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CIMT and the Power of HABIT

Recent advances in efficacious Neurorehabilitation treatments all include two key components: active training by the participant and intensity of training.

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What is CIMT?

Constraint-Induced Movement Therapy (CIMT) involves restraint of the most functional upper extremity of a child with CP along with active training of the more affected upper extremity. This treatment was first developed for adults with hemiplegia due to stroke in the 1990's. After recognition that movement disorders in children with CP change, and children may improve their motor

performance if given opportunities to practice, CIMT was adapted and tested in children with hemiplegia (one form of CP) around the turn of the century. Since then, it is the most-tested physical rehabilitation approach, with lots of research evidence supporting its use for many children with CP.

What is HABIT?

Hand and arm bimanual intensive training (HABIT) was developed shortly after the CIMT program. Recognizing that training is a key feature of rehabilitation,



as well as the importance of specificity of training, a parallel treatment approach can be beneficial. The training forgoes the restraint and focuses on using both hands.

This was developed based on the recognition that children with hemiplegia have one well-functioning upper extremity, and thus don't need to develop a second dominant hand. Instead, children and caregivers most frequently request that treatment focuses on gaining functional independence by acquiring skills necessitating the use of both hands



What is neurorehabilitation?

Recent advances in efficacious Neurorehabilitation treatments all include two key components: active training by the participant and intensity of training. Two approaches that capitalize on these components are:

- Constraint-induced movement therapy, eliciting practice of the more affected upper extremity by restraining the contralateral one
- Bimanual intensive training, eliciting practice by performing tasks necessitating use of both upper extremities.

and doing sport activities).

Bimanual training maintains the intensity of training elicited with the CIMT program, but instead of use of a restraint, tasks requiring use of both hands are practiced. Research has also supported the efficacy of bimanual training.

Several studies comparing CIMT and HABIT have suggested that with a few nuances, similar improvements are seen following both types of training.

They can both be seen as motor-learning approaches that elicit intensive practice. Furthermore, they are not mutually exclusive of each other, and can be combined in one treatment period or over time as seen fit.

How do CIMT/HABIT work?

Studies show that CIMT works across a

wide range of ages, including toddlers through adolescents. It works one-on-one in therapeutic environments, day camp group environments and when provided at home by trained caregivers.

A wide range of restraints, such as gloves, slings and casts have been used. Current research has not directly compared the different approaches. Therefore, we cannot conclude that any one model of restraint elicits a better outcome than another. However, since repeated participation in training over a number of years shows additive effects, it is important to consider the model that best fits the child's preferences, the environment, and parenting philosophy. Given that it is not a one-time approach, there is no need to trade child friendliness for any slight benefits one model could potentially have over another. It is important to consider that:

It is not the restraint per se, but rather the practice that is elicited that is the key ingredient.

However, restricting use of the better upper extremity 24/7 could result in unintended consequences. In experiences done with animals, mimicking the neurologic conditions of a child with CP it has been shown that restricting a limb for long periods of time (2 weeks) can alter the normal development of the brain connectivity to the restrained forelimb, especially during periods corresponding to infancy.

It is not known whether such "critical periods" exist in humans, but positive outcomes in toddlers have shown with a daily 2 hours period of restraint. Large improvements in motor function in the more affected arm/hand can occur. Use of casts 24/7 are not recommended in very young children and infants.

So, what are the key ingredients?

Research to date suggests that Intensity is one of the key ingredients! More is better, but not more of the same. Ingredients, incorporating:

- task specificity: meaningful activities for the child.

- motor learning: practice makes perfect!

What do we know about motor skills learning for children with CP?

Since the turn of the 21st century, considerable advances have been made regarding physical rehabilitation of the upper extremity in children with cerebral palsy (CP). The key advances are based on two key aspects of how typical motor skills develop and are acquired:

- First, motor skills develop through *large amounts of practice*. For example, emerging (infant) walkers undergo about 14,000 steps (46 football fields) per day, and 100 falls per day for many months before becoming proficient walkers. Similar large amounts of practice likely occur for reaching and grasping. This leads to the obvious question: Why would one expect large improvements in motor function, given the few opportunities for practice, in the short duration of therapy typically provided?
- Second, people improve motor skills by actively practicing them. In rehabilitation, this is termed “task-oriented training” or a “motor learning approach” to acquisition of motor skills. In a recent review of the efficacy of all rehabilitation approaches for improving activity performance in children with CP, only a handful of approaches were identified as having sufficient levels of evidence to recommend clinical implementation. Interestingly, all of them were active training approaches with intensive training. Two common approaches include constraint-induced movement therapy (CIMT) and bimanual intensive training.

