



## Evidence-Based Care Guideline

# Pediatric Modified Constraint Induced Movement Therapy (mCIMT) plus Bimanual Training (BIT)<sup>a</sup>

Publication Date: December 2014

## Target Population

### Inclusions:

Patients over one year of age<sup>b</sup> with:

- unilateral upper extremity impairment(s) associated with neurological conditions (e.g. cerebral palsy, traumatic brain injury, tumor resection, brachial plexus injury, etc.)
- a caregiver able and willing to commit to the time required for daily procedure and follow-up care

### Exclusions:

This guideline is not intended for use with patients with the following:

- inability to participate in purposeful play or functional activity
- contractures that significantly limit functional arm use
- dystonia preventing the patient from having any controlled movement with the affected upper extremity

The referring provider should be contacted to determine an alternative plan for patients who do not meet the inclusion criteria or who meet the exclusion criteria for this guideline (*LocalConsensus 2013 [5]*)

<sup>a</sup> Please cite as: **Pediatric modified Constraint Induced Movement Therapy (mCIMT/BIT) Team, Cincinnati Children's Hospital Medical Center:** Evidence-based clinical care guideline Pediatric modified Constraint Induced Movement Therapy (mCIMT) plus Bimanual Training (BIT), [http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/Pediatric modified Constraint Induced Movement Therapy \(mCIMT\) plus Bimanual Training \(BIT\).htm](http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/Pediatric%20modified%20Constraint%20Induced%20Movement%20Therapy%20(mCIMT)%20plus%20Bimanual%20Training%20(BIT).htm), Guideline 34, pages 1-21, December, 2014

<sup>b</sup> CIMT is known to be used clinically with infants at CCHMC and throughout the country. However, adequate information on appropriate protocols and effectiveness of CIMT in infants is not available at this time. Therefore, this population is excluded from this guideline.

## Target Users

Include but are not limited to (in alphabetical order):

- Hand Surgeons
- Neurologists
- Nurses
- Occupational therapists
- Patients and families
- Pediatricians
- Physiatrists
- Physical Therapists
- Physician Assistants
- Primary Care Physicians

## Introduction

References in parentheses ( ) Evidence level in [ ] (See last page for definitions)

Individuals with hemiplegia have impairments in one of their upper extremities. These impairments often include decreased range of motion, strength, coordination and sensation often affecting their ability to complete activities that require the use of two hands and may result in participation limitations across many areas of occupation. It can be caused by a number of medical conditions including brachial plexus injury, traumatic brain injury, childhood stroke and cerebral palsy. Factors that can influence engagement in bimanual tasks include unilateral neuromuscular impairments, developmental non-use, mirror movements and impaired bilateral coordination (*Eliasson 2005 [3a]*, *Charles 2006 [5a]*).

Traditionally, patients with hemiplegia receive occupational therapy and physical therapy services to maximize their functional skills. Conventional treatment approaches often incorporate concepts from a variety of frames of references including biomechanical, developmental, neurodevelopmental, and rehabilitative (including compensatory) (*Deluca 2006 [2b]*, *Eliasson 2005 [3a]*). A growing body of evidence suggests that the inclusion of constraint induced movement therapy (CIMT) and bimanual therapy (BIT) in therapeutic programming may be beneficial for patients with hemiplegia (*Novak 2013 [1a]*, *Huang 2009 [1a]*, *Hoare 2007 [1b]*). CIMT is an intervention in which a constraint is utilized on the unaffected hand of a person with hemiplegia to improve functioning of their involved upper extremity. BIT is an intervention utilized with patients with hemiparesis to improve performance of

tasks that require two hands. It should be noted that the preponderance of studies on CIMT/BIT in pediatrics involve patients with cerebral palsy. Several investigators have implemented CIMT with patients who have upper extremity limitations resulting from other diagnoses. These studies use less rigorous methodologies (e.g. case-studies, case-series and single group pre-test/post-test designs). Positive results were identified in studies involving children who incurred brachial plexus injuries/Erb's Palsy (Buesch 2010 [4a], Santamato 2011 [4b], Vaz 2010 [5a]), cerebrovascular accidents (Gordon 2007 [4b], Ploughman 2008 [5a], Ries 2006 [5a], Park 2012 [5b]), traumatic brain injuries (Cimolin 2012 [4a], Miller 2005 [5b]), acquired brain injuries (Karman 2003 [4a]), and children who underwent cerebral hemispherectomies (de Bode 2009 [4a]).

CIMT is based on the principles of mass practice and shaping (Lin 2011 [2a], Eliasson 2005 [3a], Taub 2007 [5a], Brady 2009 [5b]). BIT focuses on intensive training utilizing functional tasks. The tasks are completed with two hands and are based on an individual's unique impairment(s), interests, and functional goals (de Brito Brandão 2012 [2a], Gordon 2007 [2a]). While these principles consistently guide practice, the application of CIMT/BIT is highly variable (Dong 2013 [1a], Huang 2009 [1a], Nascimento 2009 [1b], Hoare 2007 [1b]). Treatment has been effective when provided at home (Chen 2013 [2a], Case-Smith 2012 [2a], Lin 2011 [2a], Hsin 2012 [2b], Al-Oraibi 2011 [2b], Wallen 2008 [4a], Vaz 2010 [5a]), in the clinic setting (Hoare 2013 [2a], Taub 2004 [2a], Rocca 2013 [3a], Kuhnke 2008 [3b]), in a group setting (Aarts 2011 [2a], Sakzewski 2011 [2a], Charles 2006 [2a], Geerdink 2013 [2b], Charles 2001 [4a], Gordon 2005 [5a]), individually (Chen 2013 [2a], Case-Smith 2012 [2a], DeLuca 2012 [2a], Eliasson 2011 [2a], Charles 2006 [2a], Al-Oraibi 2011 [2b], Cimolin 2012 [4a]), implemented by a therapist (Hoare 2013 [2a], Case-Smith 2012 [2a], DeLuca 2012 [2a]) or implemented by a caregiver trained by a therapist (Eliasson 2011 [2a], Eliasson 2005 [3a], Eliasson 2009 [4b]). Several types of constraints have been effective including casts, splints, slings, and mitts (Huang 2009 [1a]). Perhaps most prominent is the variability in dosage. Prominent ranges in dosage variability found in the literature included: durations from 5 days (Coker 2010 [4a]) to 70 days (Facchin 2011 [3a]), intensities from 1 hour a day (Coker 2009 [5a]) to 6 hours a day (Sakzewski 2011 [2a]), and total number of hours from 12 (Psychouli 2010 [4b], Pierce 2002 [5b]) to 210 (Rocca 2013 [3a], Cimolin 2012 [4a]). It should be noted that while protocols with lower dosages (i.e. less than 30 total hours) were effective, these studies were less robust with weaker designs and smaller sample sizes than those using higher doses. Additionally, it is difficult to compare the effectiveness of the protocols

secondary to the diversity of outcome assessments being used (Dong 2013 [1a], Huang 2009 [1a]).

