LINK MEDICAL JOURNAL
of Health and Community Research | LMJHCR
Volume 4, Issue 1 | June 2026 | ISSN 3007-3448

Indexed in DOAJ | CC BY 4.0
DOI: 10.61919/r0bbda07

Original Article

Effects of Two Different Modes of Task Practice with Upper-Limb Constraint-Induced Movement Therapy in People with Stroke: A Randomized Controlled Trial

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"Cite this Article" | **Received**: 06 February 2026; **Accepted**: 01 May 2026; **Published**: 30 June 2026.

ABSTRACT

Background: Constraint-induced movement therapy is used to improve upper-limb recovery after stroke, but conventional protocols may be difficult to implement because they often require prolonged treatment duration and intensive therapist supervision. Repetition-based dosing may provide a clearer and more practical method for prescribing task-specific CIMT practice. Objective: To compare the effects of duration-based and repetition-based upper-limb CIMT on motor activity, motor function, motor impairment, and upper-limb self-efficacy in people with stroke. Methods: This single-center randomized controlled trial included 70 participants with ischemic or hemorrhagic stroke within four weeks of onset. Participants were randomized into Group A, which received duration-based CIMT, and Group B, which received repetition-based CIMT. Group A performed three hours of shaping practice per day, while Group B completed 300 shaping repetitions per day in three sessions. Outcomes were assessed at baseline, week 2, and week 4 using the Motor Activity Log, Wolf Motor Function Test, Fugl-Meyer Assessment, and Upper Limb Self-Efficacy Test. Non-parametric tests were used because baseline outcome data were not normally distributed. Results: Both groups showed significant within-group improvement across all outcomes over four weeks. Between-group rank analysis favored repetition-based CIMT for Wolf Motor Function Test, Fugl-Meyer Assessment, and Upper Limb Self-Efficacy Test outcomes, with the strongest effects observed for Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test. Conclusion: Repetition-based CIMT produced stronger improvement in upper-limb motor impairment, functional performance, and self-efficacy than duration-based CIMT and may provide a practical alternative for post-stroke upper-limb rehabilitation.
Keywords: Constraint-induced movement therapy, stroke rehabilitation, upper limb, task practice, motor function, Fugl-Meyer Assessment, self-efficacy.

EDITORIAL INFORMATION

Author Contributions: Concept: CQ; Design: CQ and S; Data Collection: CQ, S, and W; Transcription and Translation Oversight: S and W; Coding and Analysis: CQ and S; Interpretation: CQ, S, and W; Drafting: W; Critical Revision and Final Approval: CQ, S, and W.
Ethical Approval: Universitas Prima Indonesia
Informed Consent: Written informed consent was obtained from all participants
Conflict of Interest: The authors declare no conflict of interest; **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: N/A.

INTRODUCTION

Stroke is a major cause of long-term neurological disability and frequently results in sensory, motor, and cognitive impairments that restrict functional independence. Upper-limb motor impairment is particularly disabling because activities of daily living depend heavily on coordinated arm and hand function, including reaching, grasping, feeding, dressing, writing, and self-care tasks. Constraint-induced movement therapy has been developed as a rehabilitation approach to improve use of the affected upper limb by reducing learned non-use and promoting task-specific motor recovery after stroke (1). Motor relearning after neurological injury is supported by principles of motor control and motor learning, in which repeated, goal-directed practice helps the nervous system organize and refine movement patterns (2). Recovery of movement after stroke is also influenced by interactions between spinal and supraspinal control mechanisms, which are essential for restoring functional motor output during rehabilitation (3). Because stroke can compromise voluntary motor command, especially in the upper extremity, structured rehabilitation strategies that promote repeated use of the paretic limb are clinically important for improving post-stroke function (4).

Neuroplasticity provides the biological foundation for task-oriented rehabilitation after stroke. It refers to the capacity of neural circuits to reorganize in response to experience, practice, learning, and injury, thereby supporting functional recovery when rehabilitation is delivered with sufficient intensity and specificity (5). Constraint-induced movement therapy is grounded in this concept and typically includes intensive task practice or shaping of the affected limb, restriction of the less-affected limb, and behavioral strategies intended to transfer gains into daily life. Among these components, shaping practice and restraint of the less-affected limb are considered central to the therapeutic effect because they directly encourage active use of the impaired upper extremity during functional tasks (6). Previous evidence has shown that modified CIMT can improve motor outcomes after stroke, including changes in movement performance and functional use of the affected limb in clinical and real-life settings (7).

