/s; +3.9%), with an intervention-phase mean of 0.453 ± 0.011, indicating a modest improvement. Participant 2 showed a notable improvement from 0.353 ± 0.006 at baseline to 0.540 ± 0.000 at A′ (Δ = +0.187 m/s; +52.9%). The intervention-phase mean (0.480 ± 0.069) reflected a substantial positive shift with some dispersion, followed by consolidation during the A′ phase (Table 2, Fig. 5).

3.3. Comparison of Step Length

No statistically significant difference in step length was observed across phases for Participant 1 (baseline: 0.497

Table 1. Comparison of cadence (steps/min) between the two participants following RAGT combined with 1 Hz low frequency rTMS.

Participant	Pre-test (Sessions 1–3)	Intervention (Sessions 4–12)	Post-test (Sessions 13–14)	Δ (Post–Pre)	Δ% (Post vs. Pre)
#1	52.333 ± 0.577	55.000 ± 1.581	54.000 ± 0.000	1.667	3.2%
#2	42.333 ± 0.577	57.444 ± 8.413	65.000 ± 0.000	22.667	53.5%

Values are expressed as means ± standard deviation; Δ represents the absolute difference between post- and pre-test values; Δ% indicates the percentage change relative to the pre-test, RAGT: robot-assisted gait training.

Table 2. Comparison of gait speed (m/s) between the two participants following RAGT combined with 1 Hz low frequency rTMS.

Participant	Pre-test (Sessions 1–3)	Intervention (Sessions 4–12)	Post-test (Sessions 13–14)	Δ (Post–Pre)	Δ% (Post vs. Pre)
#1	0.433 ± 0.006	0.453 ± 0.011	0.450 ± 0.000	0.017	3.9%
#2	0.353 ± 0.006	0.480 ± 0.069	0.540 ± 0.000	0.187	52.9%

Values are expressed as means ± standard deviation; Δ represents the absolute difference between post- and pre-test values; Δ% indicates the percentage change relative to the pre-test, RAGT: robot-assisted gait training.

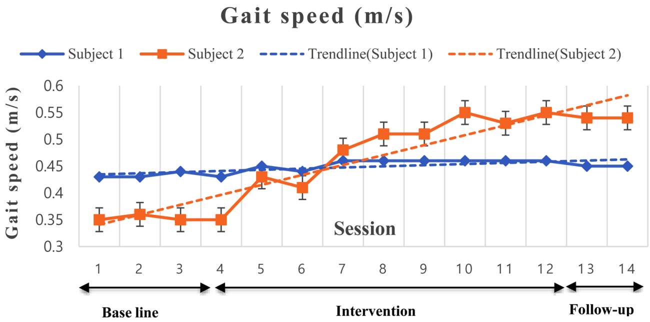

Fig. 5. (Color online) Comparison of gait speed (m/sec) between the two participants.

± 0.001 to A′: 0.500 ± 0.000; Δ = +0.003, +0.6%). The intervention-phase mean was 0.495 ± 0.003. Participant 2 exhibited only a trivial net change (0.501 ± 0.001 to 0.498 ± 0.000; Δ = −0.003, −0.6%) (Table 3, Fig. 6). These findings suggest that speed enhancement is predominantly

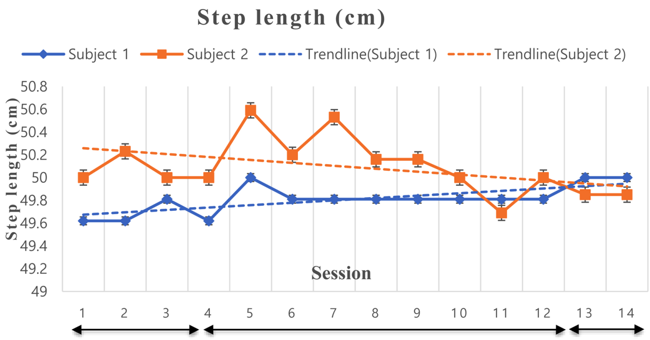

Fig. 6. (Color online) Comparison of step length (cm/step) between the two participants.

linked to cadence rather than step length.