CIMT is theorized to improve bilateral performance via improving capacity of the affected upper extremity, decreasing developmental non-use and improving the function of the impaired upper extremity through brain plasticity (Taub 2007 [5a]). While improved function of the involved upper extremity can positively influence bimanual performance, it may not improve bilateral coordination deficits (Charles 2007 [4a]). Gordon and colleagues (2007) hypothesized that improvement from CIMT result from the intensity of practice rather than the constraint. They found that bimanual treatment based on motor-learning principles provided at an intense frequency was efficacious in improving bimanual hand use (Gordon 2011 [2a], Gordon 2007 [2a]). Later studies examining the effectiveness of CIMT compared to BIT delivered at the same intensity found that both interventions were equally as effective in improving hand function. However, CIMT appears to provide greater gains in unilateral skill while BIT training shows greater gains in bimanual function (Deppe 2013 [2a], Fedrizzi 2013 [2a], Gordon 2011 [2a], Sakzewski 2011 [2a]). Investigators have begun implementing CIMT followed by bimanual training (Case-Smith 2012 [2a], DeLuca 2012 [2a], Aarts 2011 [2a], de Brito Brandao 2010 [2a], Geerdink 2013 [2b], Brandao 2010 [2b], Aarts 2012 [5a]).

The efficacy of pediatric constraint induced movement therapy and bimanual training is clearly supported by current evidence as expressed in this guideline. There are still research questions to be answered regarding mCIMT/BIT including the following:

- What is the minimum number of hours that mCIMT can be implemented but still produce a moderate to high effect size?
- In a program that implements both mCIMT and BIT, what is the optimal number of hours of each to produce a moderate to high effect?
- What is the optimal balance between therapist-delivered mCIMT/BIT therapy and caregiver implemented mCIMT/BIT therapy?
- Is mCIMT/BIT more effective for patients with hemiplegia who are classified at a certain level of functioning (MACS level)?
- What is the most effective environment in which to deliver mCIMT/BIT therapy (home, clinic, community)?

- Is one type of constraint more effective and/or more preferred by clients and their families?
- What is the most effective and/or preferred context (group or individual) for mCIMT/BIT therapy?

Additional research is needed to answer the remaining questions. While we await answers, we need to provide the best possible care to our current patients with hemiplegia. This revised guideline will promote more standardized care, thereby decreasing unwarranted variation of treatment. Providing consistent mCIMT/BIT therapy allows for data collection to measure the effectiveness of the mCIMT/BIT program and ensures therapists are implementing care based upon the highest level of evidence to achieve the best patient outcomes.

As there continues to be gaps in the knowledge related to use of mCIMT/BIT with patients, this guideline was influenced by the desire to:

- assess and treat based on the most recent, highest level evidence
- meet the needs and abilities of a diverse population of patients and families
- provide family-centered services that fit within a facility-based, cost effective treatment session(s) provision of care

The objectives of this guideline are to:

- improve upper extremity function in the affected arm of patients with a unilateral upper extremity impairment
- improve occupational performance in areas including (but not limited to) daily living skills, education, play, leisure, and social participation
- improve the coordination and consistency of care provided by therapists
- support the consistent use of outcome measures in order to evaluate the effectiveness of this treatment technique
- communicate current evidence and treatment guidelines to providers who are considering referring patients for mCIMT/BIT therapy
- maintain and improve patient and family satisfaction
- offer services that are reimbursed by most public and private insurers

## Guideline Recommendations

### Patient and Family Centered Care

1. It is recommended that self-management education and skill building is included throughout assessment and treatment based on individual patient/family needs, risks, and readiness to change (*LocalConsensus 2013 [5], Lorig 2003 [5b]*).

**Note:** Self-management is the ability of the client and family to collaborate on and adhere to individualized therapy treatment recommendations and appropriately handle signs/symptoms/difficulties associated with the therapy diagnosis to maximize quality of life and participation in life roles (*LocalConsensus 2013 [5], Lorig 2003 [5b]*).

### Assessment

2. It is recommended that in-depth education be provided to families prior to implementing mCIMT/BIT to assist the families in understanding the commitment necessary for successful completion of the mCIMT/BIT program (*Vaz 2010 [5a]*).
3. It is recommended that mCIMT/BIT evaluation and treatment be completed under the guidance of an occupational therapist and/or physical therapist who has training in the mCIMT/BIT principles as described in recommendation 12\*, mCIMT/BIT EBP clinical guidelines, assessments, and development of mCIMT/BIT home programming materials (*LocalConsensus 2013 [5]*).
4. It is recommended that an initial assessment be completed within two months prior to initiating mCIMT/BIT (*LocalConsensus 2013 [5]*).  
**Note 1:** Include standardized assessment tools when appropriate (see Table 1 and Appendices 1-6) (*Dong 2013 [1a]*).  
**Note 2:** Completing the initial assessment early allows the therapist to make a referral for additional interventions (such as botox, thumb abduction splint, etc. as appropriate) prior to starting mCIMT/BIT (*LocalConsensus 2013 [5]*).
5. It is recommended that when choosing a mCIMT/BIT assessment, the therapist consider using: at least one measure that involves individualized patient/family goals

and; at least two measures from activity - one that measures the patient’s unimanual capacity and one that measures the patient’s bimanual performance. Using a comprehensive set of assessments is critical for assessment planning and measuring the outcomes of mCIMT/BIT (*LocalConsensus 2013 [5]*). Refer to Table 1.

