CRITICALLY APPRAISED PAPER (CAP)

Focused Question

For patients with hemiparesis, 13–26 months after their first hemorrhagic stroke, is modified constraint-induced movement therapy (mCIMT) more effective than traditional rehabilitation in improving reach-to-grasp movements and functional performance?


**CLINICAL BOTTOM LINE:**

Through an assessor-blind randomized controlled trial, the study compared the efficacy of mCIMT with an equal-dose traditional intervention on promoting improvements in motor control during a reach-to-grasp functional activity and the performance of functional activities in individuals with stroke.

This study yields critical evidence that is highly relevant to both the scope of practice and the future of the occupational therapy profession. Occupational therapists working with clients with chronic stroke should consider the use of mCIMT as a means of improving reaching, as well as functional ability, to perform daily activities. Those clients with Brunnstrom Stage III or higher in the arm and hand would find the greatest success in this program due to greater repertoire of voluntary movement. When determining the efficacy of mCIMT, clinical measures that report on functional ability such as the Motor Activity Log (MAL) and Functional Independence Measure (FIM) detected the most changes. Through kinematic analysis, the study found that amounts of change in grasping strategy and gripping aperture was less compared to reaching. However, given the complexity of hand function, recovery may be sustained through carry over of practice in various contexts. Adherence to the rigorous demands, including time engaged in functional tasks to train the affected arm under the mCIMT protocol, is found to yield the optical outcomes. Overall, this study supports the use of mCIMT--delivered in 2 hours/session, 5 days a week over a course of 3 weeks--for improving reach-to-grasp and functional ability in clients with chronic stroke and is more superior than dose-matched traditional rehabilitation techniques.
RESEARCH OBJECTIVE(S)
List study objectives.

The objective of this research was to study the changes in motor control during a reach-to-grasp functional activity and the performance of functional activities in individuals treated with mCIMT as compared to those treated with traditional rehabilitation for 3 weeks. Researchers hypothesized that compared to tradition rehabilitation techniques, the use of mCIMT would have beneficial effects on an individual’s performance in functional abilities during reach-to-grasp.

DESIGN TYPE AND LEVEL OF EVIDENCE:

This research was conducted in a true-experimental, 2-group randomized control trial. Pretests and posttests were utilized to quantify changes in motor abilities and functional performance. Because of the aforementioned characteristics of the research design, this study is classified as Level I evidence.

Limitations (appropriateness of study design):
Was the study design type appropriate for the knowledge level about this topic? Circle yes or no, and if no, explain.

YES NO

SAMPLE SELECTION
How were subjects selected to participate? Please describe.

Participants were recruited from the outpatient programs in rehabilitation departments of 3 different hospitals in Taiwan. Patients who were selected were 13–26 months’ post-onset, first-ever hemorrhagic or ischemic stroke. Thirty-two participants were recruited. To create randomized group assignments, the participants were stratified based on the side of the body affected by the stroke. This was done to lessen the bias of selection. To ensure that participants were appropriate for the study, researchers screened the individuals. Methods for screening included a CIMT training and evaluation prior to the study enrollment to ensure that the individual would be able to participate in the program. A screening to determine the Brunnstrom stage of the arm and hand was completed as well as the MAL. Additionally, researchers screened the individuals’ balance, completed a Mini-Mental Status Examination (MMSE) and the Modified Ashworth Scale (MAS) in the joints of the upper extremity (UE).

Inclusion Criteria
Those included within the study experienced a single unilateral stroke, were neurologically stable, and were physically eligible for mCIMT training before the study. Additionally, these participants were classified as a Brunnstrom Stage III or above in the affected arm and according to the MAL, had a considerable amount of nonuse of the extremity. The participants included in the study had no serious cognitive deficits as determined by a modified MMSE, as well as concerns in balance that would affect safety in participation of the study. In this study,
individuals were eligible if there was no excessive spasticity, including the wrist and fingers, according to the MAS.

Exclusion Criteria

Individuals were excluded from this study if their past medical history included stroke or additional neurological, neuromuscular, or orthopedic disease or complication. Additionally, participants were excluded from this study if excessive spasticity was noted.

