FOCUSED QUESTION
In children with hemiplegic cerebral palsy, what is the effect of constraint-induced movement therapy on movement efficiency of the involved upper limb compared with bimanual training?


CLINICAL BOTTOM LINE:
Hand-arm intensive bimanual therapy (HABIT) and constraint-induced movement therapy (CIMT) resulted in similar improvements in the primary measures, which did not support the authors’ hypothesis of specificity of training. This suggests that improvements in hand function associated with CIMT can be achieved with an equally intensive bimanual approach. However, there was specificity of training for goal attainment, whereby the HABIT group made better progress on established goals and transfer to unpracticed goals. These findings have important implications, given the increasing popularity and potential invasiveness of CIMT. It is important to note that the results suggest that intensive progressive task-specific training improves hand function.

One potential advantage of CIMT is that the restraint allows the interventionist to focus solely on the more affected hand. The study’s protocol relies on a 1-to-1 interventionist-to-child ratio. In the absence of this possibility, the restraint may result in greater intensity because participants would have no choice but to use their more-affected hand (i.e., forced use). However, the restraint would preclude opportunity to practice functionally meaningful (bimanual) movements.

Limitations of this study include: the measures used were not sensitive enough to detect subtle differences between treatment outcomes; the sample size was fairly large for a physical rehabilitation study, but differences may emerge with a larger and more diverse sample; the authors did not randomize interventionist assignment or include a no treatment/UCC (usual and customary care) group; and treatment efficacy may differ at lower dosages (i.e., the 90 hours may wash out differences).

Further research is required to establish both optimal ingredients, dosage responses, and feasibility in real world settings.
RESEARCH OBJECTIVE(S)
List study objectives.

Determine if the unimanual training associated with CIMT would lead to greater improvements in unimanual dexterity, whereas bimanual training would lead to greater improvements in bimanual hand use and goal attainment.

DESIGN TYPE AND LEVEL OF EVIDENCE:
Level I: Randomized controlled trial

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.

Level I: Randomized controlled trial

Inclusion Criteria
Ability to extend wrist >20° and fingers at the metacarpophalangeal joints >10° from full flexion, the ability to lift the more affected arm 15 cm above a table surface and grasp light objects, >50% difference in the Jebsen-Taylor Test of Hand Function (JTTHF) score between the 2 hands, a time below the maximum possible (1080 s) of the paretic hand, mainstreamed in school, a Kaufman Brief Intelligence test score >70, demonstrated ability to follow instructions during screening, and completing the testing.

Exclusion Criteria
Health problems unassociated with cerebral palsy, current/untreated seizures, visual problems interfering with treatment/testing, severe muscle tone (Modified Ashworth score > 3.5), orthopedic surgery on the paretic hand within 1 year, botulinum toxin therapy in the upper extremity within the past 6 months or intended treatment within the study period, and balance problems precluding wearing a sling.

SAMPLE CHARACTERISTICS
N = 44

| % Dropouts | 4.5 |
| #/ (%) Male | 20 (48%) |
| #/ (%) Female | 22 (52%) |
| Ethnicity | White 27 (64%) |
Disease/disability diagnosis: Cerebral palsy (hemiplegia)

Check appropriate group:

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<tr>
<th>Group</th>
<th>20–50/study group</th>
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**INTERVENTION(S) AND CONTROL GROUPS**

*Add groups if necessary*

**Group 1**

**Brief Description**

CIMT group required hand restraint with slings of the less-affected hand. A progression of unimanual activities were performed with the paretic hands. The sling was strapped to participants’ trunks with the distal end sewn shut and was continuously worn except when toileting or during breaks (not more than 15 minutes per day).

**Setting**

Six CIMT day camps were conducted at the university. Participants in one room specifically received CIMT; 2 to 5 children participated at each camp.

**Who Delivered?**

Eight of the interventionists (out of 42 interventionist/child pairs) were physical or occupational therapists (PT/OT). The remaining interventionists were graduate students in kinesiology, neuroscience, speech pathology, or psychology programs and undergraduates. Despite a higher level of knowledge and awareness of how to interact in a therapeutic manner, the PT/OT interventionists were required to provide only the specific procedures related to CIMT/HABIT and were restrained from using other treatment modalities.