**Note:** Additional tools cited in the literature available relevant for patients with hemiparesis:

- Activity: Pediatric Motor Activity Log (PMAL)
- Assessment of Life Habits (LIFE-H) One of many participation outcome measures available, however LIFE-H has been shown to be sensitive to change after mCIMT (*Sakzewski 2011 [2a]*)
- Quality of life (QOL): Three QOL measures that have been recognized as relevant for school aged patients with unilateral CP (*Carlton 2010 [2b]*): Cerebral Palsy Quality of Life Questionnaire for Children (CPQOL-Child) (*Davis 2010 [2a]*), Cerebral Palsy Quality of Life Questionnaire for Teens (CPQOL-teen) (*Davis 2013 [2a]*), KIDSCREEN (*KIDSCREENGroupEurope 2006 [5]*)

**Table 1: Measurement Tools by Age Group**

Assessment Category	Assessments	1-2 yrs	3 yrs	4-7 yrs	8-18 yrs	Adult
Classification Tool	Manual Ability Classification System (MACS) ( <i>Eliasson 2006 [2a]</i> )			X	X	
Individualized Patient Family Goals	Canadian Occupational Performance Measure (COPM) ( <i>Law 2005 [5]</i> )	X Care-giver Report	X Care-giver Report	X Care-giver Report	X Client if possible	X Client if possible
	Goal Attainment Scaling ( <i>Kiresuk 1994 [5]</i> )	X	X	X	X	X
Activity - Unimanual Capacity	Melbourne Assessment 2 (MA2) ( <i>Randall 1999 [5]</i> )	2.5 → 15				
	Quality of Upper Extremity Skills Test (QUEST) ( <i>DeMatteo 1992 [5]</i> )	1.5 → 8				
Activity - Bimanual Performance	Assisting Hand Assessment ( <i>Krumlinde-Sundholm 2007 [2a]</i> )	1.5 → 12				
	ABILHAND-Kids ( <i>Arnould 2004 [5]</i> )				6 → 15	
	Children’s Hand-Use Experience Questionnaire (CHEQ) ( <i>Skold 2011 [2a]</i> )			6 → 18		

See Appendices 1-8 for details of assessment tools.

**Treatment**

**Dosing**

6. It is recommended that a combination of mCIMT followed by bimanual training (BIT) be implemented at least 48-63 hours (See Table 2) during an episode of care to expect clinically significant results (*Hoare 2013 [2a], Case-Smith 2012 [2a], Eliasson 2011 [2a], Sakzewski 2011 [2a], Geerdink 2013 [2b], Eliasson 2005 [3a], Gordon 2006 [3b], Charles 2007 [4a], Eliasson 2009 [4b], Law 2005 [5], Vaz 2010 [5a], Martin 2008 [5a]*).

**Note 1:** It is recognized that there is literature to support a fewer number of hours of mCIMT/BIT intervention, however there is higher level of evidence to support the recommended number of hours as stated above.

**Note 2:** The amount of time allocated to each intervention (mCIMT/BIT) is inconsistent in the literature; therefore, local consensus was used to determine the distribution of each intervention (see Table 2).

**Protocol Selection**

7. It is recommended that the therapist educate caregivers and engage them in shared decision making regarding:
- the details of the three mCIMT/BIT treatment protocols described in Table 2 (*LocalConsensus 2013 [5]*)
  - the risks and benefits of the different protocols (*Eliasson 2011 [2a], Vaz 2010 [5a]*)
  - the option of not implementing mCIMT/BIT or waiting for implementation at a future date (*LocalConsensus 2013 [5]*)

**Note 1:** The choice to not implement mCIMT/BIT may be viewed as conservative management and is often difficult for families to choose (*Elwyn 2001 [5a]*).

**Note 2:** Caregivers may benefit from both verbal and written education about the three protocols. The companion document *Constraint Induced Movement Therapy and Bimanual Training Knowing Note* contains a brief description of mCIMT/BIT based upon this guideline that can be given to caregivers considering mCIMT/BIT for their child.

**Note 3:** Many studies that conducted an episode of mCIMT/BIT with a shorter duration often had the participants wear the constraint for at least the majority of the waking hours. Based on the research evidence and clinical experience, individuals who choose protocol #1 (3 week protocol) may benefit from wearing the constraint during the majority of waking hours (*Case-Smith 2012 [2a], DeLuca 2012 [2a]*,

*Taub 2011 [2a], de Brito Brandao 2010 [2a], Rostami 2012 [2b], Brandao 2010 [2b], Motta 2010 [3a], Kuhnke 2008 [3b], Reidy 2012 [4a], Cope 2010 [4a], Brandão 2009 [4a], Park 2009 [4a], Stearns 2009 [4a], Karman 2003 [4a], Eliasson 2009 [4b], Sutcliffe 2009 [4b], Ries 2006 [5a]*).

**Table 2: Protocols**

	Protocol 1	Protocol 2	Protocol 3
<b>Model of Therapy</b>	Intensive	Intensive	Frequent
<b>Duration of Intervention</b>	3 weeks	6 weeks	8 weeks
<b>Duration of mCIMT/BIT</b>	2 weeks mCIMT 1 week BIT	4 weeks mCIMT 2 weeks BIT	5 weeks mCIMT 3 weeks BIT
<b>Dosage of treatment with therapist</b>	1-2 hours per day for at least 3 days per week	1-2 hours per day; 3 days per week	1-2 hours per day for one day per week
<b>Structured Practice with Caregiver</b>	3 hours per day when not with therapist*	2-4.5 hours per week	4-6 hours per week
<b>Method of Constraint (in alphabetical order)</b>	Ace Wrap Pedi-wrap Splint/Glove Removable Cast	Ace Wrap Pedi-wrap Splint/Glove Removable Cast	Ace Wrap Pedi-wrap Splint/Glove Removable Cast

\*It is strongly encouraged that children wear the constraint for all of the walking hours in this protocol. (See Recommendation 7, Note 3).

(*Hoare 2013 [2a], Case-Smith 2012 [2a], Eliasson 2011 [2a], Sakzewski 2011 [2a], Geerdink 2013 [2b], Eliasson 2005 [3a], Gordon 2006 [3b], Charles 2007 [4a], Eliasson 2009 [4b], Vaz 2010 [5a], Martin 2008 [5a]*)

**Method and Fabrication of the Constraint**

8. It is recommended that therapists engage in shared decision making with caregivers to determine the most appropriate constraint for facilitation of mCIMT (*LocalConsensus 2013 [5], Vaz 2010 [5a]*).