SAMPLE CHARACTERISTICS

N = 32

<table>
<thead>
<tr>
<th>% Dropouts</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>#/ (%) Male</td>
<td>21</td>
</tr>
<tr>
<td>#/ (%) Female</td>
<td>11</td>
</tr>
</tbody>
</table>

Ethnicity

Data not given; however, participants were recruited from hospitals in Taiwan, suggesting Taiwanese descent.

Disease/disability diagnosis

Participants being studied were 13–26 months’ post-onset ischemic or hemorrhagic stroke with unilateral UE affectedness.

Check appropriate group:

<table>
<thead>
<tr>
<th>&lt;20/study group</th>
<th>20–50/study group</th>
<th>✓</th>
<th>51–100/study group</th>
<th>101–149/study group</th>
<th>150–200/study group</th>
</tr>
</thead>
</table>

INTERVENTION(S) AND CONTROL GROUPS

Add groups if necessary.

Group 1

Brief Description

mCIMT; n = 17 (11 men, 6 women; 8 left-sided lesion, 9 right-sided lesion; average age in years, 57.11). Individuals in this group received mCIMT as categorized by wearing a mitt on the unaffected hand for 6 hours per day combined with 2 hours of intensive training of the affected UE. Functional practice tasks that were addressed during therapy included picking up marbles, flipping cards, combing hair, and writing. For each individual, the therapist graded the skill level for the activities to create an appropriate challenge. To ensure standardization of the study, deliberate treatment notes were completed and reviewed by the investigators throughout the duration of the program.
<table>
<thead>
<tr>
<th>Setting</th>
<th>Intervention occurred at 1 of the 3 participating hospitals, including the National Taiwan University Hospital, the Chang Gung Memorial Hospital, and the Cathay General Hospital.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who Delivered?</td>
<td>Intervention was delivered by 1 of 3 occupational therapists at the respective hospitals who were trained in the administration of mCIMT protocol as determined for the purposes of this study. These therapists completed a written test of competency as well.</td>
</tr>
<tr>
<td>Frequency?</td>
<td>Direct treatment for participants in this group occurred for 2 hours each day within the hospital while the unaffected hand was placed in a mitten for 6 hours outside of skilled therapy each day.</td>
</tr>
<tr>
<td>Duration?</td>
<td>The intervention protocol lasted for 5 days each week for 3 consecutive weeks.</td>
</tr>
</tbody>
</table>

**Group 2**

<table>
<thead>
<tr>
<th>Brief Description</th>
<th>Traditional Rehabilitation; n = 15 (10 men, 5 women; 6 left-sided lesion, 9 right-sided lesion; average age in years, 58.77). The daily therapy sessions for this group included strength and balance training, fine motor dexterity training, functional task practice, and stretching/weight-bearing through the affected arm. To ensure standardization of the study, deliberate treatment notes were completed and reviewed by the investigators throughout the duration of the program.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>Intervention occurred at 1 of the 3 participating hospitals, including the National Taiwan University Hospital, the Chang Gung Memorial Hospital, and the Cathay General Hospital.</td>
</tr>
<tr>
<td>Who Delivered?</td>
<td>Intervention was delivered by 1 of 3 occupational therapists at the respective hospitals who also the treating therapists of the experimental group.</td>
</tr>
<tr>
<td>Frequency?</td>
<td>Traditional therapy was given to participants for two 2 each day.</td>
</tr>
<tr>
<td>Duration?</td>
<td>The intervention protocol lasted for 5 days each week, for 3 consecutive weeks.</td>
</tr>
</tbody>
</table>

**Intervention Biases:** *Circle yes or no and explain, if needed.*

- **Contamination:** NO
- **Co-intervention:** YES
- **Timing:** YES

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4
Site

**YES/NO**

NR. It is possible that bias occurred based on the intervention site because 3 different hospitals were utilized. Within each hospital there could have been variable resources available to the treating therapists, which could have changed outcomes based on the location.

Use of different therapists to provide intervention

**YES/NO**

NR. Although supervising therapists were trained and required to take a written competency exam before treating the participants, inherent differences in treating styles and intervention approaches could exist, which could have altered the results of intervention.

