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# Is Constraint Induced Movement Therapy a Superior treatment for CVA?

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# Is Constraint Induced Movement Therapy a Superior treatment for CVA?

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# Is Constraint Induced Movement Therapy a Superior treatment for CVA?

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## CLINICAL SCENARIO:

As we know, cerebrovascular accident induced hemiplegia can have a devastating impact on someone's daily life and capacity to perform meaningful activities. In such cases, the client's upper extremity mobility limitations are of specific concern because of such a close relationship in increases in daily function. As the prevalence of CVA cases rise with the growing aging population, occupational therapists must press to develop powerful, result oriented interventions and modalities. The idea that placing a constraint on the unaffected limb of a person with hemiparesis to promote neuro-motor recovery and reorganization of the affected hemisphere while counteracting learned non-use has been both greatly praised and hotly refuted amongst the occupational therapy community. In order to draw conclusions about the effectiveness of these interventions and to support reasoning for insurance reimbursement, therapists must conduct clinical trials.

## FOCUSSED CLINICAL QUESTION:

How does Constraint Induced Movement Therapy impact recovery after CVA when compared to other types of intervention?

## SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:

- A total of 5 critically appraised papers (CAP) were written from selected literature investigating the effectiveness of CIMT.
- A meta-analysis (Shi, Tian, Yang, & Zhao, 2011) concluded that CIMT could be considered for a possible CVA intervention because when compared to traditional interventions, CIMT was shown to reduce the level of disability, improve the ability to use the paretic upper extremity, as well as increasing the use of the paretic upper limb in activities of daily living.
- An ITS design (McCall, McEwen, Colantonio, Streiner, & Dawson, 2011) concluded that CIMT was able to show a noticeably positive effect at the

participation and activity levels with less evident benefits at the impairment level.

- A single case design (Bolduc & Lawrence, 2011) concluded that CIMT was able to show improvements in motor control, strength, decreasing tone and glenohumeral subluxation in the affected limb. This led to substantial gains in use of the affected UE for ADLs.
- A randomized control trial (Hayner, Gibson, & Giles, 2010) concluded that the benefits of CIMT and traditional bilateral techniques yield very similar results in motor function (WMFT) and satisfaction with performance (COPM).
- A cohort study (Brunner, Skouen, & Strand, 2011) concluded that CIMT and mCIMT should not be considered until after 4 weeks poststroke because there was a lot of improvement in arm function was shown to occur naturally and with the help of traditional rehabilitation.

**CLINICAL BOTTOM LINE:** There is a large but conflicting body of evidence regarding CIMT as an effective therapy modality to treat CVA hemiplegia. Despite the existing research already done on CIMT effectiveness, further research needs to be conducted to prove the benefits and disadvantages and to legitimize it as a universally reimbursable intervention for occupational therapists to provide to clients with CVAs.

**Limitation of this CAT:** This critically appraised paper (or topic) has not been peer-reviewed by one other independent person/a lecturer.

- This critically appraised topic has not been peer-reviewed.
- An exhaustive literature review has not been conducted.
- This CAT was written by a student in an occupational therapy masters program.

## SEARCH STRATEGY:

### Terms used to guide Search Strategy:

- **Patient/Client Group:**
- Ideally, but not necessarily limited to adults age 50 and older with CVA
- **Intervention (or Assessment):**
- Constraint Induced Movement Therapy
- **Comparison:**
- Any other commonly used method
- **Outcome(s):**
- Increased function

Databases and sites searched	Search Terms	Limits used
09/10/2011 CINHAL- Ebsco Medline	"constraint induced movement therapy", "constraint-induced movement therapy" 80+ results	none

### INCLUSION and EXCLUSION CRITERIA

- Inclusion:
  - CIMT as CVA treatment
  - Peer reviewed articles
  
- Exclusion:
  - Articles written in any language other than English
  - Any articles written before 2005

### RESULTS OF SEARCH

Five relevant studies were located and categorised as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 1998)

**Table 1:** Summary of Study Designs of Articles retrieved

Study Design/ Methodology of Articles Retrieved	Level	Number Located	Author (Year)
Meta-analysis	1	1	(Shi, Tian, Yang, & Zhao, 2011)
ITS design	2	1	(McCall, McEwen, Colantonio, Streiner, & Dawson, 2011)
Single case design	3	1	(Bolduc & Lawrence, 2011)
Randomized control trial	2	1	(Hayner, Gibson, & Giles, 2010)
Cohort study	2	1	(Brunner, Skouen, & Strand, 2011)

### BEST EVIDENCE

The following study/paper was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting this study were:

- Most closely related to my PICO question by comparing CIMT with another more typical form of treatment.
- Used both qualitative and quantitative methods to draw conclusions
- Relevant occupational therapy practice implications

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of Comparison of constraint-induced movement therapy and bilateral treatment of equal intensity in people with chronic upper-extremity dysfunction after cerebrovascular accident by Hayner, K., Gibson, G., Giles, G. 2010

### **Aim/Objective of the Study/Systematic Review:**

**Study Design:** A stratified, randomized pretest-posttest, 6 month follow-up, two-group comparison design. Stratified to level of UE impairment ("more" or "less") determined by performance on the WFMT and then randomly appointed to either CIMT or bilateral treatment group. The raters were not blinded.

