FOCUSED QUESTION
For individuals with chronic stroke and residual hemiparesis, does modified constraint-induced movement therapy improve functional performance and reach and grasp control more than traditional rehabilitation?


CLINICAL BOTTOM LINE:
Based on the findings of this study, modified constraint-induced movement therapy results in more positive gains in functional performance, improved motor control during reaching tasks, and an ability to use feed-forward control of movements of the hand affected by hemiparesis compared to a traditional rehabilitation approach for first-time stroke survivors. These findings indicate that modified constraint-induced movement therapy is an effective treatment program for occupational therapists to use for rehabilitating the upper extremity in chronic stroke survivors. Modified constraint-induced movement therapy results in increased functional performance of the upper extremity, allowing clients to increase performance in activities of daily living. Occupational therapists considering the use of modified constraint-induced movement therapy for intervention must consider that this approach did not demonstrate more positive outcomes in movement time or smoothness of movement compared to the traditional rehabilitation approach.

The study design and moderate effect size led to the positive findings of the study; however, the limitations of this study also must be considered. Contamination bias may have occurred due to the same occupational therapists providing treatment for both the intervention and control group.

The authors have made accurate conclusions on the effectiveness of constraint-induced movement therapy, but it is important to note that more research is needed on this protocol. Further research on constraint-induced movement therapy should focus on the long-term outcomes of the ability to control reach and grasp movements on a variety of tasks that incorporate objects of various sizes. Future research also should seek to understand the use of task demands during this protocol. Results of further studies will provide occupational
therapists with a better understanding of the outcomes on using constraint-induced movement therapy in increasing functional performance in chronic stroke survivors.

RESEARCH OBJECTIVE(S)
List study objectives.

To determine the effects of modified constraint-induced movement therapy on motor control of functional reach-to-grasp tasks and functional performance tasks of daily living in individuals with chronic stroke and hemiparesis.

DESIGN TYPE AND LEVEL OF EVIDENCE:

Randomized controlled trial
Level I
Two groups, pretreatment and posttreatment measures

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.

Patients selected were participating in outpatient rehabilitation programs at the following hospitals: National Taiwan University Hospital, Chang Gung Memorial Hospital, and Cathay General Hospital. Approval of this study was obtained from the institutional review boards of these hospitals, and patients provided informed consent. Brain imaging of participants showed single unilateral stroke.

Inclusion Criteria
The authors have made accurate conclusions on the effectiveness of constraint-induced movement therapy, but it is important to note that more research is needed on this protocol.

Exclusion Criteria
Multiple strokes or other comorbid neurological or orthopedic diagnoses.

SAMPLE CHARACTERISTICS

\[ N = 32 \]
\[ \% \text{ Dropouts} \quad 5.8 \]
#/ (%) Male 21  
#/ (%) Female 11  
Ethnicity NR  
Disease/disability diagnosis Cerebral vascular accident, single, unilateral  

Check appropriate group:  

<table>
<thead>
<tr>
<th>&lt; 20/study group</th>
<th>20–50/study group</th>
<th>51–100/study group</th>
<th>101–149/study group</th>
<th>150–200/study group</th>
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INTERVENTION(S) AND CONTROL GROUPS  
Add groups if necessary  

Group 1  
Brief Description Modified constraint-induced movement therapy: the unaffected hand was placed in a mitt for 6 hours per day to limit movement; the affected arm received intensive training, which included performance of daily activities. Patients were blinded to the study hypotheses.  
Setting One of three participating hospitals: National Taiwan University Hospital, Chang Gung Memorial Hospital, and Cathay General Hospital  
Who Delivered? One of three occupational therapists trained in the modified constraint-induced movement therapy protocol  
Frequency? Intensive training, 2 hours per week day (5 days a week), with 6 hours of mitt wear per day  
Duration? 3 weeks  

Group 2  
Brief Description Traditional rehabilitation: treatment focused on targeted strength, balance, fine motor skills, participation in functional tasks, and stretching and weight-bearing of the affected arm. Patients were blinded to the study hypotheses.  
Setting One of three participating hospitals: National Taiwan University Hospital, Chang Gung Memorial Hospital, and Cathay General Hospital  
Who Delivered? One of three occupational therapists  
Frequency? 2 hours per week day (5 days a week)  
Duration? 3 weeks  

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

YES/NO Participants may have inadvertently told evaluators their assigned group. The
same occupational therapists provided treatment for both the intervention and the control group.

