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Training Pediatric Therapists to Deliver Constraint-induced Movement Therapy (CIMT) in Sub-Saharan Africa

Virginia Tech Carilion Research Institute’s Neuromotor Research Clinic

➢ Clinical Delivery of P-CIMT

➢ CHAMP Study (NIH Sponsored)
  • Full-time cast + 60 hrs [3 hrs P-CIMT/5 days a week for 4 weeks]
  • Part-time splint + 60 hrs [3 hrs P-CIMT/5 days a week for 4 weeks]
  • Full-time cast + 30 hrs [2.5 hrs P-CIMT/day for 3 days per week for 4 weeks]
  • Part-time splint + 30 hrs [2.5 hrs P-CIMT/day for 3 days per week for 4 weeks]

➢ Baby CHAMP
  • Cast + 60 hrs [3 hrs P-CIMT/5 days a week for 4 weeks] and Parent Training
  • Splint + 60 hrs [3 hrs P-CIMT/5 days a week for 4 weeks] and Parent Training
  • No Constraint + 60 hrs [3 hrs P-CIMT/5 days a week for 4 weeks] and Parent Training
As a result of this course, participants will be able to:

1) Identify the core features elements of P-CIMT needed to produce clinically meaningful and enduring effects in children with hemiplegia or asymmetrical cerebral palsy.

2) Explain important cultural and contextual considerations when developing a feasible model of P-CIMT for use in low-resource countries and rural environments.

3) List functional goals and outcomes of a successful pediatric constraint-induced movement therapy program.
Constraint-Induced Movement Therapy

One type of task-oriented training originally used with individuals post-stroke to:

- Increase functional use of the paretic upper-extremity through massed practice + shaping (6 hrs/day x 14-21 days)
- While restraining the less-involved upper-extremity (90% of waking day)
Constraint Induced Movement Therapy (CIMT)

- **Forced Use (Not-CIMT):**
  - Use of the affected limb during daily activities is "forced" because of the mitt worn on the less-affected hand (NO training)

- **CIMT (package of treatment):**
  - Constraint = mitt/cast strong hand
  - Shaping = operant training
  - Targeted massed practice using weaker hand while wearing constraint
  - Individual training with skilled therapist

Pediatric CIMT: growth from adult CIMT science

- **Basic science: primate trials**
- **Adult CIMT**
  - Instruments Neuroimaging
  - Modified protocols Active ingredients
  - New measures: PMAL, AHA, mini AHA, IMAL
  - Fidelity Measures
  - Efficient protocols: "active ingredients"
  - Applying to different clients (acute/chronic)
  - Applying in clinic and community
  - Refining clinical measures
  - Examining application "best responders"
  - Individual vs group
- **Pediatric CIMT**
What is Pediatric CIMT (P-CIMT)?

P-CIMT has been modified from adult CIMT specifically for children with unilateral motor weakness (hemiplegic CP, brachial plexus injury, hemispherectomy, TBI)

- Since 2000, over 70 studies have examined the effectiveness of P-CIMT (27 systematic reviews)
- These studies have used a variety of performance and functional measures

Anderson, et al., 2013; Kolbe et al., 2014; Sakzewski, et al., 2014

Novak, et al., 2013
**Developmental learned non-use:**
“conditioned suppression of movement”

- The child attempts to use the weaker side but finds it very challenging and many times is unsuccessful.

- The child stops using the weaker, affected side and chooses to use a unilateral approach with the stronger, non-affected side.

- The child finds some success using a “one-handed” approach and through “learned non-use” the child decreases attempts to use the weaker side.

**P-CIMT**

- Applications of P-CIMT for children with CP include:
  - A broad range of age groups (infancy through adolescents)
  - A range of abilities and co-morbidities
  - Different contexts, including home, clinic, hospital, community
  - **Different dosages, intensities, and durations**
5 Essential Elements of P-CIMT

<table>
<thead>
<tr>
<th>Elements</th>
<th>Details</th>
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<tbody>
<tr>
<td><strong>Constraint of the less impaired</strong></td>
<td>upper extremity</td>
</tr>
<tr>
<td><strong>High dosage</strong></td>
<td>(beyond typical therapy schedules)</td>
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<tr>
<td>Use of <strong>shaping techniques and repetitive practice</strong> with task variation</td>
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<tr>
<td>Sessions take place in the child’s <strong>natural environment</strong></td>
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<tr>
<td><strong>A transition/discharge program</strong> is provided.</td>
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</table>

