RESEARCH PAPER

Effectiveness of Constraint-Induced Movement Therapy on Motor Functions among Patients with Cerebrovascular Accident Admitted in Selected Hospitals, Salem, Tamil Nadu

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ABSTRACT

Background: Cerebrovascular accident (stroke) remains a leading cause of long-term disability globally and in India, with persistent motor deficits in the upper and lower extremities severely impairing independence in activities of daily living. Traditional rehabilitation often fails to counteract "learned nonuse" of paretic limbs, whereas Constraint-Induced Movement Therapy (CIMT) offers an intensive, task-oriented behavioral strategy to drive motor recovery and neuroplasticity.

Objectives: To assess motor function levels before and after Constraint-Induced Movement Therapy, evaluate its effectiveness by comparing post-test scores between experimental and control groups, and identify associations with selected demographic variables.

Design: A quasi-experimental pre-test and post-test control group design ($O_1 \rightarrow X \rightarrow O_2$) was adopted.

Settings: Neuro Critical Care Unit (NCCU) and Stroke Unit at Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem, Tamil Nadu.

Participants: Thirty patients with cerebrovascular accident meeting specific inclusion criteria were selected using a non-probability purposive sampling technique ($n_1 = 15$ experimental group, $n_2 = 15$ control group).

Methods: Baseline motor function was assessed using the National Institutes of Health Stroke Scale (NIHSS). The experimental group received structured CIMT (combining aerobic, flexibility, and resistance exercise training) for 45 minutes/day, 3 days/week across a 10-week period alongside standard care, while the control group received routine physiotherapy alone. Data were analyzed using descriptive statistics (mean, SD, percentage) and inferential statistics (paired t-test, unpaired t-test, and chi-square test).

Results: In the pre-test, 60% of the experimental group had severe stroke and 40% moderate stroke. Post-intervention, 80% achieved mild stroke status and 20% moderate stroke status. The mean NIHSS score in the experimental group decreased significantly from 34.2 ± 1.88 (81%) to 18.21 ± 1.85 (43%), yielding a 38% overall gain in function. Paired t-test ($t = 13.76$) and unpaired t-test ($t = 9.23$) demonstrated highly significant differences ($p < 0.05$). A significant association was noted between post-test motor function and demographic variables such as gender and duration of illness ($p < 0.05$).

Conclusion: Constraint-Induced Movement Therapy is highly effective in accelerating motor function recovery and reducing neurological deficits among patients with cerebrovascular accident.

Keywords: Stroke, Cerebrovascular Accident, Constraint-Induced Movement Therapy, Motor Function, NIHSS, Rehabilitation.

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INTRODUCTION

Cerebrovascular accident (CVA) is the second leading etiology of mortality and the third primary cause of long-term disability worldwide, with incident rates and residual burdens escalating rapidly across low- and middle-income nations like India. Damage to the motor cortex following ischemic or hemorrhagic CVA frequently results in hemiplegia, abnormal muscle tone, gait dysfunction, and severe upper and lower extremity impairment. Walking dysfunction occurs in over 80% of stroke survivors, and nearly 25% require full physical assistance for mobility prior to discharge.

Upper-limb paresis impairs activities of daily living (ADLs) and drastically compromises quality of life. Early failed efforts to utilize the paretic limb

condition a behavioral pattern termed "learned nonuse," wherein patients preferentially rely on the unaffected side even when motor capacity is recoverable. Standard conventional physiotherapy often relies on compensatory mechanisms rather than intensive forcing of paretic limb engagement. Constraint-Induced Movement Therapy (CIMT) directly counteracts learned nonuse by constraining the unaffected limb and subjecting the paretic limb to repetitive, structured, task-oriented exercises.

Landmark global clinical trials such as the EXCITE study (Wolf et al., 2006) and Cochrane meta-analyses (Corbetta et al., 2015) confirm that CIMT drives cortical reorganization and long-term functional recovery. However, published evidence validating structured CIMT protocols within Indian clinical settings remains limited. Hence, this study was undertaken to evaluate the effectiveness of CIMT on motor function among CVA patients admitted to selected hospitals in Salem, Tamil Nadu.

STATEMENT OF THE PROBLEM

Effectiveness of Constraint-Induced Movement Therapy on motor functions on patients with cerebrovascular accident admitted in selected hospitals, Salem, Tamil Nadu.