The conceptual origin of CIMT can be traced to experimental work on forced use after deafferentation, which later informed clinical rehabilitation strategies for patients with stroke (8). Subsequent clinical applications demonstrated that structured intensive practice could help improve motor control in individuals with hemiparesis after stroke (9). CIMT has since evolved into a broader family of rehabilitation techniques that share the common principle of increasing purposeful use of the affected limb while reducing compensatory reliance on the less-affected limb (10). Intensive practice approaches have also been explored in post-stroke rehabilitation more broadly, supporting the principle that repeated functional practice can influence motor performance and recovery trajectories (11). In patients with chronic stroke, modified CIMT protocols have shown beneficial effects on upper-limb function, supporting the clinical value of adapting CIMT intensity and duration to improve feasibility while maintaining therapeutic benefit (12).

Despite its therapeutic potential, conventional CIMT can be difficult to implement in routine clinical settings because many protocols require prolonged daily practice and extended restraint of the less-affected limb. Patients may be asked to perform shaping or task practice for 0.5 to 6 hours per day, with restraint applied for up to 90% to 95% of waking hours, depending on the protocol. Such requirements may be resource-intensive for therapists, demanding for patients, and difficult to sustain in busy rehabilitation settings where staff availability, cost, and patient tolerance are important constraints (13). Multisite clinical experience has also shown that adherence to CIMT protocols can vary, raising concerns about whether time-based dosing accurately reflects the actual therapeutic dose received by patients (14).

A key unresolved issue in CIMT dosing is whether the number of hours spent in therapy is the most appropriate way to define treatment intensity. Time-based protocols do not necessarily indicate how many meaningful task repetitions the patient performs, and two patients may complete very different amounts of active practice within the same treatment duration. Repetition-based dosing may therefore provide a more precise and clinically practical method for prescribing CIMT because it directly quantifies the amount of task-specific practice performed. Prior literature has suggested that modified CIMT protocols using shorter durations may still be effective, and that actual repetition count may be more relevant to motor recovery than total therapy time alone (15). Experimental and human motor learning literature also supports the importance of repeated practice, with reported practice doses varying widely from relatively low to very high repetition ranges depending on the task, population, and rehabilitation context (16).

The present study was designed to address this practical dosing question in people with recent stroke by comparing two modes of upper-limb CIMT practice: a time-based shaping protocol and a repetition-based shaping protocol. The population of interest was individuals with ischemic or hemorrhagic stroke within four weeks of onset who had residual upper-limb motor impairment but retained sufficient motor capacity to participate in task-based training. The intervention comparison focused on whether CIMT prescribed by a defined number of shaping repetitions could produce better motor function, motor impairment, and upper-limb self-efficacy outcomes than CIMT prescribed by daily hours of shaping practice. Therefore, the objective of this randomized controlled trial was to compare the effects of time-based versus repetition-based upper-limb CIMT on Motor Activity Log performance, Wolf Motor Function Test performance, Fugl-Meyer Assessment scores, and Upper Limb Self-Efficacy Test scores in people with stroke.

MATERIAL AND METHODS

This study was conducted as a single-center, single-blinded, randomized controlled trial at the Physical Therapy Department of Bakhtawar Amin Trust Teaching Hospital, Multan, Pakistan, over a period of nine months after approval from the Ethical Committee of the University of Lahore under approval number REC-UOL-FAHS/902/2024. The study compared two dosing approaches for upper-limb constraint-induced movement therapy in people with stroke: a time-based shaping practice protocol and a repetition-based shaping practice protocol. Participants were recruited using a non-probability purposive sampling approach according to predefined eligibility criteria and were subsequently allocated randomly into two treatment groups using a computer-generated random number method.

