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Constraint-Induced Movement Therapy vs. Bimanual Therapy for Children with Hemiplegic Cerebral Palsy

Rachael Harroun & Emily Wirtz

Background

About half the children with hemiplegic cerebral palsy (CP) experience limitations in activities of daily living and involvement in education, leisure, and other occupational activities due to impairment in hand and arm function (Tervahauta, Girolami, and Øberg, 2017).

Constraint-Induced Movement Therapy (CIMT) is a common intervention for children with hemiplegic cerebral palsy (Chen, Pope, Tyler, and Warren, 2014). By restraining the unaffected arm during functional participation, CIMT aims to increase spontaneous use of the affected arm (Dong, Tung, Siu & Fong, 2013).

Bimanual therapy (BIT) is also implemented with this population and includes intensive training in functional bimanual tasks and play. The aim of this treatment is to improve the coordination of both arms through meaningful, structured activities (Dong, et al., 2013).

1 Ask: Research Question

What is the evidence on the effects of constraint induced movement therapy (CIMT) vs. bimanual therapy (BIT) in treating children with hemiplegic cerebral palsy (CP)?

2a Acquire: Search Terms

Databases: PubMed, ProQuest, Taylor & Francis Journals, SAGE Journals

Search Terms: constraint-induced movement therapy, bimanual therapy, hemiplegia, pediatrics, occupational therapy, cerebral palsy

2b Acquire: Selected Articles

Chen et al. (2014): A meta-analysis on the effectiveness of CIMT when compared to other upper extremity therapies, including BIT, on improving arm function in children with CP.

Tervahauta et al. (2017): A systematic review. Examines the evidence on the effect of CIMT compared to BIT, as well as the quality and homogeneity of that evidence and treatment protocols used.

Dong et al. (2013): A systematic review. Compares the effectiveness of CIMT and BIT in improving overall performance capacity and functioning of the hemiplegic arm for children with unilateral CP.

3a Appraise: Study Quality

Chen et al. (2014): Level I. n=894 from 27 RCT's. PEDro quality scores (assess for internal validity) ranged from 5 to 9, one article scoring at 5, meaning quality of studies were good to excellent. Outcome measures reliable and valid. RCT's conducted in 15 countries, 6 in US, could impact external validity.

Tervahauta et al. (2017): Level I. n=225 from 9 RCT's. Two studies considered high quality, four moderate, and three low quality based on AACPDM scale. Intervention protocols not operationally defined and varied between studies, threatening internal validity. Outcome measures reliable and valid.

Dong et al. (2013): Level II. n=247 from 7 RCT's. PEDro: four good (7), two fair (5) and one poor (3). All primary assessments reliable and valid. Inconsistent protocols and limited appraisal of study methodologies. Unable to blind subjects or therapists.



(TDLC, 2019)



(Fisher and Newton, 2016)

3b Appraise: Study Results

Chen et al. (2014): CIMT had a medium effect size ($d=0.55$; $p<0.001$). There was moderate heterogeneity, $I^2=53\%$ ($Q=55.74$, $p=0.00$). 2 out of 3 effect sizes decreased at follow-up when compared to posttest. Dose-equivalence, location, and follow-up time were significant factors ($p<0.05$).

Tervahauta et al. (2017): There was considerable clinical and methodological heterogeneity across studies. Effect sizes were similar and small as indicated by broad 95% CI's. It is not possible to determine whether one intervention protocol would provide more favorable outcomes.

Dong et al. (2013): This narrative-style systematic review reported significant improvements in general arm function after both interventions and significant differences in skills gained between CIMT and BIT ($p<0.05$). However, lack of standardized protocols and methodology limits the possibility of drawing conclusions about the effects of CIMT and BIT to guide practice.

4 Apply: Conclusions for Practice

As discussed, definitive conclusions cannot be drawn from the heterogeneous research. However, the following themes emerged from the review. The intensity of interventions (60-90 hours per week) was the most pertinent factor for improved bilateral upper extremity function, regardless of the type of therapy. BIT may be more useful for everyday activity and bilateral upper extremity use and easier to continue after therapy concludes. CIMT may be better for increasing grasp functions, but the research demonstrates limited retainment of skills learned in therapy if not practiced. This indicates that skills transfer training is an important intervention component for hemiplegia, along with training in the child's natural environment.

References:

Chen, Y., Pope, S., Tyler, D., & Warren, G. L. (2014). Effectiveness of constraint-induced movement therapy on upper-extremity function in children with cerebral palsy: A systematic review and meta-analysis of randomized controlled trials. *Clinical Rehabilitation*, 28(10), 939-953. doi: 10.1177/0269215514544982

Dong, V., Tung, I., Siu, H., & Fong, K. (2013). Studies comparing the efficacy of constraint-induced movement therapy and bimanual training in children with unilateral cerebral palsy: A systematic review. *Developmental Neurorehabilitation*, 16(2), 133-143.

Tervahauta, M., Girolami, G., & Øberg, G. (2017). Efficacy of constraint-induced movement therapy compared with bimanual intensive training in children with unilateral cerebral palsy: A systematic review. *Clinical Rehabilitation*, 31(11), 1445-1456. doi: 0.1177/0269215517698834

There is no significant difference between equal doses of CIMT vs. BIT in children with hemiplegic CP.