**Frequency?**

15 consecutive weekdays

**Duration?**

6 hours per day (adjusted for holidays; 90 hours, making up any missed hours)

**Group 2**

**Brief Description**

HABIT did not use a physical restraint; instead, participants were engaged in age-appropriate fine and gross motor bimanual activities using motor learning approaches.

**Setting**

Six HABIT day camps were conducted at the University. Participants in one room specifically received HABIT; 2 to 5 children participated at each camp.

**Who Delivered?**

Eight of the interventionists (out of 42 interventionist/child pairs) were physical or occupational therapists. The remaining interventionists were
graduate students in kinesiology, neuroscience, speech pathology, or psychology programs and undergraduates. Despite a higher level of knowledge and awareness of how to interact in a therapeutic manner, the PT/OT interventionists were required to provide only the specific procedures related to CIMT/HABIT and were restrained from using other treatment modalities.

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

Contamination

YES/NO

Co-intervention

YES/NO

Timing

(YES)/NO

Site

YES/NO

Use of different therapists to provide intervention

YES/NO  Participants worked individually with their interventionist or in groups (1:1 interventionist-to-participant ratio always maintained). Interventionists were paired with children prior to randomization using family-centered approaches considering caregiver and supervisors’ best judgment based on the child’s age and gender. Emphasis was placed on making participation enjoyable.

**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.

Two primary outcome measures were used to quantify unimanual capacity and bimanual performance under the International Classification of Functioning and Health (ICF) “activity and performance” domain.

The Assisting Hand Assessment (AHA, version 4.3) quantifies the effectiveness with which a child with unilateral disability uses his/her affected (assisting) hand in bimanual activity. It has excellent validity and reliability (interrater = .97, intrarater = .99).

The Jebsen-Taylor Test of Hand Function (JTTHF) is a standardized test of simulated functional tasks quantifying the time to complete a battery of unimanual activities. Reliability
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.

Three secondary measures were also used.

The dissociated movements (ICF “body function”) and grasp (ICF “body function” and “activity and performance”) subtests of the Quality of Upper Extremity Skills Test (QUEST) were used to characterize dissociation of distal and proximal upper-extremity movements and attainment of specific grasp patterns of the two hands (ICF activity and performance and body function/structure). The reliability and validity were not reported.

The Goal Attainment Scale (GAS; ICF “activity and performance” and “participation”) was used to quantify progress on established goals before group assignment (one functional and one play goal defined by caregivers and/or older participants). Goals were assessed for appropriateness based on age and current abilities and scaled off-site by a physical therapist. The reliability and validity were not reported.

Children wore activity monitors (Manufacturing Technology Inc, Fort Walton Beach, Florida, #7164; 5.1 cm × 2.6 cm × 1.5 cm, 42.9 g) on their wrists during the AHA test sessions. The number of accelerations was measured as activity counts (0.01664 g for an acceleration of 2.13 g directed parallel to the x-axis at 0.75 Hz), which were used to determine the percentage of time each hand was used while performing AHA activities. The reliability and validity were not reported.

Participants were evaluated directly prior to treatment (pretest), within 2 days (“immediate”), and 1 and 6 months after treatment by a physical therapist blinded to group allocation (verified following testing).

Measurement Biases

Were the evaluators blind to treatment status? Circle yes or no, and if no, explain.

YES/NO

Recall or memory bias. Circle yes or no, and if yes, explain.

YES/NO

Others (list and explain):
RESULTS
List results of outcomes relevant to answering the focused question
   Include statistical significance where appropriate (p < 0.05)
   Include effect size if reported

For the JTTHF, there was a 141.7 s (37.8%) and a 131.2 s (34.5%) decrease for the CIMT and HABIT groups, respectively. Similarly, the AHA scaled logit scores improved 2.24 and 3.0 points for the CIMT and HABIT groups, respectively. Planned comparisons revealed that the changes were attributed to differences between the pretest and immediate posttest that were maintained over the 6 months. There were no Group × Test Session interactions for either primary measure.

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

YES/NO

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.

Bimanual training and CIMT resulted in similar improvements in the primary measures, which did not support the authors’ hypothesis of specificity of training. This suggests that improvements in hand function associated with CIMT can be achieved with an equally intensive bimanual approach. The findings of similar improvements in hand function for both treatments may indicate that both dosing schedule and intensity may be important.

This work is based on the evidence-based literature review completed by Tik Wan (Lydia) Cheung, OTS, and Ashley Halle, OTD, OTR/L, Faculty Advisor, University of Southern California.


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