3.4. Comparison of Clinical Outcomes

Both participants demonstrated improvements in balance (BBS: +3 and +2 points) and reductions in functional mobility time (TUG: −2 s for each), while ambulatory independence (FAC) remained unchanged (Table 4, Figs. 7–9).

4. Discussion

In this study, two participants after stroke were evaluated

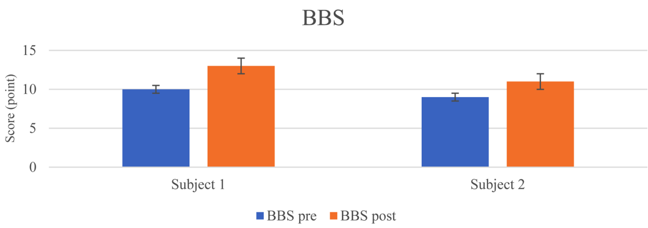

Fig. 7. (Color online) Comparison of Berg Balance Scale (BBS) scores between the two participants.

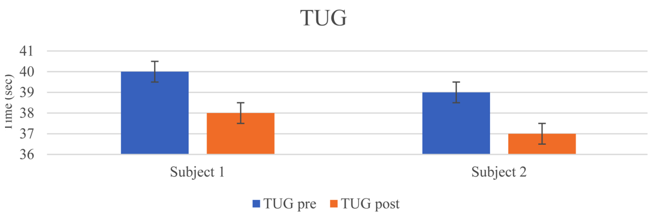

Fig. 8. (Color online) Comparison of Timed Up and Go (TUG) test scores between the two participants.

Table 3. Comparison of step length (m/step) between the two participants following RAGT combined with 1 Hz low frequency rTMS.

Participant	Pre-test (Sessions 1–3)	Intervention (Sessions 4–12)	Post-test (Sessions 13–14)	Δ (Post–Pre)	Δ% (Post vs. Pre)
#1	0.497 ± 0.001	0.495 ± 0.003	0.500 ± 0.000	0.003	0.6%
#2	0.501 ± 0.001	0.502 ± 0.003	0.498 ± 0.000	−0.003	−0.6%

Values are expressed as means ± standard deviation; Δ represents the absolute difference between post- and pre-test values; Δ% indicates the percentage change relative to the pre-test, RAGT: robot-assisted gait training.

Table 4. Comparison of pre–post changes in clinical outcomes between the two participants following RAGT combined with 1 Hz low frequency rTMS.

Outcome	Scale / Unit	Participant 1 (Pre)	Participant 1 (Post)	Δ	Participant 2 (Pre)	Participant 2 (Post)	Δ
BBS	0–56 (score)	10	13	+3	9	11	+2
TUG	Seconds	40	38	-2	39	37	-2
FAC	0–5 (ordinal)	2	2	0	2	2	0

Δ represents the absolute difference between post- and pre-test values.
BBS; berg balance scale, TUG: timed up and go test, FAC: functional ambulation category, RAGT: robot-assisted gait training, rTMS: repetitive transcranial magnetic stimulation.

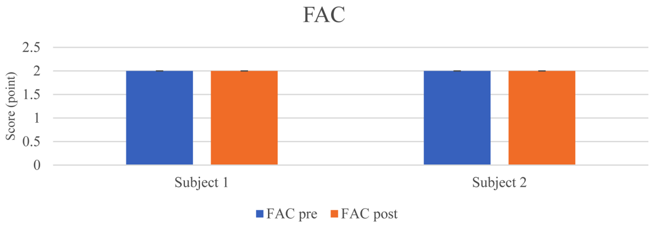

Fig. 9. (Color online) Comparison of Functional Ambulation Category (FAC) scores between the two participants.