**Note 1:** There is insufficient evidence to support the use of a specific type of constraint over another (*Huang 2009 [1a], Hoare 2007 [1b], Gilmore 2010 [4a], Psychouli 2010 [4b]*).

9. It is recommended that the fabrication of a removable cast or splint for constraint be completed by occupational therapists with specific training in their fabrication (*LocalConsensus 2013 [5]*).

**Note:** Cast/splint fabrication is a skill that if done incorrectly, has potential to cause harm to the patient's arm or hand. Experience has shown the risk of skin breakdown and/or discomfort is minimized when the cast/splint is fabricated by therapists with training in fabricating casts/splints for constraint (*LocalConsensus 2013 [5]*).

### Treatment sessions

10. It is recommended that treatment sessions occur in individualized or group settings (*Eliasson 2011 [2a]*, *Sakzewski 2011 [2a]*, *Gilmore 2010 [4a]*, *Charles 2001 [4a]*, *Vaz 2010 [5a]*, *Gordon 2005 [5a]*).

**Note:** Evidence has shown group mCIMT/BIT based treatment sessions may result in increased social participation and be more motivational (*Gilmore 2010 [4a]*, *LocalConsensus 2013 [5]*).

11. It is recommended that treatment (both therapy sessions and structured practice with caregiver) are based on the following principles of mCIMT/BIT (*de Brito Brandão 2012 [2a]*, *Eliasson 2005 [3a]*, *Brady 2009 [5b]*):

- provide motivation to use the impaired arm and hand by using the individual's inner drive to play (*Eliasson 2005 [3a]*, *Gilmore 2010 [4a]*)
- select activities of an appropriate difficulty level so that the individual can be successful while developing new skills (*Eliasson 2005 [3a]*, *Gilmore 2010 [4a]*)
- provide many opportunities for repetition (*Eliasson 2005 [3a]*, *Brady 2009 [5b]*)
- utilize functional tasks (*de Brito Brandão 2012 [2a]*, *Eliasson 2005 [3a]*).

12. It is recommended that the treating therapist incorporates the following into each treatment session:

- include the caregiver into the treatment session
- model interventions
- problem solve concerns with caregiver
- update home program recommendations to guide structured practice with caregiver
- check fit and function of constraint, modifying if needed.

(*Eliasson 2011 [2a]*, *Eliasson 2005 [3a]*, *LocalConsensus 2013 [5]*)

13. It is recommended that the treating therapist consider simultaneous use of other therapeutic techniques that may complement mCIMT/BIT, including, neuromuscular electrical stimulation, Botulinum toxin, kinesio taping, or splint/orthoses

(*Hoare 2013 [2a]*, *Xu 2012 [3a]*, *Park 2009 [4a]*, *Santamato 2011 [4b]*, *LocalConsensus 2013 [5]*).

### Caregiver Education/Home Program

14. It is recommended that caregivers are educated on the principles and essential elements of mCIMT/BIT as stated in recommendation eleven (*de Brito Brandão 2012 [2a]*, *Eliasson 2011 [2a]*, *Glover 2002 [5b]*).

15. It is recommended that therapists engage caregivers in shared decision making to develop and update a home program for structured practice (*Eliasson 2011 [2a]*, *Eliasson 2005 [3a]*) including:

- individualized functional activities of interest to the family and patient (*Aarts 2010 [2a]*, *Xu 2012 [3a]*, *Gilmore 2010 [4a]*, *Novak 2007 [4a]*, *LocalConsensus 2013 [5]*, *Ploughman 2008 [5a]*, *Taub 2007 [5a]*)
- an activity log to encourage daily follow through with the program (*LocalConsensus 2013 [5]*)

### Re-Assessment Following mCIMT/BIT

16. It is recommended that re-assessment be conducted within 1 month following completion of the mCIMT/BIT program, using the same assessments used in the baseline assessment in order to measure the effect of mCIMT/BIT and make future treatment recommendations (*LocalConsensus 2013 [5]*, *Law 2005 [5]*, *Shriners 2005 [5]*).

### Completion of mCIMT

17. It is recommended that the therapist and the patient's caregiver reassess the patient's need for continuing therapy services.

**Note 1:** The plan for continued therapy needs to be individualized and influenced by family and patient's goals and interests, the therapist's assessment of potential for progress, the client's current functional level, and the department's Models of Therapy Guidelines and other policies (*LocalConsensus 2013 [5]*).

**Note 2:** Evidence has shown patients retained and further improved on the use of their affected limb when caregivers followed through with at least 30 minutes per day of structured practice following mCIMT intervention (*Ploughman 2008 [5a]*, *Taub 2007 [5a]*, *Park 2012 [5b]*).

18. It is recommended that the therapist discuss with the family that repeated trials of mCIMT/BIT may result in cumulative

improvement (*Charles 2007 [4a], DeLuca 2003 [5a]*).

19. It is recommended that when participating in a repeated episode of mCIMT/BIT, patients take a break in between sessions for at least 3 months (*Eliasson 2011 [2a], Charles 2007 [4a]*).