**Setting:** Samuel Merritt University, a health science training institution in Oakland, California. Performed in clinic rooms with a kitchen, tables, and typical occupational therapy supplies.

**Participants:** Participants were gathered from a free clinic at Samuel Merritt University, clinics in the vicinity, and a local CVA support group. Potential participants were first pre-screened by phone interview and if they met the initial inclusion criteria, were invited to an in-person screening. Pre-screening inclusion criteria included English-language skills, 18-100yrs old, at least 6 months after CVA with related UE dysfunction, had sufficient endurance to participate in therapy 6hr/day for 10 consecutive days, agreed not to smoke (because the testing center couldn't provide a smoking area), could walk without an ambulatory aid, could eat food that was not mechanically altered, and were available for the study period. Participants who satisfied these pre-screening requirements were administered the Mini-Mental State Examination, an author developed balance test, and participants had to be able to place their affected hand on a table surface and show at least trace movement in the hand.

There were thirteen people who met inclusion criteria but one who was randomized to the CIMT group, injured his affected UE in a non-study related accident at home and was dropped from the study, leaving twelve participants (6 in CIMT group, 6 in the bilateral group). The mean age for the CIMT group was 54.00 and the bilateral group was 59.50. One mentioned bias of the study is that the mean time since CVA in the bilateral group was drastically higher (2039 days) compared to that of the CIMT group (642.33 days).

**Intervention Investigated:** Based on the participants' scores on the WMFT, they

were ranked into two categories, “more impaired” and “less impaired” and distributed amongst the two groups (CIMT and Bilateral). The CIMT (experimental) group wore a padded mitt on the unaffected hand and practiced functional activities with only the affected UE, preventing use of the unaffected UE (with the exception of bathroom activities). The bilateral (control) group was provided with repetitive verbal and visual cuing to use both hands during all activities (even tasks typically performed unilaterally).

The tasks were graded to be the just right level of difficulty for the participants’ to perform either individually or with others or they were provided just as much assistance that was needed to achieve task performance. Assistive devices were used when required by a participant in the CIMT group to accomplish a task with one hand.

The activities were designed to promote function and active range of motion. They included purposeful and meaningful activities like crafts, table games, table setting, cooking, gathering ingredients, cleanup, repetitive activities like chopping vegetables, and washing hands.

At the beginning of each day, there was a morning meeting with each patient, to discuss how they had spent their time at home performing activities with constraint or performing tasks bilaterally. Then a stretching/warm up activity, then lunch where patients would perform meal subcomponents (ie setup, cooking, table setting, serving, eating, and clean up), and wrap up session in the afternoon. They were encouraged to do as much at home to report back the following day. The participants were assessed before and after the 10 day treatment period, and again 6 months post-test for a follow up.

**Outcome Measures** *(Primary and Secondary) Give details of each measure, maximum score for each measure and range, administered by whom, where*

- Wolf Motor Function Test (WMFT)- the most commonly used measure for UE motor function in CIMT research, measuring fine and gross motor skills determined by quality and speed of movement on 15 tasks.
- Canadian Occupational Performance Measure (COPM)- a clinical assessment that allows clients to develop and rate their own therapy goals related to self-care, productivity, and leisure.
- Administered by three occupational therapy researchers, seven second-year masters of occupational therapy students, and four first-year masters of occupational therapy students. The assessments were all either administered by or directly supervised by licensed occupational therapists.

**Main Findings:** The WMFT scores were explained in a mix model ANOVA which found that the functional level and trial main effects to be significant. The pre-test scores were significantly lower than the post-test ( $p = .009$ ) and follow up ( $p = .008$ ) scores across all groups which indicated significant improvement in function from pre-test to post-test and from post test to follow up ( $p = .022$ ) but did not differentiate between the CIMT or bilateral groups. The less impaired subgroup scored significantly higher on the WMFT. However, there was not a great statistical difference found in improvement between the CIMT and bilateral groups as both groups showed similar improvements.