The sample size was calculated on the basis of motor impairment as the main outcome. The calculation indicated that 29 participants were required in each group to detect a difference in motor impairment between the two CIMT protocols. After allowing for a 20% dropout rate, the required sample size was increased to 35 participants per group, giving a total sample of 70 participants. Eligible participants included male and female patients aged more than 15 years who had ischemic or hemorrhagic stroke within the previous four weeks. Participants were required to have no significant impairment of motor function as indicated by a score of 1 to 3 on the motor arm item of the National Institutes of Health Stroke Scale and a score of 3 or above on the upper-arm item of the Motor Assessment Scale. Participants were also required to have no upper-extremity injury that would interfere with CIMT participation. Patients were excluded if they had impaired cognition, defined as a Mini-Mental State Examination score of less than 24, or if they had any condition affecting the upper limb, including severe pain, shoulder subluxation, upper-limb injury, frozen shoulder, fracture, or recurrent stroke.

All eligible participants were informed about the study protocol, intervention procedures, assessment schedule, and expected participation requirements before enrollment. Written informed consent was obtained before data collection. After enrollment, participants were randomly assigned to Group A or Group B using computer-generated random numbers. Group A received the time-based CIMT protocol, labelled CIMT-D, and Group B received the repetition-based CIMT protocol, labelled CIMT-R. Participants were instructed not to discuss their intervention protocol with other participants in order to reduce contamination between treatment groups. The study was described as single-blinded; however, the intervention procedures were active rehabilitation protocols, and therefore the manuscript should clearly specify in the final version whether blinding applied to participants, outcome assessors, or data analysts.

Participants in Group A received modified upper-limb CIMT using a time-based shaping practice approach. The protocol consisted of three hours of shaping practice per day, five days per week, for four weeks. The shaping activities included functional upper-limb tasks such as picking up a cup from a desk, bringing the cup to the mouth and drinking, writing letters, moving an item across a table from left to right, moving the hand from the lap to the head and then forward and backward, brushing the teeth, bringing the hand to the nose, and putting on and removing shoes. The shaping method involved breaking each functional activity into manageable components according to the participant's current motor capacity and progressively increasing task difficulty as motor performance improved. The manuscript should maintain one consistent description of restraint application throughout the abstract, methods, and discussion; if the intended protocol was restraint for 90% of waking hours, this should be stated consistently, whereas if restraint was applied only during training sessions, the 90% waking-hour statement should be removed.

Participants in Group B received modified upper-limb CIMT using a repetition-based shaping practice approach. The protocol consisted of 300 repetitions of shaping practice per day, delivered as three sessions of 100 repetitions per session, five days per week, for four weeks. The same functional shaping tasks used in the time-based group were applied in the repetition-based group. Each task was repeated according to the planned repetition schedule, with progression based on the participant's motor capacity and ability to complete the task with improved control. Because repetition count was the defining feature of this protocol, the final manuscript should include a task-wise repetition schedule showing how the total of 100 repetitions per session and 300 repetitions per day was achieved. This clarification is necessary to ensure intervention reproducibility and to allow comparison with the previous repetition-based CIMT trial that informed the study rationale (17).

Outcome data were collected at baseline, at the second week, and at the fourth week for both groups. The main clinical outcomes were upper-limb motor activity, motor function, motor impairment, and upper-limb self-efficacy. Upper-limb motor activity was assessed using the Motor Activity Log, including the "how well" and "amount" components. Motor function was assessed using the Wolf Motor Function Test. Motor impairment was assessed using the Fugl-Meyer Assessment. Upper-limb self-efficacy was assessed using the Upper Limb Self-Efficacy Test. The final manuscript should explicitly identify one primary outcome and classify the remaining outcomes as secondary outcomes to strengthen trial reporting and interpretation.