<table>
<thead>
<tr>
<th>Co-intervention</th>
<th>YES/NO</th>
<th>NR</th>
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<tr>
<th>Timing</th>
<th>YES/NO</th>
<th>No</th>
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<tr>
<th>Site</th>
<th>YES/NO</th>
<th>Intervention took place at three different hospitals. All interventions were in outpatient rehabilitation programs.</th>
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Use of different therapists to provide intervention

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<th>YES/NO</th>
<th>One of three occupational therapists facilitated both the intervention group and the control group.</th>
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**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>Reliability</th>
<th>Validity</th>
<th>Use of measure</th>
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<tbody>
<tr>
<td>Kinematic analysis</td>
<td>NR</td>
<td>NR</td>
<td>Change in motor control characteristics during a functional reaching and grasping task</td>
</tr>
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<td></td>
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<td>Measure was administered before and after the 3-week intervention period.</td>
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<tr>
<td>Motor Activity Log</td>
<td>NR</td>
<td>NR</td>
<td>Functional outcomes of daily activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Good test–retest reliability, internal consistency, stability, responsiveness, and convergent validity</td>
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<tr>
<td></td>
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<td>Measure was administered before and after the 3-week intervention period.</td>
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<tr>
<td>Functional Independence Measure</td>
<td>NR</td>
<td>NR</td>
<td>Functional outcomes of daily activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Good interrater reliability, construct validity, and discriminant validity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Measure was administered before and after the 3-week intervention period.</td>
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RESULTS
List results of outcomes relevant to answering the focused question
Include statistical significance where appropriate \((p < 0.05)\)
Include effect size if reported

During reach and grasp tasks for the modified constraint-induced movement therapy group, kinematic analysis using post-hoc ANCOVAs showed there was a significant and moderate effect on reaction time \((p = 0.018)\), but no significant effect on movement time \((p = 0.19)\). There also was a significant and moderate effect of peak velocity occurring for percentage of reach \((p = 0.046)\), but no significant effect on movement units \((p = 0.18)\). MANCOVAs showed a significant main effect for temporal efficacy \((F[1,28] = 2.76, p = 0.041)\) and a significant and moderate main effect for reaching strategy \((F[1,28] = 3.44, p = 0.024)\). The control group spent more time planning reach and grasp movements and used more feedback methods, while the constraint-induced movement therapy group used feed-forward methods.

During functional tasks, the modified constraint-induced movement therapy group showed significant and large effects on amount of use of involved hand, using post-hoc ANACOVAs \((p < 0.0001)\), and quality of movement \((p < 0.0001)\). There were significant and moderate effects on the Functional Independence Measure \((p = 0.016)\). Functional ability showed a significant, moderate-to-large effect \((F[1,21] = 4.44, p = 0.012)\). The control group had smaller improvements in amount of use of arm and quality of movement for functional tasks.

These results demonstrate that constraint-induced movement therapy resulted in more positive gains in function of the hand affected by hemiparesis than traditional rehabilitation. The modified constraint-induced movement therapy group was able to shift to a feed-forward method of control for reach and grasp tasks, while the traditional rehabilitation group continued to use a feedback method of control. A feed-forward pattern is more effective for reaching and grasping tasks.

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

The authors concluded that constraint-induced movement therapy resulted in more positive gains in motor control for reach and grasp tasks than did traditional rehabilitation. The constraint-induced movement therapy group demonstrated shorter reaction times, which shows better preplanning abilities, and also a feed-forward control of movement rather than feedback control, as seen in the traditional rehabilitation group. Feed-forward control of motor movement involves having an internalized motor plan prior to initiation of movement, while feedback control requires sensory input to alter and correct subsequent motor movements. The constraint-induced movement therapy group showed that peak velocity occurred more frequently during movement time than the traditional rehabilitation group, which shows this group was using feed-forward control. The constraint-induced movement therapy group also demonstrated greater gains in functional performance than the rehabilitation group, as shown by the Functional Independence Measure and the Motor Activity Log.

his work is based on the evidence-based literature review completed by Melissa Julian, OTS, and Kelly Erickson, PhD, OTR/L (faculty adviser).