Ramey, Coker-Bolt, & DeLuca, 2013
P-CIMT Constraint Options

- Full-arm cast
- Hand mitt
- Arm sling

Ethiopia Project:
Developing an adapted model of P-CIMT for Addis Ababa, Ethiopia
Ethiopia Project Aims

- **Aim 1**: Determine a culturally-relevant and feasible Ethiopian P-CIMT model that retains the critical elements of the evidence-based P-CIMT approaches developed in westernized cultures
  - Invitation from an international healthcare system, CURE Hospital

- **Aim 2**: Train Ethiopian therapists to conduct P-CIMT

- **Aim 3**: Test the reliability and initial efficacy of the Ethiopian P-CIMT Treatment approach

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Process to Implement Workshop

1. **Contacted by Hospital in Addis Ababa Ethiopia**
   - Provide workshop to therapists and staff on pediatric constraint-induced movement therapy

2. **Sought and Obtained Funding to Support Project**
   - Submitted grant proposal to the MUSC Center for Global Health

3. **Planned In-Country Training with Therapists Working for CURE Hospital**
   - Determined dates of workshop, specific material, type of format, and workshop participants

4. **Obtained Required Approvals from Governmental Agencies**
   - Received approvals from the Ethiopia Ministry of Health

5. **Received Final Approval from MUSC and VTCRI Institutional Review Board**
   - Grant funds released; confirmed travel arrangements and purchased workshop supplies
Methods

- Workshop Training
  December 2013

- Workshop held at CURE Hospital in Addis Ababa
  - CURE Ethiopia Children’s Hospital is a 36 bed hospital, established in 2007 by CURE International

- Therapists from 5 hospitals in Addis Ababa attended workshop

Collaborative Development of Workshop Material

- Didactic educational sessions

- Hands-on training with children with hemiplegia
  - Screened 18 children for P-CIMT study

- Daily review of key information from prior day

- Sought contributions from therapists about current cultural and therapy practices in Ethiopia
P-CIMT Workshop

Day 1
- Overview of pediatric CIMT
- Discussion with therapists about therapy in Ethiopia
- Begin development of Ethiopian P-CIMT Model

Day 2
- Video taped examples of P-CIMT
- Evaluation of children with hemiplegia
- Types of constraints
- Afternoon hands-on session to evaluate children with hemiplegia

Day 3
- Working with families
- Goal setting
- Demonstration of casting and splint/mitt constraints
- Demonstration of P-CIMT session with child screened on Day 2

Day 4
- Review P-CIMT information from prior days
- Documentation of therapy outcomes
- Screen children with hemiplegia for Ethiopia P-CIMT
- Provide P-CIMT session with child seen on Day 2 & 3

Day 5
- Review model for Ethiopia P-CIMT
- Provide P-CIMT sessions for 2 children seen on Day 3 & 4
- Review plan for Addis Ababa P-CIMT program
- Therapists complete post-workshop survey

Understanding Current Therapy Practice in Ethiopia

Rehab Approaches in Sub-Saharan Africa

Passive movement, manipulation of joints

Contracture management, surgery, orthotics

Goal-directed, focus on specific daily tasks

Increased dosage; engagement of family and child
Interview with lead therapist at CURE Hospital

Workshop Training

Demonstration of P-CIMT session with children with hemiplegia who attended afternoon sessions
Workshop Training

Demonstration of constraint using cast material

Demonstration of different types of constraints
Methods: 
Assessment of Therapists’ Knowledge

- Therapist Workshop Participant Survey
- Workshop participant’s knowledge of critical elements of CIMT
- In-person observations of therapists’ skill during practice sessions with children