Results of the COPM assessments included a self-assessed Performance and a Satisfaction With Performance rating. These COPM results found that the functional level and trials main effects to be significant as well as the interaction between the Trial x Treatment group and Functional Level. In the CIMT group, the post-test ( $p=.026$ ) and the follow-up test ( $p=.023$ ) between the more and less impaired were found to be significantly different. However, in the bilateral group, the more and less impaired UE groups did not show a significant difference from pre-test ( $p=.08$ ), post-test ( $p=.091$ ), or follow-up ( $p=.938$ ).

**Original Authors' Conclusions:** "High- intensity occupational therapy using a CIMT or bilateral approach can improve UE function in people with chronic UE dysfunction after CVA. Treatment intensity rather than restraint may be the critical therapeutic factor." (Hayner, Gibson, & Giles, 2010 p.528)

### Critical Appraisal:

**Validity-** This study aimed to provide exactly the same type and amount of intervention (level of intensity) to each group to explore the importance of intervention level intensity to effectiveness of CIMT.

One bias of this study was that the raters were not blinded. Another was that the bilateral group was significantly longer post-CVA than the CIMT group. This could have caused the bilateral group to show more drastic improvements; more comparable to the CIMT group. Furthermore, the study mentions that the learned behaviors resulting from study activities may have been more easily utilized by the bilateral group, described as "translation-failure" (Hayner, Gibson, & Giles, 2010) possibly explained why the CIMT more impaired group reported less satisfaction and home practice than any other groups. PEDro score 5/10.

### Interpretation of Results

- While CIMT may in theory bring greater gains in individuals with CVA, the benefits are not drastically superior to those elicited from intense bilateral therapies.
- CIMT did show improvement in motor function.

**Summary/Conclusion:** It appears that the associated high level of intensity that is assumed with CIMT is a major contributing factor to its beneficial outcomes. This high level of intensity is what forces clients with hemiplegia from CVA to try to use their affected UE instead of compensating with the unaffected UE and compounding the effects of learned non-use.

(Shi, Tian, Yang, & Zhao, 2011)

(McCall, McEwen, Colantonio, Streiner, & Dawson, 2011)

(Bolduc & Lawrence, 2011)

(Brunner, Skouen, & Strand, 2011)



<b>Intervention investigated</b>	A meta-analysis that synthesized the results of thirteen RCTs involving 278 patients that explored the relationship effectiveness of CIMT compared to traditional rehab methods.	For 2hrs, 5 days/wk for 2 weeks, clients wore a padded mitt on their unaffected UE and did tasks individually customized tasks specific to each participant's functional goals on the COPM. Activities included motor tasks, goal-specific functional tasks, and other tasks of daily living.	This single case study followed a 41 yr old man diagnosed with acute CVA who suffered from right hemiplegia and apraxia. Treated in an acute inpatient rehab setting, this gentleman's outcomes were measured pre, post, and follow up (3 and 6 months).	This prospective, repeated-measures study assessed patients 3 times: 1 to 2 weeks after stroke, 4 weeks after, and 3 months after to assess AROM and motor function. The purpose of this study was to examine the eligibility requirements for CIMT and to identify the population that could benefit from CIMT in a subacute phase after stroke.
<b>Comparison intervention</b>	Shaping techniques, ADLs (ie. Writing, combing, flipping cards), range of motion activities, compensatory techniques, functional tasks from the WMFT.	All participants participated in modified CIMT.	The only participant in this study did participate in mCIMT.	Some subjects received CIMT and others did not.
<b>Outcomes used</b>	The Fugl Meyer Assessment, Action Research Arm Test, FIM, Motor Activity Log (use and quality of use), Wolf Motor Function Test, Stroke Impact Scales; Kinematic variables- Normalized movement unit, normalized total displacement, percentage of movement over time where peak velocity occurred, peak velocity.	Participation- COPM Activity limitations- the self- report version of the FIM, the Chedoke Arm and Hand Activity Inventory (measures clinically important change in the affected upper extremity's progression from stabilizer to manipulator when performing tasks of daily living) Impairment- Action Research Arm Test	Fugl-Meyer, Modified Ashworth Scale, hand strength via Dynamometer, 9-hole peg test, measurements taken at evaluation, before CIMT, and after 11 days of CIMT.	Action Research Arm Test, Nine hole Peg Test
<b>Findings</b>	Combined results from the 13 RCTs found that there was statistical significance between the groups in the variables used. mCIMT seems to be shown to reduce the level of disability, increase functional use of the affected UE in daily living activities, and enhances the motor automaticity during movement.	Modified CIMT showed a positive effect at the participation and activity levels but the positive effects were less noticeable at the impairment level.	The study showed that iCIMT improved motor control, increased strength and decreased tone and glenohumeral subluxation in the right upper extremity, improvements in ADL capability.	Because much of the UE motor improvement for clients post CVA occurs during the first 4 weeks, eligibility for CIMT shouldn't be considered until after the 4 <sup>th</sup> week.

## IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

- It is important for occupational therapists to understand that to counteract the negative effects of learned non-use resulting from UE hemiparesis, a high intensity intervention may be necessary. If anything, the findings from this research has shown that the geriatric population is capable of withstanding this extremely high level of stress which is useful because they are the ones experiencing the highest levels of CVA.
- With the high level of stress in mind, it is important for occupational therapists to provide patients engaging in CIMT with lots of feedback and to have them focus on achieving small milestones to reduce stress. Dually important is the education provided to caregivers which focus on encouragement and the importance of patients doing activities themselves independently.
- Further evidence-based research should be done on CIMT interventions that implement more client selected occupations. It would be interesting to see how client motivation influences recovery speed and extent.

## REFERENCES

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**CAT Grading Criteria: Overall Score**   18/20  

4.0    3.7    3.3    3.0    2.7    2.3    2.0    1.7    1.3    1.0    0.0  
 A    A-    B+    B    B-    C+    C    C-    D+    D    F

<b>Rating</b>	<b>Weight</b>	<b>Objective</b>
4 3 2 1 0	20%	Clinical scenario, Clinical question, Summary/key findings, Bottom line <ul style="list-style-type: none"> <li>• sections are clear, succinct, and comprehensive</li> </ul> <a href="#">Clear statement of issue and well stated clinical bottom line.</a>
4 3 2 1 0	10%	Search strategy, PICO, Inclusion/exclusion <ul style="list-style-type: none"> <li>• Search terms listed are comprehensive and accurate</li> <li>• Databases/sites are easily identifiable and comprehensive</li> <li>• Inclusion/exclusion criteria are relevant, clear, and comprehensive</li> </ul> <a href="#">Give additional detail for reader to follow your trail.</a>

4 3 2 1 0	20%	<b>Results of Search</b> <ul style="list-style-type: none"> <li>• Summary of information retrieved is comprehensive and accurate</li> <li>• Research article reflects highest level of evidence available</li> <li>• Reasons for selection are comprehensive and accurate</li> <li>• Sufficient details from studies' results are included and accurate</li> <li>• Details from studies' are accurate</li> <li>• Irrelevant information is not included</li> </ul> <i>Nice balance of studies, particularly with Brunner's prospective study.</i>
4 3 2 1 0	20%	<b>Best evidence</b> <ul style="list-style-type: none"> <li>• Rationale for selection of best evidence is identified</li> <li>• Appraisal of study is accurate and comprehensive</li> </ul> <i>Clear, thorough, conclusion well stated.</i>
4 3 2 1 0	20%	<b>Implications for practice, education and future research</b> <ul style="list-style-type: none"> <li>• Realistic and exclusively based on information/results of appraised study</li> </ul> <i>Additional recommendations for education.</i>
4 3 2 1 0	10%	<b>References</b> <ul style="list-style-type: none"> <li>• Reference list is complete</li> <li>• Reference list is in APA format</li> <li>• Grammar/spelling/punctuation are correct</li> <li>• Guidelines followed regarding format of paper</li> </ul> <i>Insert your name in the footer. Intermittent suggestions for writing style above to improve clarity. Spacing, etc. noted above.</i>

- 4** Exceeds expectations. Fully addresses the stated objective(s) and reflects a high level of achievement. Generally, to receive a rating of a 4 for a specific objective, the demonstration of the objective has to be outstanding and exceptional and only minor recommendations would be made. A rating of 4 means that performance is above expectations.
- 3** Meets expectations. The stated objective(s) is/are essentially met but depth or breadth may be limited or inconsistent. May need some re-working but overall, objective is met. Generally, a rating of 3 means the objective meets expectations. Demonstration of the objective is good but some recommendations for improvement are still possible. A rating of 3 means that performance meets expectations.
- 2** Below expectations. Writing needs improvement to meet expectations for stated objective(s). Objective(s) may only be superficially addressed and additional work is required to fully demonstrate and meet expectations. A rating of 2 means that demonstration of the objective did not meet expectations and requires major improvement. Recommendations for further professional development are required to meet expectations. A rating of 2 means that performance is not meeting expectations.
- 1** Does not meet expectations. Writing needs substantial improvement. Objective(s) clearly is/are not met. Missing major components of the objective and/or is poorly organized. Requires substantial work to fully demonstrate and meet expectations. A rating of 1 means that performance is significantly below expectations.
- 0** Did not complete objective or performance does not warrant any credit.