Title: There is strong support for the effectiveness of mCIMT compared to conventional therapy in improving physical function and occupational performance of the affected upper extremity in adults 0 to 3 months post CVA.

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CLINICAL SCENARIO:

Intervention:

Modified constraint induced movement therapy (mCIMT) is an intervention in which a client's unaffected upper extremity (UE) is restrained while the affected UE is forced to be used during functional activities based on the motor learning principles of repetition, feedback, and practice (Pendleton & Schultz-Krohn, 2006). Clients participate in therapy, which includes repetitive use of the affected UE during functional activities selected by both the therapist and the client. Traditional CIMT protocol requires six hours of daily therapy and constraint at least 90% of waking hours. mCIMT is an intervention that is modified from the original protocol of CIMT, varying in both intensity and duration of restraint of the unaffected limb. mCIMT is defined as less than three hours of daily therapy with constraint of the unaffected UE less than 90% of waking hours and ranging from a total of two to ten weeks.

Science behind intervention:

By repeating a motion that is part of a functional activity, the central nervous system is provided with proprioceptive, kinesthetic, and tactile input that will help lay down pathways for future voluntary motor and praxis skills (Pendleton & Schultz-Krohn, 2006). Liepert, Bauder, Miltner, Taub, and Weiller (2000), found that after mCIMT, the cortical area of the affected hemisphere of the brain for muscle output was significantly larger than before the treatment. This cortical reorganization also corresponded with improved mobility and coordination of the affected UE, suggesting that the damaged hemisphere recruited adjacent areas of the brain in order to improve function. mCIMT also helps to combat learned nonuse. Learned nonuse can occur after a cerebral vascular accident (CVA) when an individual consistently uses his or her unaffected UE to perform tasks, and therefore learns to not use the affected UE. mCIMT forces the use of the affected UE, thereby preventing learned nonuse from occurring (Pendleton & Schultz-Krohn, 2006).

Relation to occupational therapy

In the reviewed articles, mCIMT addresses performance skills, specifically motor and praxis skills. They address client factors of body functions, specifically neuromusculoskeletal and movement-related functions of joint mobility, muscle power, muscle endurance and control of voluntary movements (AOTA, 2008). Client factors of body functions, specifically sensory and pain, along with vestibular and touch are also addressed in the reviewed articles. Additionally, they address the beliefs of the participants, which are measured through the self-report outcomes.

mCIMT is a purposeful activity intervention because functional tasks, such as ADLs and IADLs, are performed during the time of constraint and therapy. Purposeful activities allow clients to develop skills through the practice of selected activities to increase occupational engagement (AOTA, 2008).

Some of the functional activities performed during mCIMT therapy included holding a glass of water and drinking from it, using a telephone, picking up coins, using a utensil to eat, combing hair, and writing (McCall, McEwen, Colantonio, Streiner, & Dawson, 2011; Treger, Aidinof, Lehrer, & Kalichman, 2012).

Client population

This CAT applies to adults of at least 18 years of age who are 0 to 3 months post CVA. The critically appraised articles did not provide information regarding the minimum amount of function required to participate in the intervention of mCIMT.

FOCUSED CLINICAL QUESTION:

- Patient/Client Group: Adults 0 to 3 months post CVA
- Intervention: Modified constraint induced movement therapy
- Comparison Intervention: Conventional therapy
- Outcome: Improved physical function and occupational performance of the affected UE

SUMMARY:

There is strong support for the effectiveness of mCIMT compared to conventional therapy in improving physical function and occupational performance of the affected UE in adults 0 to 3 months post CVA. Five data bases were searched, and five relevant articles were located. The levels of evidence of these five included, one level 1a, two level 1b, one level 2b, and one level 4. Three articles were chosen to be critiqued and included: one systematic review (level 1a), one randomized control trial (level 1b), and one case-series (level 4). The systematic review included two of the five relevant articles located, one 1b and one 2b; and because of this these articles were not critically appraised.

CLINICAL BOTTOM LINE:

There is strong support for the effectiveness of mCIMT compared to conventional therapy in improving physical function and occupational performance of the affected UE in adults 0 to 3 months post CVA.