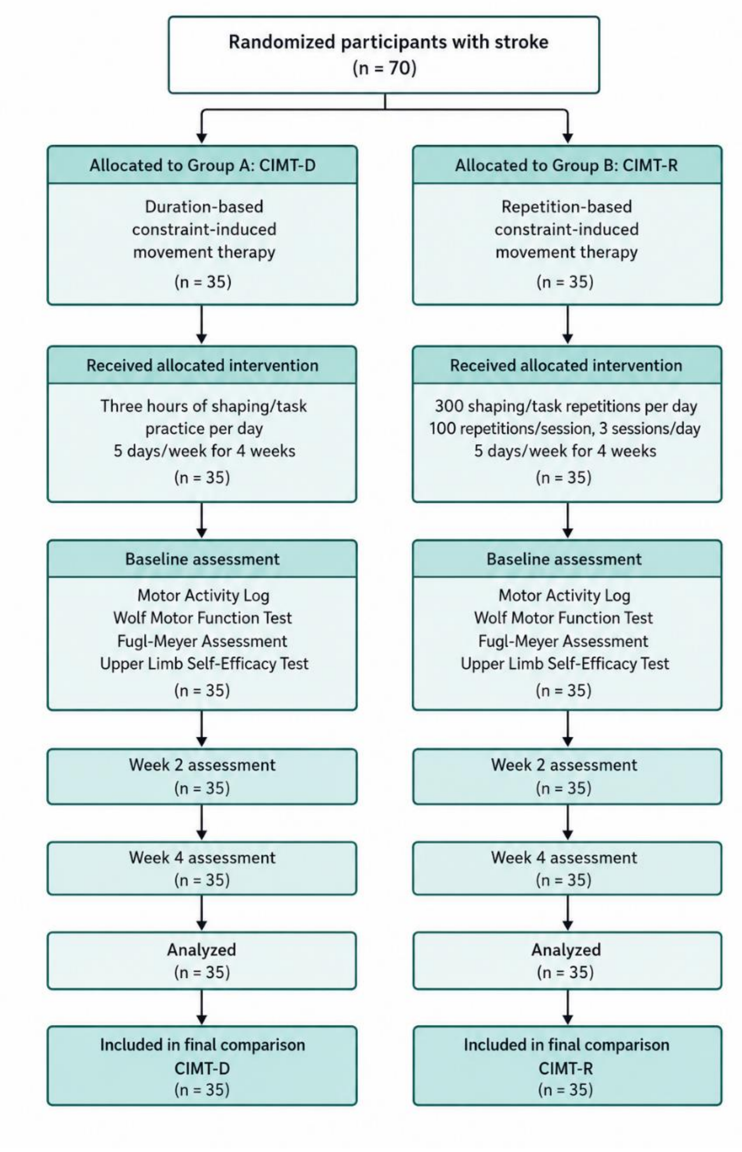

Figure 1 CONSORT Flowchart

Data was entered and analyzed using SPSS version 24. Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables, including gender, hand dominance, and affected side, were planned to be reported as frequencies and percentages. Numerical variables, including age and symptom duration, were summarized as mean and standard deviation. Baseline normality of outcome data was tested using the Kolmogorov-Smirnov test separately for both treatment groups. Because the outcome data were not normally distributed at baseline, non-parametric statistical tests were applied. Between-group differences were analyzed using the Mann-Whitney U test, while within-group changes across baseline, second week, and fourth week were analyzed using Friedman's analysis of variance. A p-value of less than 0.05 was considered statistically significant. For publication-level reporting, the results should also present actual clinical scores at each time point, preferably as median and interquartile range for non-normally distributed data, together with between-group change comparisons from baseline to fourth week. Missing data handling, adherence reporting, adverse events, and final analysis denominators should also be added to support CONSORT-compliant reporting.

RESULTS

Seventy participants with stroke were included in the randomized comparison, with 35 participants allocated to the duration-based constraint-induced movement therapy group and 35 allocated to the repetition-based constraint-induced movement therapy group. Group A received duration-based CIMT, while Group B received repetition-based CIMT. Outcomes were assessed at baseline, week 2, and week 4.

Table 1. Baseline Age and Symptom Duration by Treatment Group

Variable	Group A: CIMT-D Mean ± SD	Group B: CIMT-R Mean ± SD
Age, years	58.94 ± 5.32	57.48 ± 5.57
Symptom duration, weeks	2.80 ± 1.02	2.57 ± 1.19

Abbreviations: CIMT-D, duration-based constraint-induced movement therapy; CIMT-R, repetition-based constraint-induced movement therapy; SD, standard deviation.

The mean age was 58.94 ± 5.32 years in Group A and 57.48 ± 5.57 years in Group B. The mean symptom duration was 2.80 ± 1.02 weeks in Group A and 2.57 ± 1.19 weeks in Group B, showing close baseline similarity between the two groups for age and duration since stroke onset.