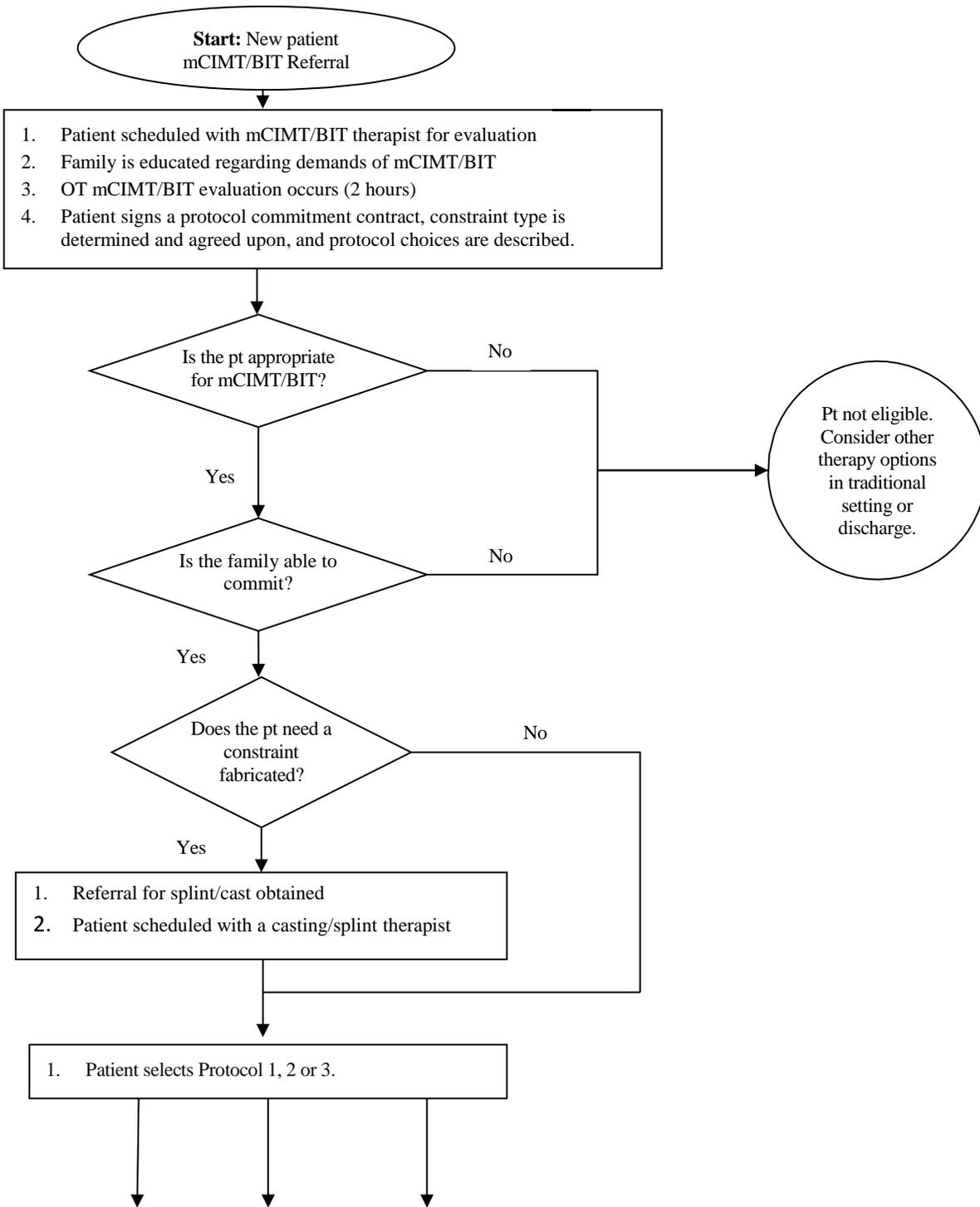
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### **Future Research Agenda**

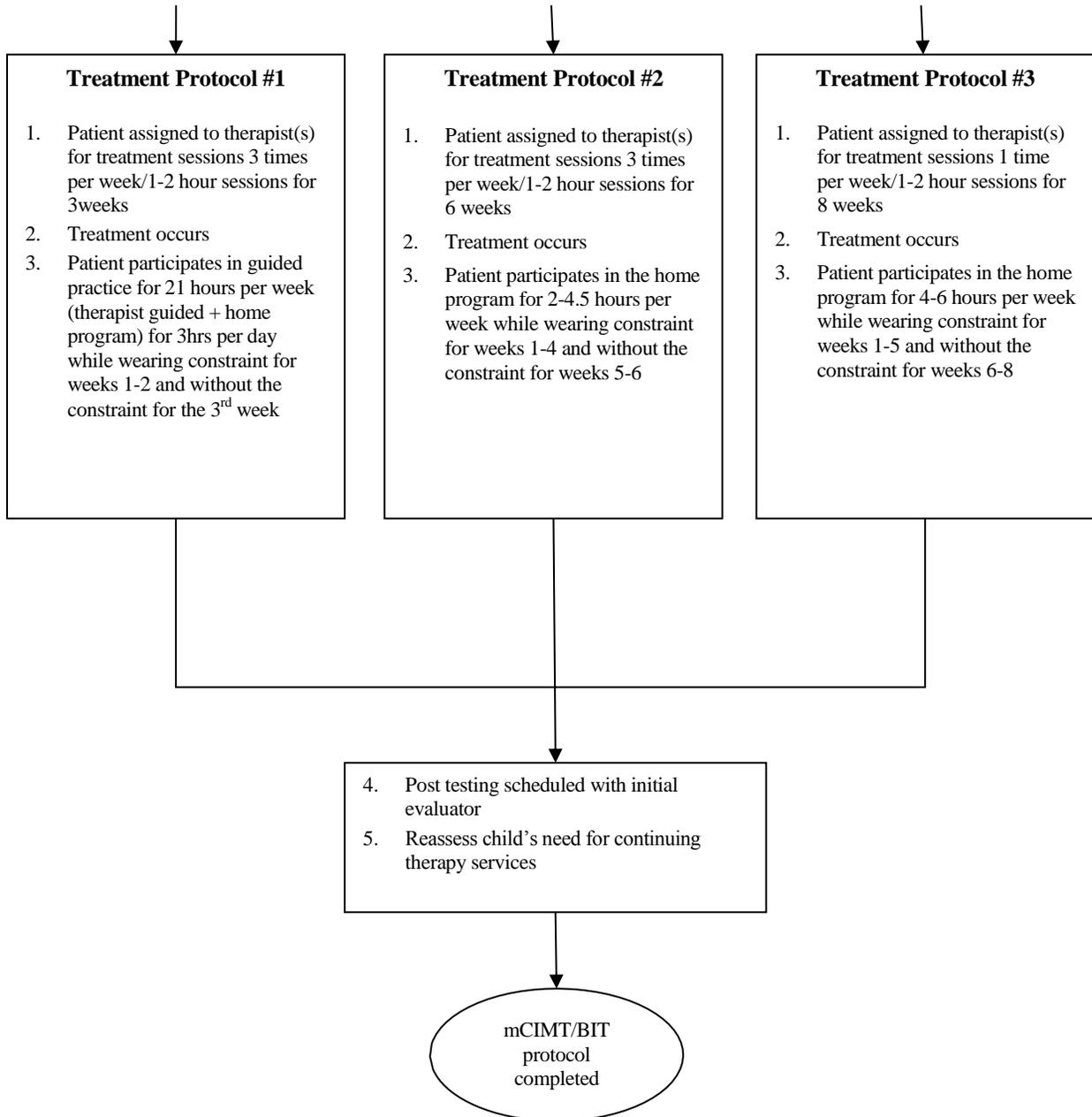
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1. In patients with hemiplegia, is one mCIMT/BIT protocol more effective than the other?
2. In patients with hemiplegia, is mCIMT/BIT more effective than traditional therapy for improving functional performance and spontaneous use of the affected upper extremity?
3. In patients with unilateral impairments other than hemiplegia, is mCIMT/BIT effective?
4. Are there specific characteristics of certain patients (such as age, physiology, personality) that are predictive of better outcomes following mCIMT/BIT?
5. In patients who have used mCIMT/BIT, would a period of intensive bilateral upper extremity therapy following mCIMT/BIT improve long-term outcomes?