Limitation of this CAT:

This critically appraised paper (or topic) has been reviewed by occupational therapy graduate students and the course instructor.

SEARCH STRATEGY:

Table 1: Search Strategy

Databases Searched	Search Terms	Limits used	Inclusion and Exclusion Criteria
CINAHL Plus with Full Text OVID MEDLINE with Full Text EBSCOhost OT seeker	constraint-induced movement therapy constraint induced movement therapy CIMT modified constraint induced movement therapy modified constraint-induced movement therapy mCIMT subacute stroke acute stroke	+, and, or	Articles written in English Published within the last 7 years Subjects no more than 3 months post CVA Adults (subjects at least 18 years old) Full text

RESULTS OF SEARCH

Table 2: Summary of Study Designs of Articles Retrieved

Level	Study Design/ Methodology of Articles Retrieved	Total Number Located	Data Base Source	Citation (Name, Year)
Level 1a	Systematic Reviews or Metanalysis of Randomized Control Trials	I	*MEDLINE with Full Text*	(Nijland, Kwakkel, Bakers, and van Wegen, 2011)
Level 1b	Individualized Randomized Control Trials	II	*CINAHL Plus with Full Test EBSCOhost*	(Dromerick et al, 2009) (Treger et al, 2012)
Level 2a	Systematic reviews of cohort studies			
Level 2b	Individualized cohort studies and low quality RCT's (PEDRO < 6)	I	*EBSCOhost*	(Page et al, 2005)
Level 3a	Systematic review of case-control studies			
Level 3b	Case-control studies and non-randomized controlled trials			
Level 4	Case-series and poor quality cohort and case-control studies	I	*OVID*	(McCall, et al, 2011)
Level 5	Expert Opinion			

STUDIES INCLUDED

Table 3: Summary of Included Studies

	Study 1: mCIMT for Elderly Clients with Subacute Stroke (McCall, McEwen, Colantonio, Streiner, & Dawson, 2011)	Study 2: mCIMT Improved Upper Limb Function in Subacute Poststroke Patients: A Small Scale Clinical Study (Treger, Aidinof, Lehrer, & Kalichman, 2012)	Study 3: CIMT for the upper paretic limb in acute or sub-acute stroke: a systematic review (Nijland, Kwakkel, Bakers, and van Wegen, 2011)
Design and PEDRO rating	4; Case-series	1b; Individualized RCT PEDRO: 7	1a; Systematic Review
Population	4 participants were recruited from inpatient and outpatient rehabilitation units; Ages range from 71-91 years old; Time since CVA ranged from 43 to 81 days	28 subacute CVA patients; patients were 11-68 days post CVA; 9 in experimental group and 19 in control group; ages range from 43-82 years old	63 participants, 2-14 days post CVA, average age ranged from 58.6-71.4 years
Intervention Investigated	All participants had 2 hours of treatment a day, 5 days per week for a total of 2 weeks. During the 2 hours of therapy, subjects worked on motor tasks, goal specific functional tasks, and other tasks of daily living chosen by the subject. Each task was repeated 6-10 times. For tasks that were unilateral in nature, participants were asked to use only their affected arm or if both	mCIMT patients had unaffected arm restrained during OT sessions. The patients were urged to don a restrictive mitten up to 4 hours/day, every day, for 2 weeks while they were not in OT. Both groups participated in OT sessions, 5 times a week where therapy was focused on improving UE function. Both groups attended 30 minutes of individual treatments and 30 minutes of group exercises. All participants received intensive treatments for the UE.	Low (LO) CIMT (less than 3 hours of shaping therapy per day and restraining less than 90% of waking hours)

	arms were necessary to complete task, the therapist would use their own arm. All subjects were instructed to restrain their unaffected arm for 4 hours per day when they were not in OT.		
Comparison Intervention	No comparison intervention was used. Subjects results were compared to predicted natural recovery.	Control group experienced similar standard rehabilitation except their unaffected UE was not restrained.	Control groups received conventional therapy, as determined by each randomized control trial.
Dependent Variables	Occupational Performance: COPM- subjective self-measure of performance during functional tasks FIM-SR- activity limitation CAHAI- detects change in affected upper extremity when performing tasks Daily Activity Log- keep record of functional use of the impaired UE outside of treatment Physical Function: ARAT- grasp, grip, pinch, and gross arm movement	Occupational Performance: Peg Transfer, Ball transfer, "Eating" with a Spoon- upper UE function (developed for this study) FIM- level of disability Physical Function: MFT- arm motions and manipulative activities	Occupational Performance: MAL-amount of use and quality of the movement Physical Function: FMA-motor function, balance, sensation, joint function ARAT-grasp, grip, pinch, and gross arm movement