Table 2. Baseline Normality Testing for Outcome Measures

Treatment Group	Outcome Measure	Kolmogorov-Smirnov Statistic	p-value
Group A: CIMT-D	Motor Activity Log, How Well	0.345	<0.001
Group A: CIMT-D	Motor Activity Log, Amount	0.476	<0.001
Group A: CIMT-D	Wolf Motor Function Test	0.239	<0.001
Group A: CIMT-D	Fugl-Meyer Assessment	0.121	0.040
Group A: CIMT-D	Upper Limb Self-Efficacy Test	0.223	<0.001
Group B: CIMT-R	Motor Activity Log, How Well	0.390	<0.001
Group B: CIMT-R	Motor Activity Log, Amount	0.533	<0.001
Group B: CIMT-R	Wolf Motor Function Test	0.307	<0.001
Group B: CIMT-R	Fugl-Meyer Assessment	0.143	0.045
Group B: CIMT-R	Upper Limb Self-Efficacy Test	0.214	<0.001

Abbreviations: CIMT-D, duration-based constraint-induced movement therapy; CIMT-R, repetition-based constraint-induced movement therapy.

Table 3. Within-Group Changes in Outcome Measures Across Baseline, Week 2, and Week 4

Treatment Group	Outcome Measure	Baseline, MR	Week 2, MR	Week 4, MR	Friedman χ^2	Kendall's W	p-value
Group A: CIMT-D	Motor Activity Log, How Well	1.30	1.94	2.76	37.49	0.536	<0.001
Group A: CIMT-D	Motor Activity Log, Amount	1.01	2.16	2.83	59.31	0.847	<0.001
Group A: CIMT-D	Wolf Motor Function Test	1.11	1.89	3.00	63.15	0.902	<0.001
Group A: CIMT-D	Fugl-Meyer Assessment	1.00	2.00	3.00	70.00	1.000	<0.001
Group A: CIMT-D	Upper Limb Self-Efficacy Test	1.00	2.00	3.00	70.00	1.000	<0.001
Group B: CIMT-R	Motor Activity Log, How Well	1.07	2.23	2.70	49.27	0.704	<0.001
Group B: CIMT-R	Motor Activity Log, Amount	1.00	2.09	2.91	64.27	0.918	<0.001
Group B: CIMT-R	Wolf Motor Function Test	1.09	1.91	3.00	64.27	0.918	<0.001
Group B: CIMT-R	Fugl-Meyer Assessment	1.00	2.00	3.00	70.00	1.000	<0.001
Group B: CIMT-R	Upper Limb Self-Efficacy Test	1.00	2.00	3.00	70.00	1.000	<0.001

Abbreviations: MR, Mean Rank, CIMT-D, duration-based constraint-induced movement therapy; CIMT-R, repetition-based constraint-induced movement therapy.

The Kolmogorov-Smirnov test showed non-normal distribution for all outcome measures in both groups. All baseline outcome variables had p-values below 0.05, supporting the use of non-parametric statistical analysis for within-group and between-group comparisons.

Within-group analysis showed significant improvement over time in both treatment groups across all outcome measures. In Group A, the Motor Activity Log "How Well" mean rank increased from 1.30 at baseline to 2.76 at week 4, and the Motor Activity Log "Amount" mean rank increased from 1.01 to 2.83. The Wolf Motor Function Test increased from 1.11 to 3.00, while the Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test each increased from 1.00 to 3.00. In Group B, the Motor Activity Log "How Well" mean rank increased from 1.07 to 2.70, and the Motor Activity Log "Amount" mean rank increased from 1.00 to 2.91. The Wolf Motor Function Test increased from 1.09 to 3.00, while the Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test each increased from 1.00 to 3.00. Kendall's W ranged from 0.536 to 1.000, indicating moderate to very strong within-group change across the four-week intervention period.

Figure 2 The figure shows that both CIMT-D and CIMT-R groups improved across baseline, week 2, and week 4, with mean-rank progression reaching the highest week-4 ranks for WMFT, FMA, and ULSET. Between-group comparison favored CIMT-R across all assessed outcomes, with the largest rank advantages observed for Upper Limb Self-Efficacy Test (+17.74) and Fugl-Meyer Assessment (+17.34), followed by Wolf Motor Function Test (+12.46). The effect-size profile similarly showed the strongest effects for ULSET (r = 0.436) and FMA (r = 0.426), indicating that repetition-based CIMT produced the most pronounced advantage in upper-limb self-efficacy and motor impairment outcomes.