using a single-case, repeated-measures A–B–A′ design (Baseline–Intervention–Follow-up). RAGT (Angel Legs M20) was combined with 1 Hz low frequency rTMS, with Participant 2 additionally receiving familiar place-based visual cues. This study aimed to determine whether incorporating familiar, place-based visual information into RAGT combined with 1 Hz low frequency rTMS could improve balance, functional gait ability, and ambulatory performance outcomes in post-stroke rehabilitation [25, 26]. In the context of the Fourth Industrial Revolution in rehabilitation, robotic therapy has emerged as one of the most widely implemented and effective interventions for patients with gait disorders following brain injury. In particular, the Angel Legs M20 robotic system provides real-time computation of device-embedded spatiotemporal metrics during training, enabling quantitative verification of gait performance and training fidelity. In this study, Participant 2 demonstrated notable benefits consistent with task specificity when robotic therapy was combined with low frequency rTMS. The addition of familiar place-based visual scenes—such as those depicting the participant's neighborhood or hospital surroundings—appeared to strengthen perception action coupling, facilitating the transfer of in-device gait practice to motor learning in ecologically valid contexts. Among the two cases, the multimodal intervention implemented for Participant 2, combining contralesional 1 Hz low frequency rTMS with familiar place-based visual cues during wearable RAGT using the Angel Legs M20, was associated with increased cadence and gait speed without changes in step length. This pattern is interpreted as a speed gain driven primarily by temporal modulation namely, tempo and cadence rather than spatial scaling such as stride or step length, aligning with an external attentional focus and an ecologically enriched training context [27]. First, the foundational platform of RAGT provides standardized, high-repetition, task-specific stepping and is supported by moderate to high quality evidence for improving walking post-stroke, particularly when an adequate stepping dose is achieved and implemented in the early recovery phase. Recent reviews have concluded that integrating the use of electromechanical or robotic devices into physiotherapy can increase the likelihood of regaining independent walking and enhance walking capacity outcomes in selected patients with stroke [28]. Second, contralesional 1 Hz rTMS serves as a priming technique designed to reduce excessive interhemispheric inhibition and facilitate corticospinal excitability in the lesioned hemisphere prior to task practice. In the present study, the combination of RAGT with familiar place-based visual cues and 1 Hz low frequency rTMS applied to the contralesional (less affected) hemisphere yielded clear benefits [28, 29]. We confirmed improvements in gait-related outcomes and balance, including increased cadence and gait speed, as well as higher BBS and FAC scores. Third, familiar place–based visual cues likely enhanced external focus of attention, engagement, and perception–action coupling during stepping. Evidence for virtual reality or immersive training and ecologically valid training environments in post-stroke gait rehabilitation indicates gains in gait performance, functional mobility, balance, and even gait symmetry compared to conventional training [30]. Prior research suggests that task-relevant visual information enhances prediction, imitation, and motor planning, thereby strengthening perception–action coupling and supporting anticipatory postural control during gait [31]. Within this framework, visual cueing tends to modulate tempo parameters (cadence) while constraining step-length scaling, resulting in faster gait with minimal change in step length. Ecologically framed cues may further enhance feed-forward control for turning and obstacle negotiation and may help avoid wrong judgement strategies, such as overextended steps. For patients with subacute stroke, a visuomotor neuromotor sequence (1 Hz rTMS priming followed by RAGT with familiar place based visual cues) is a viable strategy for enhancing cortical motor excitability, maintaining high gait speed under standardized support, and providing familiarity based visual information, and increasing motivation. Nevertheless, in the present study, functional transfer indexed by the FAC showed improvement following RAGT augmented by familiar place-based visual cues.

However, the limitations of this study should be acknowledged. Because the study included only two participants, these results cannot be generalized. Potential confounding factors included lesion topography, cortico-spinal tract integrity, baseline disparities, and within-device parameter adjustments (speed, guidance/impedance, and body weight support). Future research should adopt a comparative design including (a) RAGT alone, (b) rTMS

+ RAGT, (c) visual cueing + RAGT, and (d) rTMS + visual cueing + RAGT, with neurophysiological endpoints such as the MEP amplitude and latency to delineate the underlying mechanisms.

5. Conclusion

This two-participant, single-case, A–B–A′ study contrasted two intervention protocols: (i) 1 Hz low frequency rTMS combined with wearable RAGT and (ii) the same protocol augmented with familiar place-based visual cues. Compared with the control participant (#1), the participant (#2) who received intervention (ii) demonstrated increases in cadence and gait speed, with only minimal changes in step length. Functionally, both participants demonstrated improvements on the BBS (+3 and +2 points) and reduced TUG times (−2 s each), while FAC scores remained unchanged. These findings suggest that combining rTMS, familiar-place-based visual information, and RAGT may facilitate motor learning and facilitate the transfer of gait improvements to real world settings in post stroke rehabilitation.

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