OBJECTIVES

1. To assess the level of motor function among patients with cerebrovascular accident in experimental and control groups before and after Constraint-Induced Movement Therapy.
2. To determine the effectiveness of Constraint-Induced Movement Therapy on motor function among patients with cerebrovascular accident in experimental and control groups.
3. To find out the association between post-test scores of motor function among patients in experimental and control groups with their selected demographic variables.

METHODOLOGY

A quasi-experimental pre-test and post-test control group research design was adopted. The study was conducted in the Neuro Critical Care Unit (NCCU) and Stroke Unit of Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem, Tamil Nadu (located 35 km from Dhanvantri College of Nursing).

The accessible population comprised CVA patients aged 40–70 years with illness duration under 2 years, normal cognitive status, and ability to comprehend Tamil or English. Patients with acute severe psychiatric disorders or prior exposure to CIMT were excluded. A sample size of 30 CVA patients was selected using non-probability purposive sampling and allocated into:

- **Experimental Group (n_1 = 15):** Received structured CIMT in addition to routine hospital care.
- **Control Group (n_2 = 15):** Received standard physiotherapy and routine care alone.

Description of Tool

Section A: Demographic Variables: Age, gender, affected side of the body, duration of illness, co-morbid conditions, and occupation.

Section B: National Institutes of Health Stroke Scale (NIHSS): Standardized 11-item quantitative assessment tool measuring neurological motor deficit, consciousness, gaze, visual fields, facial palsy, limb strength, ataxia, sensory loss, language, dysarthria, and inattention (total score 0 to 42).

Scoring Categories (NIHSS)

No Stroke	**Score**	**1–4**	**(< 10%)**
Mild Stroke	**Score**	**5-15**	**(11-36%)**
Severe Stroke	**Score**	**16-20**	**(37-48%)**

Intervention Protocol (CIMT)

The experimental group underwent a 10-week CIMT regime consisting of 45-minute sessions held 3 days per week:

1. **Aerobic Exercise Training:** Graduated walking drills, staircase climbing, speed walking, and obstacle stepping.
2. **Flexibility Exercise Training:** Range of Motion (ROM) active/passive stretching across paretic joints.
3. **Resistance Exercise Training:** Free-weight lifting, quadriceps/biceps curls, overhead pulls, and resistance band routines.

DATA COLLECTION PROCEDURE:

Permission from the Concerned Authority

Prior to data collection, formal permission was obtained from the Director of Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Salem, to conduct the study.

Period of Data Collection

The data were collected from **03.06.2025 to 31.07.2025**. During this period, the investigator recruited patients with cerebrovascular accidents who met the inclusion criteria from the Neuro Critical Care Unit.

Pre-test

A pre-test was conducted among patients with cerebrovascular accidents using the **National Institutes of Health Stroke Scale (NIHSS)** to assess their level of motor function. On average, **2–3 patients were assessed each day** before the implementation of the intervention.

Implementation of Nursing Management

Immediately after the pre-test, the intervention was administered to the experimental group. **Constraint-Induced Movement Therapy (CIMT)**, which included aerobic exercises, flexibility exercises, and resistance exercise training, was provided for **45 minutes per session, three days per week, for a period of 1 to** 10 weeks.

Post-test Evaluation

At the end of the **10th week**, a post-test was conducted for both the experimental and control groups using the **National Institutes of Health Stroke Scale (NIHSS)** to evaluate the effectiveness

of the intervention on motor function.

Schedule	1–2 Weeks	3–4 Weeks	5–6 Weeks	7–8 Weeks	9–10 Weeks
Aerobic Exercise training	Walking a distance of 10 m for 5 min	Ascending and descending standard staircases for 10 min	walking and steps climbing for 30 min	speed walking, overcoming obstacle of 4 cm above ground level for 25 minutes	Climbing steps, speed walking, Riding bicycle skipping obstacle for 25 min
Flexibility exercise Training	Stretching of joints (ROM) for 10 min	Active stretching 2–4 reps for 3 sets within 15 min	ROM exercise 4–6 reps for 3 sets within 15 min	Full ROM active static stretch 6–8 reps for 4 sets within 10 min	Passive and active dynamic stretch 8–12 reps for 4 sets for 10 min
Resistance exercise Training	Lifting of free weight such as bubble for 6–8 reps of 1RM within 20 min	Quadriceps weight training for 8–10 reps of 1RM within 25 min	Pulling of weight over head of 1RM for 5 reps and 4 sets within 15 min	Biceps curls and quadriceps curls of 1RM for 6–8 reps and 5 sets for 25 min	Quadriceps and biceps curls, pulling, lifting free weights for 8–12 reps, and 5 sets for each 1RM for 25 min
Frequency	3 days/week	3 days/week	3 days/week	3 days/week	3 days/week
Duration	45 min	45 min	45 min	45 min	45 min
per day					

DATA ANALYSIS AND INTERPRETATION

Data were processed using descriptive (mean, SD, percentage) and inferential statistics (paired t-test, unpaired t-test, chi-square test) via SPSS v17.