Developed new Ethiopian adapted model of P-CIMT

<table>
<thead>
<tr>
<th>5 Essential Components of P-CIMT</th>
<th>Signature or Traditional P-CIMT Protocol</th>
<th>Ethiopia Adapted Model of P-CIMT</th>
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<tbody>
<tr>
<td>1. Constraint of the less or unimpaired upper extremity</td>
<td>Constraint of the less or unimpaired upper extremity using cast for majority of waking hours and during active treatment</td>
<td>Constraint using full arm cast (plaster or fiberglass) OR resting hand splint used during therapy and worn at home during day</td>
</tr>
<tr>
<td>2. High dosage (likely minimum threshold = 2 hour sessions per day for 5 days per week)</td>
<td>High dosage of therapy in concentrated period of time involving active treatment for a minimum of 3 hours a day for 5 days per week for multiple weeks (dosage = ...)</td>
<td>Therapist provides 1-hour of therapy and the parent provides 1-hour of therapy (2-hour total therapy) - 5 days a week for 4 weeks in a row (DOSAGE = 40 hours)</td>
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<td>3. Use of shaping techniques and repetitive practice with task variation</td>
<td>Use of shaping techniques</td>
<td>Use of shaping techniques</td>
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<td>4. Learning functional skills in natural and diverse settings</td>
<td>Learning functional skills in natural and diverse settings (that is, treatment is in these settings)</td>
<td>Treatment in a clinic setting - focus is on things children do at home and in everyday life; backpack with toys sent home - practice at home with family</td>
</tr>
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<td>5. Transition (post-therapy)</td>
<td>Post-therapy planning to promote functional bilateral and unilateral upper extremity; practice of new skills with more impaired upper extremity</td>
<td>Post-therapy planning - continue to work on new skills and not lose the benefits of high-intensity P-CIMT</td>
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Results

• 12 therapists completed the full workshop, although many days we had as many as 17 attendees

• Post-survey
  – 100% able to identify essential elements of P-CIMT
  – 100% able to identify specific functional goals for their children
  – Only 25% could identify important elements of a discharge program

Results – Therapist Feedback

| Overall Workshop Feedback | "It was a very good workshop. This will help us to provide more therapeutic benefits to our patients. You showed us a new way of treating weakness and disability that we can now use."
| Benefits of P-CIMT for Children in Ethiopia | "This therapy should be carried on at other hospitals, too. This approach will greatly change the way our children live in Ethiopia."
| | "To get great and functional progression within a limited period of time."
| Challenges of Providing P-CIMT in Addis Ababa, Ethiopia | "Change the life expectation of the child to his family and our society."
| | "The parents will develop good hope and better life (less stigma)."
| | "Better function at home and (ability to) go to school, since children have to be able to self-care to go to school here."
| | "Limitation of resources"
| | "Few human resources (therapist)"
| | "Socioeconomic structure; socio-economic status of the family"
Child Case Examples

Enrollment of Children into P-CIMT Study

• Informed consent of children with hemiplegia to participate in new Ethiopian adapted P-CIMT program

• Therapist who completed workshop training provided new Ethiopian adapted model of P-CIMT to 6 children
Child A

- 1 year, 8 months
- Cerebral palsy, left hemiparesis

- Left UE weakness
  - Tightness in shoulder, poor overhead movement
  - Instability in shoulder, inconsistent weight bearing on extended arm
  - Poor grasp and release in hand
  - Only using left hand when requested by parent

P-CIMT program

- Mitt constraint (splint + mitt)
- Worn during therapy sessions
- 4 weeks, 5 days a week, 2 hours each session
- Dosage = 40 hours
- Toys sent home in back pack to encourage additional practice time at home with mother; wore mitt and used toys for additional left UE practice
Child A

Goals for P-CIMT therapy
✓ Reach for toys/play using > 90 degree left shoulder flexion
✓ Hold bottle with both hands
✓ Use left hand to grasp and release toys
  ✓ Spontaneously, with minimal cues to use left hand
✓ Bring both hands to midline to clap

Child A

Pre-CIMT Video                      Last-CIMT session video
Child A: Change in Overall Function/Goals

- Changes after P-CIMT program
  - Able to reach for toys/play with ~110 degrees of left shoulder flexion
  - Open left hand and able to bring to midline to hold bottle
  - Able to bring left hand to midline to clap
  - Using left hand to cross midline, reach for toys without cues

Child A: NEW Functional Activities

- Able to feed self by holding own bottle
- Assisting with dressing tasks (taking arm in and out of shirt, pulling shirt off head)
- Playing with toys with both hands
- Improved verbal communication
- Able to move around more (scooting and commando crawling)
Child A: Feedback from Therapist and Parent

- “the child that he has 2 hands and he can try to use them together”

- “parents were happy to bring child to therapy so often because they were happy with the results in each session”

Child B

- 3 year, 9 months Female
- Cerebral palsy, right hemiparesis
- Right UE weakness
  - Tightness in shoulder, poor overhead movement
  - Poor grasp and release in Rhand
  - Only using right hand when requested by parent
- Unable to walk unsupported
Child B

P-CIMT
• Cast and Mitt Combined
• Re-Casted – to improve fit/comfort; cast on at all times, weekly skin checks
• 4 weeks, 5 days a week, 2 hours each session
• Dosage = 40 hours
• Toys sent home in back pack to encourage additional practice time at home with mother

Child B

Therapy Goals
✓ Bring R hand to mouth better for eating/self-feeding
✓ Pick up and release items with R hand
✓ Use R hand to engage in play activities with twin
✓ Walk unsupported (improve balance)
Child B: Change in Overall Function/Goals

• “She can hold and release objects. She reached her hand to her mouth and face.”