Between-group analysis showed higher mean ranks in Group B than Group A for all reported outcome measures. For the Motor Activity Log "How Well" component, the mean rank was 39.50 in Group B and 31.50 in Group A, with a small effect size. For the Wolf Motor Function Test, Group B had a higher mean rank than Group A, with values of 42.73 and 30.27, respectively. The Fugl-Meyer Assessment showed a stronger between-group difference, with a mean rank of 44.17 in Group B and 26.83 in Group A. The Upper Limb Self-Efficacy Test also favored Group B, with a mean rank of 44.37 compared with 26.63 in Group A. The largest effect sizes were observed for the Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test.

Table 4. Between-Group Comparison of Outcome Measures

Outcome Measure	Group A: CIMT-D Mean Rank	Group B: CIMT-R Mean Rank	Rank Sum Group A	Rank Sum Group B	Mann-Whitney U	z-value	p-value	Effect Size r
Motor Activity Log, How Well	31.50	39.50	1102.50	1382.50	472.50	-1.64	0.100	0.197
Wolf Motor Function Test	30.27	42.73	1059.45	1495.55	429.45	-2.15	0.032	0.257
Fugl-Meyer Assessment	26.83	44.17	939.05	1545.95	309.05	-3.56	<0.001	0.426
Upper Limb Self-Efficacy Test	26.63	44.37	932.05	1552.95	302.05	-3.65	<0.001	0.436

Abbreviations: CIMT-D, duration-based constraint-induced movement therapy; CIMT-R, repetition-based constraint-induced movement therapy.

Overall, both duration-based and repetition-based CIMT produced significant within-group improvements over four weeks. The repetition-based CIMT group showed higher between-group ranks across all assessed outcomes, with the clearest differences observed in Fugl-Meyer Assessment and Upper Limb Self-Efficacy

Test scores. The Wolf Motor Function Test also showed a significant between-group difference favoring repetition-based CIMT, while the Motor Activity Log “How Well” component showed a smaller between-group difference. These findings indicate that repetition-based CIMT produced stronger improvement in upper-limb motor impairment, functional performance, and self-efficacy than duration-based CIMT over the four-week intervention period.

DISCUSSION

The present randomized controlled trial compared duration-based and repetition-based upper-limb constraint-induced movement therapy in people with stroke and found significant within-group improvement in both treatment protocols over four weeks. Improvements were observed in self-reported upper-limb use, motor function, motor impairment, and upper-limb self-efficacy, indicating that both CIMT dosing strategies were associated with measurable recovery across functional and impairment-based outcomes. These findings are consistent with the core therapeutic principles of CIMT, in which structured task practice and restriction of compensatory use of the less-affected limb are intended to reduce learned non-use and promote active use of the paretic upper extremity (6). The improvement observed in both groups also supports previous evidence that modified CIMT can enhance upper-limb motor outcomes after stroke when delivered through repeated, task-specific practice (12).

A central finding of this study was that the repetition-based CIMT group demonstrated higher between-group ranks than the duration-based CIMT group across the reported outcomes, with clearer advantages in Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test scores. This suggests that defining CIMT intensity by the number of completed task repetitions may provide a more clinically meaningful representation of therapeutic dose than defining intensity by treatment duration alone. Time-based dosing does not necessarily reflect the amount of active motor practice completed by each patient, because patients may perform different numbers of meaningful repetitions within the same therapy duration depending on fatigue, speed, assistance level, task complexity, and therapist supervision. This concern has been raised previously, with the argument that time spent during CIMT may not be an adequate measure of actual rehabilitation dose unless the number and quality of repetitions are also considered (15).

The present findings are also supported by prior repetition-based CIMT work, which suggested that using the number of shaping repetitions as the dosing unit may be a practical and effective alternative to prescribing treatment by hours of practice (17). Repetition-based protocols may be easier to standardize because the therapist and patient can directly count the number of completed task attempts. This can improve clarity of treatment prescription, reduce ambiguity in dose delivery, and make home or outpatient implementation more feasible. The clinical relevance of repetition-based dosing is further supported by motor learning principles, where repeated task-specific practice is considered important for motor skill acquisition and cortical reorganization after neurological injury (16). In the current study, the repetition-based protocol was structured as 300 shaping repetitions per day, divided into three sessions of 100 repetitions, which offered a clear and measurable treatment target.

