Efficacy of Constraint Induced Therapy in Children with Cerebral Palsy

Clinical Question
In children with hemiplegic CP, does constraint induced movement therapy improve upper extremity skills and other function?

Literature Reviewed
In March 2008, the databases CINAHL and PSYCH info (1990 to present) were searched using the terms child, ‘upper extremity’ and variations of the term ‘constraint-induced therapy’. This search yielded 20 articles including a Cochrane systematic review (2006). This review and randomized clinical trial (RCT) published after its publication were selected for review. In March 2011, Google scholar was searched for RCT published after 2008. Three additional studies were identified. Summaries of the critical appraisal of these six studies follow. The factsheet ends with a summative discussion of these studies clinical implications.

Summaries of Articles Critical Appraisals

The purpose of this systematic review was to determine the efficacy of constraint-induced movement therapy (CIMT), modified CIMT (mCIMT), and ‘forced-use’ in children with hemiplegic cerebral palsy. The literature search and selection method were exemplary. Three studies met the inclusion criteria [i.e., randomized controlled trials (RCT) or clinical controlled trials (CCT)] and were reviewed. Study intervention included variations of casting and splinting of the uninvolved upper extremity with intensive therapeutic intervention 6 hours per day for 21 days to 2 months. Children were between 7 months and 8 years of age. Outcome measures were different for each study, including observational and functional measures. A trend favoring CIMT was found on several outcome measures including a study demonstrating maintenance of improvement at 2 and 6 months post-treatment. The studies’ methods do not allow the differentiation between the benefit of intensive rehabilitation and CIMT intervention specifically.
The authors of the review recommend that the use of CIMT and mCIMT remain within clinical trials until the evidence is made clearer through further research.


The purpose of this randomized controlled trial (n=18) was to determine the efficacy of CIMT in children with hemiplegic cerebral palsy (CP) ages 7-96 months. The participants were randomly assigned to the intervention group, which received constraint-induced movement therapy (6 hours a day for 3 weeks) or a control group, which received ‘usual rehabilitation care’ (i.e., conventional PT and OT services).

Outcome measurements occurred pre-intervention, at 3-weeks post-intervention and at 3 and 6-month for follow-ups using the Emerging Behaviors Scale, the Pediatric Motor Activity Log, and blinded ratings of videotaped sessions of the Toddler Arm Use Test. The authors concluded that there was substantial improvement in the motor function of the children in the experimental group and that improvements were maintained at 3 and 6 months. The study had many limitations including reliability and validity of the outcome measures used. Details about the interventions were lacking limiting reproducibility. From the study method, it is not possible to determine whether the intensity of services for the intervention group could have been the cause of changes instead of CIMT specifically.


This article described a single-blinded, randomized controlled study, which set out to examine the effects of mCIMT on upper extremity function in children with hemiplegic cerebral palsy. Twenty-two children were divided into intervention and control groups. The intervention group received six hours of mCIMT each day for 10 of 12 consecutive days. During the treatment phase, the children wore a sling on their uninvolved upper extremity, and participated in structured play and functional activities involving shaping or repetitive tasks using their involved upper extremity. Outcome areas that were examined included: (1) efficiency of the involved upper extremity; (2) speed and dexterity of the involved upper extremity; (3) caregiver perceptions of the child’s use of the involved upper extremity; (4) sensibility; (5) hand strength; and (6) muscle tone of the involved upper extremity. Both groups were evaluated pre-intervention, post-intervention, and at 1 and 6 months for follow-ups. Results showed statistically significant greater improvement for the intervention group in outcome areas 1, 2, and 3. The authors concluded that mCIMT improve function in the involved upper extremity without change in impairment. The control group was used as a delayed treatment crossover group, but showed no significant improvement in any outcome area. The authors concluded that the results of the study support the use of mCIMT in children with hemiplegic CP. Limitations in this study include the psychometric properties of some of the outcome measures. Like in the previous studies, it is unclear whether the intensity of treatment or mCIMT resulted in the improvements.

A randomized control trial of 16 children ages 4 to 9 with hemiplegic CP (i.e., GMFCS scores I and II; MACS scores I, II, and III) was conducted to compare short-term (2 weeks) modified constraint-induce therapy which included 3hrs per day of OT intervention to children who received care-as-usual (45 minutes per week of OT intervention). The Jebsen-Taylor Hand Function Test (Jebsen) to measure manual dexterity and the Pediatric Evaluation of Disability Inventory (PEDI) to measure self-care skills and independence were given 1-week prior to intervention, 1-week post intervention and 1-month post intervention. The Jebsen and PEDI have adequate psychometric properties in the peer-reviewed literature and in terms of intra-rater reliability within the study. However, the PEDI was not translated to Portuguese or adapted to Brazilian culture, which may alter validity. The children and families did not differ significantly on measured characteristics. Children in the treatment group showed significant improvement in self-care skills and independence over the control group. The gain in skills and independence appear large enough to be clinically important as the study suggests that approximately 1 in 2 children treated would benefit from the intervention. No significant differences were found in terms of manual dexterity. The primary limitations are the inability to attribute the gain in intervention group to the constraint-induced therapy as it might have resulted simply from the increase intensity. Equally important the gain was noted on the PEDI, which was rated by parents who may have expected the gain and so may not be a reliable source of information.