• “It is better to apply CIMT for another child too. I did it for a child to have Cerebral Palsy and she improved a lot. This is wonderful treatment.”

• “She grasped, released, threw, and played with objects easily. It was difficult for her to run and jump”

• “She would stand and stay much longer by herself. She would take 2 or 3 steps with no support. Crawled not as previously, she would put one knee after the other.”
Child B: Feedback from Therapist and Parent

“Her mom said that it was difficult to put her affected foot inside shoe, because she keeps her toes in flexion position. But after this P-CIMT session she can do it without difficulty.”

Child C

- 8 year Male, Cerebral palsy, right hemiparesis

- Right UE weakness
  - Tightness in Rshoulder, poor overhead movement
  - Poor grasp and release in Rhand
  - Difficulty using right hand in standing position
    - Core instability LE tightness, long sitting balance difficult
Child C

P-CIMT

• Cast – worn at all times with weekly skin checks

• 4 weeks, 5 days a week, 2 hours each session

• Dosage = 40 hours

• Toys sent home in back pack to encourage additional practice time at home with mother

Goals for P-CIMT therapy

- Use R hand to feed self
- Use both hands to dress and undress by himself
- Sit in different position with improved balance responses
- Use R hand for play activities
- Improve fine motor skills in R hand
- He is attending school:
  - writing using his R hand is very essential
Child C Therapy Examples

Changes after P-CIMT Program

- Eat/feeds self using his right hand
- Dresses and undresses by himself using both hands
- Able to sit in different positions with improved balance
- Improve fined motor skills in Rhand
Child C: Feedback from Therapist and Parent

**Therapist**
- "At the beginning of the therapy, I used splinting for the constraint and it was not that much helpful because the child is 8 years old and tries to take it away but after cast is applied he gets much improvement"
- "Home exercises is much helpful, the child only spent 2 hours a day in therapy but he can do all the exercises at home 24 hours"

**Parent**
- "He starts to use his right hand actively, eating, dressing."
- "The parent says she didn’t give him any time to spend and encourage him to use his right hand but now she learns to encourage him and play with him is more helpful"

Lessons Learned: Implications for therapy
Implications for Therapy – International or Rural Setting

• Adapted or Modified P-CIMT program can be designed and implemented for settings where resources may be limited

– Important to consider essential elements of P-CIMT and how to maintain elements in adapted/modified model

**THE 5 ESSENTIAL OR CORE COMPONENTS of P-CIMT**

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<td>2. High dosage (likely minimum threshold = 2 hour sessions per day for 5 days per week)</td>
<td>High dosage of therapy in concentrated period of time involving active treatment for a minimum of 3 hours a day for 5 days per week for multiple weeks</td>
<td>High dosage of therapy in concentrated period of time with a minimum of 2 hours a day for 5 days per week for multiple weeks <strong>DOSAGE =&gt; 30 hours</strong></td>
</tr>
<tr>
<td>3. Use of shaping techniques and repetitive practice with task variation</td>
<td>Use of shaping techniques to review, extend, practice, and refine skills that uses formal operant learning techniques with immediate feedback and reinforcement with all treatment sessions</td>
<td>Use of shaping techniques to review, extend, practice, and refine skills as an active component of treatment</td>
</tr>
<tr>
<td>4. Learning functional skills in natural and diverse settings</td>
<td>Learning functional skills in natural and diverse settings (that is, treatment is in these settings)</td>
<td>Treatment may occur in clinics or natural and diverse settings</td>
</tr>
<tr>
<td>5. Transition (post-therapy) planning for maintenance of gains</td>
<td>Post-therapy planning to promote functional bilateral and unilateral upper extremity development and continued practice of new skills with more impaired upper extremity</td>
<td>Post-therapy planning to promote functional bilateral and unilateral upper extremity development and continued practice of new skills</td>
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Implications for Therapy – International or Rural Setting

- A thorough review of the cultural practices of setting in which you implement P-CIMT should be completed and embedded into any adapted model.

- Strong consideration should be made to the type of communication available to in-country collaborators before, during, and after the planned workshop sessions.

- Develop a long-term plan for your partnership; consider engaging local colleges that trained therapists, to contribute to a more sustainable infra-structure.

Considerations for Future Training
Questions?

References