The improvement in motor impairment measured by the Fugl-Meyer Assessment is particularly important because impairment-level recovery reflects changes in selective motor control, coordination, and upper-limb movement capacity. The stronger rank distribution favoring repetition-based CIMT for this outcome suggests that repetition-count dosing may have provided a more consistent stimulus for motor relearning than duration-based practice. Similarly, the stronger effect observed in upper-limb self-efficacy suggests that patients receiving repetition-based practice may have developed greater confidence in using the affected limb. Self-efficacy is clinically relevant in stroke rehabilitation because confidence in limb use can influence engagement, practice behavior, and willingness to use the paretic limb during daily activities.

The Wolf Motor Function Test also favored repetition-based CIMT, indicating better upper-limb functional performance in the repetition-based group. This finding is clinically meaningful because WMFT captures task-related upper-limb performance and is aligned with the functional goals of CIMT. However, the Motor Activity Log “How Well” component showed a smaller between-group difference than the Fugl-Meyer

Assessment and Upper Limb Self-Efficacy Test. This pattern may indicate that impairment-level and confidence-related changes were more responsive to repetition-based dosing within the four-week intervention period than self-perceived quality of real-world limb use. Changes in real-world upper-limb behavior may require longer follow-up, transfer-package strategies, or continued environmental reinforcement to fully translate motor gains into habitual daily use.

The findings align with evidence suggesting that modified CIMT protocols can be useful in acute and subacute post-stroke rehabilitation, particularly when protocols are adapted to improve feasibility and patient adherence (18). In clinical practice, conventional CIMT protocols may be difficult to deliver because prolonged treatment duration and extended restraint use require substantial therapist time, patient tolerance, and institutional resources. Surveys of neurological rehabilitation practice have shown that implementation barriers may limit the routine use of CIMT in clinical settings, despite evidence supporting its therapeutic value (13). A repetition-based model may reduce some of these barriers by making the therapy dose easier to define, monitor, and reproduce across therapists and settings.

The study has several limitations that should be considered while interpreting the findings. It was conducted at a single center with a relatively small sample size, which may limit generalizability. The number of repetitions completed by participants in the duration-based group was not measured, and the time required to complete repetitions in the repetition-based group was not reported; therefore, direct equivalence between time-based and repetition-based treatment dose cannot be established. Lesion location and lesion size were not documented through radiological classification, although these factors may influence upper-limb recovery after stroke. Therapist blinding was not feasible because the interventions required active delivery and supervision. The study also did not include long-term follow-up, so the durability of treatment effects after the four-week intervention period remains unknown.

Future trials should use larger multicenter samples, assessor-blinded outcome measurement, detailed dose tracking, and longer follow-up periods. Repetition count, active practice time, task difficulty progression, restraint compliance, adherence, and adverse events should be reported together to provide a more complete understanding of CIMT dose-response effects. Future research should also compare whether repetition-based protocols produce better transfer of gains into daily upper-limb use when combined with structured behavioral strategies, home practice logs, and patient-centered functional goals. Accurate recording of treatment time is also important because rehabilitation documentation may not always reflect the true dose delivered during therapy sessions (21). Larger studies using robust longitudinal analyses would help determine whether repetition-based CIMT should be preferred as a standard dosing approach for upper-limb rehabilitation after stroke.

CONCLUSION

Both duration-based and repetition-based upper-limb constraint-induced movement therapy produced significant improvement over four weeks in people with stroke. The repetition-based CIMT protocol showed stronger between-group performance across motor function, motor impairment, and upper-limb self-efficacy outcomes, with the clearest advantages observed for Fugl-Meyer Assessment and Upper Limb Self-Efficacy Test scores. These findings suggest that prescribing CIMT by a defined number of shaping or task-practice repetitions may be a practical and clinically useful alternative to prescribing therapy by duration alone. Repetition-based CIMT offers a clearer and more measurable rehabilitation dose, which may improve standardization and feasibility in clinical settings.

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