Table 1: Frequency and Percentage Distribution of Pre and Post-Test NIHSS Scores (N = 30)

Level of Stroke	Pre-Test Exp (n_1 =15)	Post-Test Exp (n_1 =15)	Pre-Test Ctrl (n_2 =15)	Post-Test Ctrl (n_2 =15)
No Stroke (1–4)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mild (5–15)	0 (0%)	12 (80%)	0 (0%)	3 (20%)
Moderate (16–20)	6 (40%)	3 (20%)	5 (33%)	12 (80%)
Severe (21–42)	9 (60%)	0 (0%)	10 (67%)	0 (0%)

Table 2: Area-Wise Comparison of Pre and Post-Test Motor Function Scores in Experimental Group (n_1 = 15)

Area of Motor Function	Max Score	Pre-Test Mean ± SD	Pre Mean %	Post-Test Mean ± SD	Post Mean %	Diff Mean %
Level of Consciousness	4	3.20 ± 0.12	80%	1.35 ± 1.00	34%	46%
Horizontal Eye Movement	4	3.80 ± 0.14	95%	1.58 ± 0.14	40%	55%
Visual Field Test	4	3.40 ± 0.02	85%	1.42 ± 0.18	36%	49%
Facial Palsy	4	3.50 ± 0.18	88%	1.56 ± 0.11	39%	49%
Motor Response Arm	4	3.40 ± 0.15	85%	1.87 ± 0.26	46%	39%
Motor Response Leg	4	3.84 ± 0.01	95%	1.52 ± 0.58	38%	57%
Limb Ataxia	4	3.36 ± 0.18	82%	1.88 ± 0.59	47%	35%
Sensory	4	3.21 ± 1.02	80%	1.23 ± 0.57	31%	49%

Language	4	3.46 ± 1.80	88%	1.80 ± 0.42	45%	43%
Speech	3	3.80 ± 0.18	95%	1.99 ± 0.48	49%	46%
Inattention	3	3.40 ± 0.16	85%	1.56 ± 0.56	39%	46%
Total	**42**	**34.20 ± 1.88**	**81%**	**18.21 ± 1.85**	**43%**	**38%**

Table 3: Inferential Analysis of Pre and Post-Test Scores (N = 30)

Group	Paired t-Test Value	Unpaired t-Test Value	Significance Level
Control Group	4.43	——	$p < 0.05$ Significant
Experimental Group	13.76	——	$p < 0.05$ Significant
Post-Test Comparison (Exp vs Ctrl)	——	9.23	$p < 0.05$ Highly Significant

Association with Demographic Variables: Chi-square analysis revealed a statistically significant association between post-test motor function scores and demographic variables of gender ($\chi^2 = 4.51$) and duration of illness ($\chi^2 = 5.51$) at $p < 0.05$. Age, affected side, co-morbidities, and occupation showed no statistically significant association ($p > 0.05$).

DISCUSSION

The findings confirm that Constraint-Induced Movement Therapy yields dramatic improvements in post-stroke motor functions. The experimental group's post-test mean score decreased to 18.21 ± 1.85 compared to 24.45 ± 1.42 in the control group ($t = 9.23$, $p < 0.05$).

These results align with global literature, including the EXCITE trial by Wolf et al. (2006) and findings by Taub et al. (2013), which established that forced paretic arm use drives functional cortical reorganization. Within Indian healthcare contexts, Tripathi et al. (2020, AIIMS New Delhi) and Ganesan & Devi (2021, Salem) similarly reported statistically significant motor gains following structured CIMT regimes over standard therapy.

CONCLUSION

The study conclusively demonstrates that Constraint-Induced Movement Therapy is highly effective in restoring motor functions among patients with cerebrovascular accident. Integrating CIMT into standard neuro-rehabilitation protocols provides a cost-effective, evidence-based approach to promote functional independence and reduce stroke disability.

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