How to deliver this intervention?

It does not have to be delivered all at once. Recent findings suggest that these intensive protocols can be successfully adapted to children with lower extremity

limitations as well. Despite great progress, it should be acknowledged that training alone won't be sufficient. Multimodal approaches, combining neuroscience, orthopedics/surgery, pharmacological treatment, engineering and other rehabilitation (PT/OT) strategies will be required to maximize functioning and health.

How is CIMT being implemented in Canada?

*Keiko Shikako-Thomas, PhD
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In a recent study we have asked program managers and therapists across Canada about the use of CIMT/HABIT in rehabilitation settings. We asked if their center offered such programs, and if not, what were the barriers preventing the implementation of this intervention, which we know is effective to treat children with hemiplegic CP.

We found out that only 7/31 pediatric rehabilitation centers in Canada offer group interventions in the format of CIMT/HABIT summer camps. More centers offer individual CIMT, but there were no clear guidelines being followed in individual sessions.

What factors that facilitated the implementation of CIMT/HABIT interventions?

- Supportive families pushing this type of intervention
- Critical mass of children who were good candidates for the intervention
- Administrative and management support to implement innovations
- Clinicians' connections to research such as journal clubs or the presence of a researcher in the center

On the other hand, not being in an urban location, not having the critical mass of patients, having a more rigid managing structure (not allowing clinicians to change schedules or budget allocations to implement new programs) were perceived as the main barriers to the implementation of CIMT/HABIT programs.

A few successful strategies to implement a CIMT/HABIT program are:

- The presence of a champion: someone who was willing to gather the evidence, create schedules and propose activities, which were often an occupational therapist, or a parent and clinician team.
- Thinking creatively about funding allocations. For example, the hiring of volunteer students (to help with camp adult- to-child ratios to ensure safety for children), apply for foundation money (to ascertain that clinicians can get release time to be on camp or deliver home or school-based programs)

Based on the study participant's feedback, and in order to give clinicians and families an easier access to information, and the opportunity to exchange ideas, obtain successful models, activities and suggestions for CIMT/HABIT programs, we have created the LINK to CIMT – a web-space created to LINK people in learning about, discussing and implementing CIMT/HABIT programs!

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A recent study further illustrates the potential of CIMT and repetitive transcranial magnetic stimulation (rTMS) in enhancing current rehabilitation programs in hemiparetic children. rTMS can be used as a therapeutic tool in various neuropsychiatric disorders because of its ability to specifically modulate distinct brain areas.



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Want to learn more on the topic?

Suggested articles:

1. Andersen, J, Majnemer, A, O'Grady, K, Gordon, AM (2013) Intensive upper extremity training for children with hemiplegia: From science to practice. *Seminars in Pediatrics* 20:100-105.
2. Eliasson AC, Holmefur M. The influence of early modified constraint-induced movement therapy training on the longitudinal development of hand function in children with unilateral cerebral palsy. *Dev Med Child Neurol*. 2015 Jan;57(1):89-94
3. Novak I, McIntyre S, Morgan C, Campbell L, Dark L, Morton N, Stumbles E, Wilson SA, Goldsmith S. A systematic review of interventions for children with cerebral palsy: state of the evidence. *Dev Med Child Neurol*. 2013 Oct;55(10):885-910

This study examined whether the addition of rTMS and/or CIMT to intensive therapy increases motor function in children with perinatal stroke and hemiparesis. The intensive therapy was comprised of 2-week, goal-directed, peer-supported motor learning camp randomized to daily rTMS, CIMT, both, or neither. What did they find?

- Adding rTMS, CIMT, or both, to the intensive therapy camp doubled the chances of improvement.
- The camp alone produced large improvements in Canadian Occupational Performance Measure scores.
- Quality-of-life scores improved.