A randomized controlled trial of 52 children unilateral spastic CP (MACS scores I, II, or III) ages 2.5 to 8 years was conducted to determine whether 6 weeks of mCIMT followed by 2 weeks of bimanual training (mCIMT-BiT) would improve the spontaneous use of the affected arm. The children were randomly divided into two groups. The mCIMT-BiT group received 3-hrs a day, 3-days a week of therapy while the control group received usual rehabilitation care. The intervention is thoroughly described in the article and appears fun and functional. The outcome measures used to estimate upper extremity (UE) movement quality, motor skills, and parent-oriented functional goals appear psychometrically sound. The person who administered the outcome measures was blind to group assignment and the phases of treatment. The groups were similar at baseline on measured characteristics. The study group made significantly more improvement than the control group on all outcome measures except in quality of UE movement quality. The improvements in the mCIMT-BiT group were moderate to large ranging for 10-117% over baseline depending on the outcome measured and these were generally maintained at follow-up. The authors propose that mCIMT-BiT is an effective treatment to improve spontaneous use of the affected upper extremity in children with hemiplegic CP. However, the 2 groups did not receive the same intensity of therapy, thus it is unclear whether gains in intervention group is a result of mCIMT-BiT or receiving occupational therapy at greater intensity.

This before and after study estimated the affects of a mCIMT intervention program on the temporal-spatial parameters of gait of children with hemiplegic CP using a GAITRite walkway, which has good reliability. The 12 children in the study ages 2 to 5 participated in a mCIMT camps (6 hours a day, for 5 consecutive days). The data was collected the day before and after the mCIMT intervention. They found that there were changes in the velocity and base of support during gait leading to increased stability and balance. The results of this study need to be interpreted cautiously because the sample size was small, there was no control group and there was no long-term follow-up.

Implications for Practice

This selected review found that intensive intervention that includes CIMT resulted in significant improvement in function of the affected UE of children with hemiplegic cerebral palsy. These positive results are dampened by the imperfect psychometric properties of some of the outcome measures and some methodological challenges in the studies. The intensity of intervention in the most recent study was shorter, as little as 3 hours a day for 5-days suggesting that positive outcomes are possible rapidly. However, the children received an intensity of services that was greater than the intensity of services in the control group. Therefore, it is unclear whether the intensity of the services for the children in the intervention groups resulted in the improvements instead of the type of CIMT specifically.

In considering clinical application, therapists had previously expressed concerns about the potential adverse effects of CIMT on children and their families because of the constraint and duration of intervention. At present with the shorten intervention and a clear focus on fun activities (e.g., pirate theme) these concerns are minimized. Recent studies described the degree of motor impairment of the children, which will assist clinicians in determining which patients may benefit from the intervention. Studies also describe in details the intervention used allowing for replicability. The intensity of CIMT intervention brings forth concerns about third party reimbursement for this intervention. Providing small group CIMT might alleviate this issue but may be difficult to implement in small rural states. Therapists are encouraged to seek professional development before implementing this intervention. Finally, in spite of the building evidence for this intervention, therapists should set clear goals with the families and use psychometrically sound assessment to measure progress.

Clinical Application Resources

Constraint-induced movement therapy resources:
• CIMT selected review: http://www.canchild.ca/en/canchildresources/constrainttherapy.asp
• CIMT protocol: www.cincinnatichildrens.org/assets/0/78/1067/2709/2777/2793/9199/fa42566b-64d7-4d5b-8c38-62a82d660937.pdf

CIMT impact evaluation resources:
• The Quality of Upper Extremity Skills Test is a psychometrically sound is designed to evaluate movement patterns and hand function in children with CP available at: www.canchild.ca/en/measures/quest/asp
• Manual Ability Classification System is available at www.macs.nu
• Goal Attainment Scaling is a method to develop goals and determined whether they were achieved. Resources: www.personalresearchandevaluation.com/documents/goal_attainment/ColinSHARP-Paper-Workshop2-GAS.pdf; www.bsrn.co.uk/Research/ResearchMethods/RMRm-Goal%20Attainment%20Scaling%20in%20Rehabilitation.doc