**MEASURES AND OUTCOMES**

Complete for each relevant measure when answering the evidence-based question:

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article--yes/no/NR [not reported]), and how frequently the measure was used.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Outcome</th>
<th>Reliable and Valid</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAL</td>
<td>Functional outcomes</td>
<td>Good construct validity, good discriminant validity, and good interrater reliability were reported.</td>
<td>Before and after 3-week intervention period.</td>
</tr>
<tr>
<td>FIM</td>
<td>Functional outcomes</td>
<td>Good construct validity, good discriminant validity, and good interrater reliability were reported.</td>
<td>Before and after 3-week intervention period.</td>
</tr>
<tr>
<td>Kinematic analysis</td>
<td>Motor control characteristics of the affected hand</td>
<td>Validity and reliability were not reported.</td>
<td>Before and after 3-week intervention period.</td>
</tr>
</tbody>
</table>
Measurement Biases
Were the evaluators blind to treatment status? Circle yes or no, and if no, explain.

YES NO

Recall or memory bias. Circle yes or no, and if yes, explain.

YES NO

Others (list and explain):

RESULTS
List results of outcomes relevant to answering the focused question.

Include statistical significance where appropriate (p < 0.05).
Include effect size if reported.

The results of this study indicated that mCIMT had higher post-treatment scores as compared to the traditional rehabilitation (TR) group on some of the elements assessed related to reaching. Reaction time was discovered to be significantly greater between the mCIMT and the TR group, revealing a p value of 0.018. There was no statistical significance between the effects of mCIMT and the TR group on movement time (p = 0.19). Additional follow-up analyses indicated a significant difference between the two groups on the percentage of reach where the peak velocity occurs (p = 0.046); however, there was little statistical significance on movement units (p = 0.18). These results indicate that the individuals who received mCIMT spent significantly less time preplanning reaching and grasping movements, as compared to those individuals who were treated with traditional rehabilitation. Furthermore, the individuals who were treated with mCIMT relied more heavily on feed-forward control after treatment, as compared to the group of participants who received traditional rehabilitation. Overall, these findings indicate that a change in movement strategy occurs after mCIMT, involving a shift from feedback to feed-forward control.

In regard to grasp, the results of this study found changes for both the mCIMT and TR groups. A non-significant (p = 0.081) effect on grasping strategy was found.

Additionally, the difference in grip aperture was not significant between the two groups (p = 0.066). Furthermore, non-significant differences were found for the percentage of movement time where maximum grip aperture takes place (0.063). In summary, the results of this study related to reaching indicate a change in movement strategy for the mCIMT group, yet the results related to grasp indicate that both groups demonstrated a comparable change.

MANCOVA analysis indicated that mCIMT had a significant effect on functional ability as well (p = 0.012). Both the amount of use and quality of movement revealed statistically significant results (p < 0.0001 for each). The FIM was used to determine overall functional independence. Participants receiving mCIMT showed significant improvements in FIM scores (p = 0.016). There was an increase in the number of activities that participants engaged in as measured by the MAL. Prior to treatment, participants in the mCIMT group indicated the
ability to use the affected arm for 18 activities as compared to 25 activities after treatment. Overall, both the mCIMT and traditional rehabilitation group showed significant improvements in post-treatment scores and functional abilities; however, results indicated that the mCIMT showed greater improvements than the TR group.

Was this study adequately powered (large enough to show a difference)? Circle yes or no, and if no, explain.

| YES | NO |

Were appropriate analytic methods used? Circle yes or no, and if no, explain.

| YES | NO |

Were statistics appropriately reported (in written or table format)? Circle yes or no, and if no, explain.

| YES | NO |

CONCLUSIONS
State the authors’ conclusions that are applicable to answering the evidence-based question.

In conclusion, the results of this study indicated strong evidence for the use of mCIMT for individuals with chronic strokes. Greater improvements were observed in functional performance of daily activities and motor control during reach-to-grasp movements in those participants from the mCIMT group as compared to the TR (control) group. Individuals in the intervention group displayed more efficiency in preplanning reach-to-grasp movement, as indicated by reaction time and the dependency on feedforward control during reach. Additional research on this topic is needed to investigate the benefits of incorporating task demands into mCIMT for task-specific training of movement performance in stroke rehabilitation.

This work is based on the evidence-based literature review completed by Lindsay Chavis, Kathleen Ellen, Lindsey Raffol and Salvador Bondoc, OTD, OTR/L, FAOTA, Faculty Advisor, Quinnipiac University.


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