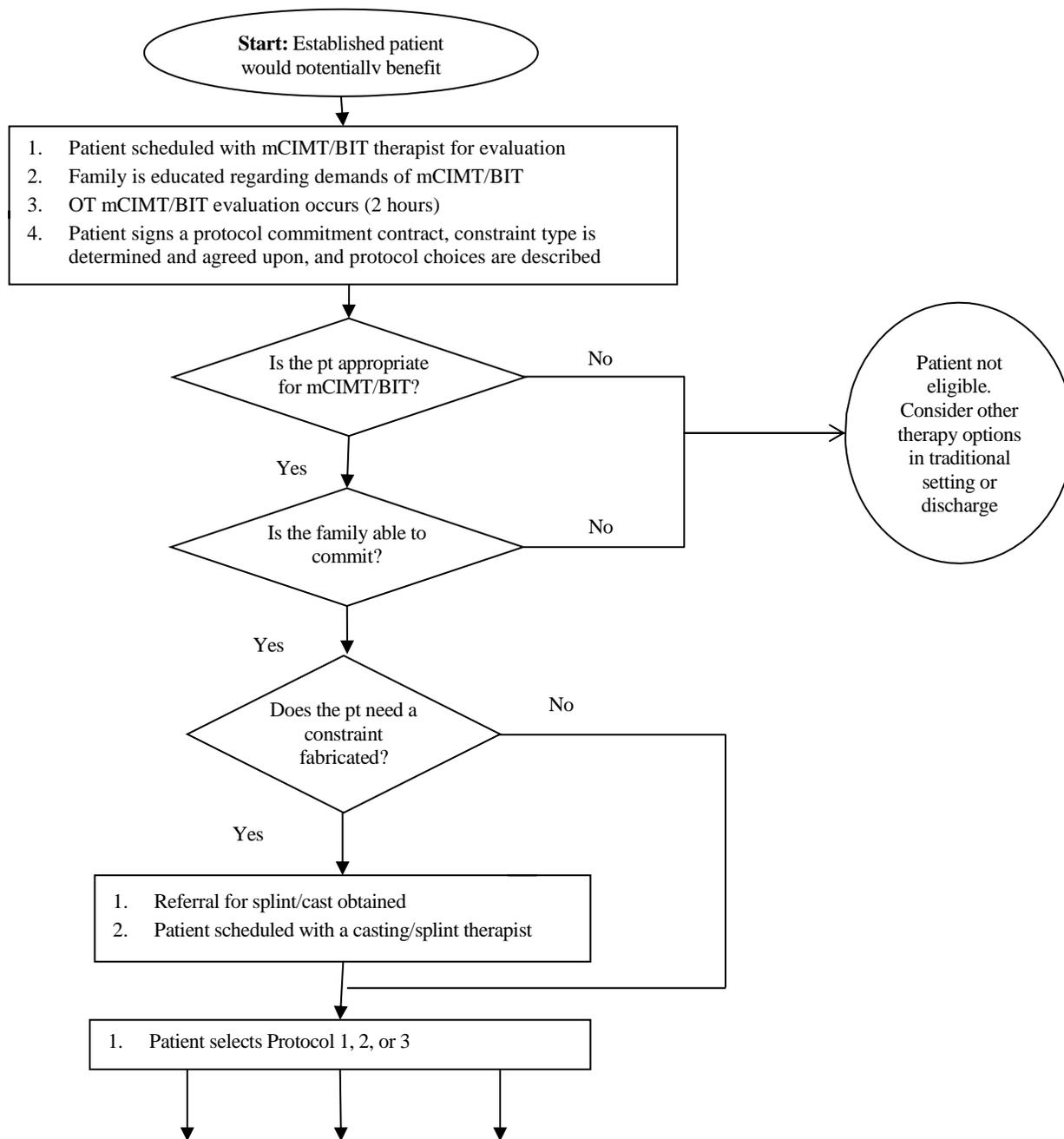
### Algorithm for mCIMT/BIT – New Patient