Outcome Measures	Occupational Performance: Canadian Occupational Performance Measure (COPM) Functional Independence Measure-Self Report (FIM-SR) Chedoke Arm and Hand Activity Inventory (CAHAI) Daily Activity Log Physical Function: Action Research Arm Test (ARAT)	Occupational Performance: Peg Transfer Ball Transfer "Eating" with a Spoon Functional Independence Measure (FIM) Physical Function: Manual Function Test (MFT)	Occupational Performance: Motor Activity Log (MAL) for Amount of Use (AOU) Quality of Movement (QOM) Physical Function: Fugl–Meyer Motor Assessment of the Arm (FMA) Action Research Arm Test (ARAT)
Results	Changes were considered significant if the 95% confidence intervals (CI) did not overlap for each data point. COPM- for 3 of the 4 participants, there was no overlap of CI and they fell above the predicted trendline FIM SR- 3 of the 4 participants had post intervention trend lines above the predicted, but only 1 had no overlap of CI CAHAI- all 4 participants had post intervention trendlines fall above the predicted, although all participants had	No significant differences between the mCIMT group and the control group were found in the change scores of the FIM and MFT. The mCIMT group showed significantly more improvement in the peg transfer, ball transfer, and "eating" with a spoon than the control group.	Significant mean differences were found in favor of LO CIMT for all outcome measures (FMA, ARAT, MAL). FMA- significant difference in favor of LO CIMT ARAT- significant mean difference in favor of LO CIMT MAL- (AOU and QOM) AOU- significant difference in favor of LO CIMT QOM- significant difference in favor of LO CIMT

	overlap of CI <u>ARAT</u> -*Grasp*: 3 of the 4 participants had post intervention trendlines fall above the predicted, although all participants had overlap of CI -*Grip*: 1 participant had post intervention trendlines fall above the predicted- no CI overlap was mentioned -*Pinch*: 1 participant had no overlap of CI- no post intervention trendlines compared to predicted lines were mentioned -*Gross motor*- 1 participant had post intervention trendlines fall above the predicted and there was no overlap of CI (there was a ceiling effect for other participants) <u>Daily Activity Log</u>- 1 of the 4 participants attempted to complete this log but did not complete all components		
Effect Size	None	Between groups effect sizes (the baseline to post treatment comparison of CIMT & control group): Occupational Performance: FIM: Non-existent (d= -0.027)	Between groups effect sizes Physical Function: FMA: • (Page, 2005) Large (d=2.60) ARAT:

		Peg: Medium (d=0.591) Ball: Medium (d=0.756) Spoon: Large (d=1.161) Physical Function: MFT: Non-existent (d=0.086)	• (Dromerick, 2009) Small (d=.419) • (Dromerick, 2000) Large (d=1.0) • (Page, 2005) Large (d=4.099) Occupational Performance: MAL (AOU): • (Page, 2005) Large (d=7.517) MAL (QOM): • (Page, 2005) Large (d=4.84)
Conclusion	A lower intensity of mCIMT showed some positive results with an elderly population compared to natural healing alone. Additional research should be completed with a larger sample size.	This study supports the use of mCIMT in the functional rehabilitation of adults post CVA 0 to 3 months. Additional studies need to be conducted to support these findings and determine treatment intensity of mCIMT.	LO CIMT may result in better outcomes than conventional therapy for patients 0 to 3 post CVA. These results should be considered with caution, however, because the small number of studies included and the number of participants in each study were small.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

PICO Question

Is modified constraint induced movement therapy (mCIMT) more effective than conventional therapy in improving physical function and occupational performance in the affected UE for adults 0 to 3 months post CVA?