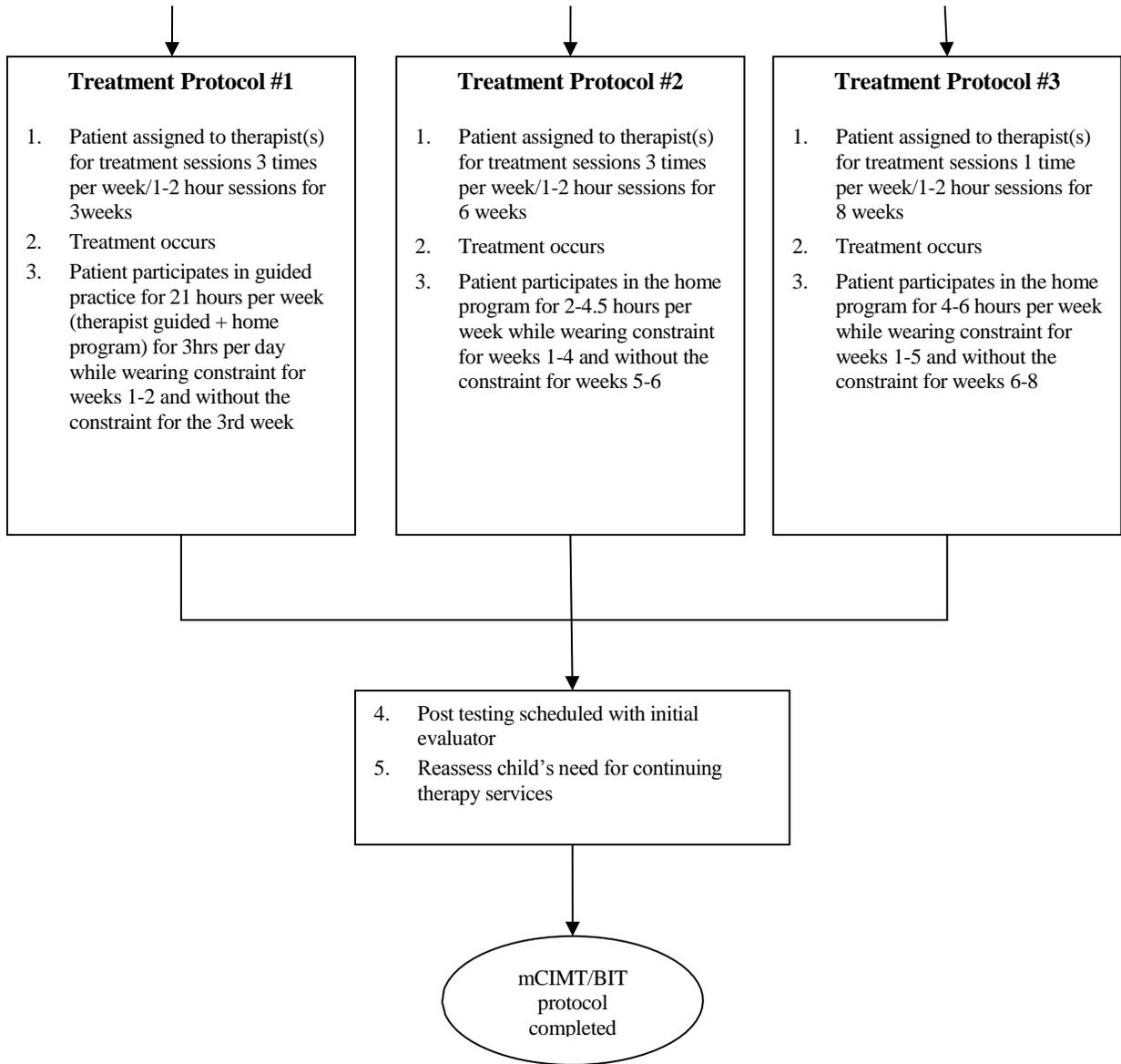
**Algorithm for mCIMT/BIT – New Patient (continued)**



### Algorithm for mCIMT/BIT – Established Patient



**Algorithm for mCIMT/BIT – Established Patient (continued)**



## Appendix 1

### Manual Ability Classification System for Children with Cerebral Palsy (MACS) (*Eliasson 2006 [2a]*)

#### Overview:

- Systematic method to classify how children with cerebral palsy use their hands when handling objects in daily life
- Intends to describe which level best represents the child's usual performance at home, school, and community settings
- Classification based on child's actual performance in daily life. It should not be done as a specific assessment but by asking someone who knows the child and how that child performs typically
- The child's ability to handle objects is considered from an age-related perspective
- Intends to report the performance of both hands working together in activities, not an assessment of each hand separately

#### Assessment focus:

- Ability to handle objects in daily activities for play, leisure, and self-care

#### Administration and Scoring:

- Children with cerebral palsy aged 4-18 years
- Ask someone who knows the child about how the child performs typically, observe
- Determine which of five levels most accurately describes the child's performance. A distinction between levels is provided
- Approximately 5 minutes are required to determine classification level

#### Reliability:

- The intra-class correlation coefficient between therapists was 0.97 (95% confidence interval 0.96-0.98), and between caregivers and therapist was 0.96 (0.89-0.98), indicating excellent agreement

#### Validity:

- Validation was based on the experience within an expert group, review of the literature, and through analysis of children across a spectrum of function

## Appendix 2

### Canadian Occupational Performance Measure, 4th edition (COPM) (*Law 2005 [5]*)

#### Overview:

- Criterion-referenced, individualized outcome measure that can be used with clients of all ages and conditions

- Client or caregiver is interviewed, using the evaluation form as a guide, in order to determine problem areas in occupational performance
- Assists in treatment planning and goal setting
- Measures change in client/caregiver perception of performance and satisfaction with performance
- Supports the notion that all clients are responsible for their health and therapeutic process
- Allows input from family and/or caregiver if client is under the age of eight and/or unable to answer on his/her own behalf

#### Assessment focus:

- Self-care including personal care, mobility, community management
- Productivity including paid/unpaid work, household management, school, and play
- Leisure including quiet recreation, active recreation, and socialization

#### Administration and Scoring:

- Requires approximately 30 minutes to initially administer; requires approximately 10 minutes to administer at follow-up
- Ask the client to list problems using structure of performance areas
- Ask the client to rate the importance of the problems (1-10)
- Ask the client to rate his/her present level of performance and level of satisfaction with that performance (1-10)

#### Validity:

- Study completed with evidence supporting content, criterion, and construct validity of the COPM
- The COPM has been validated against several other measures with support for its validity while supporting that the assessment provides information that cannot be obtained with other standardized instruments

#### Reliability:

- Inter-rater agreement of the prioritized problems was moderate
- Test-retest reliability has been shown to be acceptable with various health conditions although it has not been assessed with CP
- The reproducibility of the mean performance and satisfaction scores was moderate but it was

poor for the scores of the separate problems. Therefore, the mean scores should be used for individual assessment

**Reason for Use:**

- Measures effectiveness of intervention
- Helpful in developing client centered goals and intervention
- Motivational interviewing offers health care professionals a potentially effective strategy for increasing a patient's readiness to change health behaviors

**Appendix 3**

**Goal Attainment Scaling (GAS) (Kiresuk 1994 [5])**

**Overview:**

- 5-point scale quantifying performance on client-centered outcomes

**Assessment Focus:**

- Facilitating client-centered, outcome based treatment planning
- Evaluating changes in performance over time attributed to participation in a specific treatment program, educational experience, or other intervention

**Administration and Scoring:**

- The GAS is versatile, sensitive, and can be used with any population
- Administration time varies from 30-45 minutes
- The client or caregiver is interviewed to establish meaningful goals. Goals are rated by client or caregiver based on importance
- Goals are weighted based on level of difficulty and importance to the client and/or caregiver
- The therapist observes the client perform the goals. Based on the clients performance, the therapist creates a scale to rate the clients performance of the goal after treatment
- After the episode of care, the therapist rates the client's performance on a scale from -2 (less than expected outcome) to +2 (much more than expected outcome)