Overall Conclusions

The outcome variables in this CAT were physical function and occupational performance. Physical function was defined as client factors including range of motion, strength, and motor movement. Occupational performance was defined as the performance of ADLs, IADLs, and other valued occupations.

All articles agreed that there was improvement from baseline to post-test regarding occupational performance and physical function. In regard to physical function, the randomized control trial (Treger et al., 2012) found no statistically significant improvement with non-existent effect sizes when compared to conventional therapy, however, this is likely because both the mCIMT and the control group improved. The systematic review (Nijland et al., 2011) found statistically significant improvement with large effect sizes in physical function when compared to the control group. Improvement in physical function was also supported by the McCall et al. (2011) article.

In regard to occupational performance, the systematic review (Nijland et al., 2011) found statistically significant improvement with large effect sizes compared to the control group. The randomized control trial (Treger et al., 2012) also found statistically significant improvements with moderate effect sizes in occupational performance using outcome measures they created. These results should be interpreted with caution because the outcome measures were not standardized or validated. Treger et al. (2012) reported no statistically significant improvements, with non-existent effect sizes, in occupational performance using the FIM outcome measure. This may be because the FIM measures overall ADL performance, and participants could skew results by compensating with their unaffected arm. The case-series (McCall et al., 2011) supported the findings that mCIMT improved occupational performance.

There are several differences between the studies that may have impacted the results. As stated above, Treger et al. (2012) created their own outcome measures for occupational performance. Additionally, outcome measures between the systematic review and the randomized control trial did not measure the same outcomes, which could have affected the detection of change from pre- to post-test. Sample size was also limited in the Treger et al. (2012) study, with only 28 participants. There was a large variation in treatment dosage and duration; the intervention ranged from 10 to 20 hours of therapy, 56 to 250 hours of constraint, and during from 2 to 10 weeks. The Treger et al. (2012) study had a total of 66 hours of constraint, which was the lowest amount of total treatment in all of the studies. This could be one reason why there was no significant difference between the control and the experimental group. The number of prior CVAs participants had varied, which could have impacted the results; Treger et al., (2012) excluded participants with more than one previous CVA whereas the other studies did not have this criteria.

Due to the level of evidence of the systematic review (Nijland et al., 2011) compared to the other two articles, it can be concluded that there is strong evidence supporting the results that mCIMT improves physical function and occupational performance of the affected UE in adults 0 to 3 months post CVA.

Boundaries

Participants included in this CAT were: adults of at least 18 years of age, less than three months post CVA, and have the ability to follow directions and communicate with test administrators. There were a total of 95 participants in the three appraised articles with ages ranging from 43 to 91 years, and they ranged from 2 to 81 days post CVA. Aside from one article within the systematic review, Page et al. (2005), individuals were excluded if they had visual-spatial neglect or conditions that affected use of their paretic arm, such as amputations and orthopedic conditions; however, specific exclusions varied between studies. Only the Page et al. (2005) study specifically stated that participants must have at least 10 degrees active movement in the fingers and 20 degrees in the wrist. All other studies reviewed did not require a minimum amount of finger or wrist range of motion.

Implications for practice

In order for physical function and occupational performance to improve, it is important that the tasks performed during treatment focus on meaningful, task-specific activities that are practiced repeatedly. These studies demonstrated statistically significant improvements in physical function with

15 to 20 hours of therapy and 84 to 250 hours of constraint. The studies also demonstrated statistically significant improvements in occupational performance with 10 to 20 hours of therapy and 56 to 250 hours of constraint. The highest effect sizes were found with participants who had more hours of constraint and fewer hours of therapy per week over the course of 10 weeks. This indicated that a lower intensity, but longer duration of treatment is more effective for adults 0 to 3 months post CVA. However, the long-term effects of mCIMT for this population are unknown as no follow-up data was collected in the three appraised articles.

In addition, it is important to use outcome measures that are standardized in order to appropriately track changes in performance of the affected UE. When choosing an outcome measure, it is important that it measures the improvements of function and performance in the affected UE rather than performance using both UEs, which can be impacted by compensation of the unaffected UE.

REFERENCES:

Appraised Articles:

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