**Reliability:**

- Current evidence supports the use of GAS, however does not speak to the reliability of the measure. More research is needed to establish reliability
- If the therapist has been trained, there is reportedly high inter-rater reliability

**Validity:**

- Early studies from the 1970's suggest good content, criterion-related, and construct validity. However, there is no current evidence on validity for the GAS

**Appendix 4**

**Melbourne Assessment 2 (MA2) (Randall 1999 [5])**

**Overview:**

- Measures the quality of movement of the affected upper extremity for patients with neurological impairments with hemiplegia between of 2.5 to 15 years of age
- Criterion-referenced test that extends and refines the scale properties of the original Melbourne Assessment
- Assists in treatment planning and goal setting
- Demonstrates a strong correlation with the Pediatric Evaluation of Disability Inventory

**Assessment Focus:**

- Provides measurement regarding four elements of upper extremity quality of movement across sub-scales of: range of movement, accuracy, dexterity and fluency
- Designed for individuals with Cerebral Palsy or a unilateral disability

**Administration and Scoring:**

- Comprised of 16 test items of reaching, grasping, releasing and manipulating simple objects
- Time to administer test is between 10-30 minutes depending on the client's age, level of ability, attention
- Score is based upon the quality of movement for range of motion, accuracy, fluency, and dexterity

**Reliability:**

- Reliability is high:
  - internal consistency (Cronbach's alpha = 0.96)
  - inter-rater reliability (ICC = 0.95)
  - intra-rater reliability (ICC = 0.97)
  - test-retest reliability (CCC = 0.97-0.98)

**Validity:**

- Good content validity and good construct validity
- Significant correlations with the PEDI (Spearman's  $\rho = 0.939$ ), mobility (Spearman's  $\rho$

= 0.783), and total functional skills (Spearman's  $\rho = 0.718$ )

## Appendix 5

### Quality of Upper Extremity Skills Test (QUEST)

(DeMatteo 1992 [5])

#### Overview:

- Criterion-referenced observational assessment
- Concentrates mainly on patients with cerebral palsy who are in between the ages of 18 months to 8 years
- Assists in treatment planning and goal setting
- Strongly relates to the Peabody Developmental Fine Motor Skills
- Developed to overcome limitations of currently available measures of hand function

#### Assessment Focus:

- Focuses on dissociated movements, grasp, weight bearing, and protective extension
- Items are related to quality of movement, not to chronological age
- Administered within a normal play context

#### Administration and Scoring:

- Comprised of 34 items
- Approximately 30-45 minutes to administer the test
- Both impaired and unimpaired upper limbs are assessed and included in the scoring

#### Reliability:

- Internal consistency (Cronbach's  $\alpha = 0.97$ )
- Inter-rater reliability (ICC = 0.86-0.96)
- Intra-rater reliability (ICC = 0.97-0.99)
- Test-retest reliability (ICC = 0.95) and (Spearman's  $\rho = (0.85 - 0.94)$ )

#### Validity:

- Good content validity based on literature review and discussions with clinicians and experts
- Good construct validity: correlations between Melbourne Assessment of Upper Limb Function (MUUL) and QUEST ( $r = 0.84$ ) and QUEST and Peabody Developmental Motor Scale-Fine Motor (PDMS-FM) ( $r = 0.83$ )

## Appendix 6

### Assisting Hand Assessment (AHA) (Krumlinde-Sundholm

2007 [2a])

#### Overview:

- Measures and describes how individuals with unilateral impairment effectively use the impaired hand to assist in bimanual tasks

- Criterion referenced test that measures typical performance while completing everyday tasks
- Appropriate to use for individuals with hemiplegic cerebral palsy (CP) or obstetric brachial plexus palsy (OBPP)
- Two versions are available for use. The Small Kids AHA is used for children 18 months to 5 years. The School Kids AHA is used for children 6 to 12 years
- Video-based tool for assessment of impaired upper limb
- Assists in treatment and goal setting

#### Assessment Focus:

- Measures how well a child with unilateral impairment uses their affected hand during bimanual tasks; not a measure of capacity
- Observations are made while the child plays with toys that require 2 hands
- Describes performance skills such as general arm use, range of motion, grasp and release, bilateral coordination, and pace of completing tasks

#### Administration and Scoring:

- Play based assessment that requires 10-15 minutes to administer
- Play session is video-taped and scored at a later time
- Scored on 22 items consisting of observable actions, e.g. manipulates, varies grasp, releases, and holds

#### Reliability:

- Internal consistency (Cronbach's  $\alpha = 0.97$ )
- Inter-rater reliability (ICC = 0.97 - 0.98)
- Intra-rater reliability (ICC = 0.99)
- Test- retest reliability for the Small Kids (ICC = 0.99) and School Kids (ICC = 0.98) (ICC=.99)
- High reliability between the small kids and school kids AHA (ICC=.99)

#### Validity:

- Construct Validity: Discriminates between patients with different levels of hand function (separate value=6.16); levels of impairment are not related to age
- Content validity: developed by experts in the field; Rasch model is used

## Appendix 7

### ABILHAND-Kids (Arnould 2004 [5])

#### Overview:

- Assess the manual abilities of children with impaired upper-limb function who are in between the ages 6-15 years
- Provides information relevant to goal setting for occupational therapy

#### Assessment Focus:

- Used for individuals with cerebral palsy who are between 6-15 years of age
- Caregiver completed questionnaire
- Focuses on how well each skill is performed

#### Administration and Scoring:

- 21 items covering both unimanual and bimanual self-care activities
- Rated 0= impossible, 1= difficult, and 2= easy
- There is no time limit on how fast test must be completed
- Questions are presented in random order to avoid any systematic effect

#### Reliability:

- Internal consistency (Cronbach's alpha = 0.94)
- Test-retest reliability (r = 0.91)

#### Validity:

- Construct validity
- Good content validity: Based on existing scales, expert advice and used Rasch model

## Appendix 8

### Children's Hand-Use Experience Questionnaire (CHEQ) (Skold 2011 [2a])

#### Overview:

- Questionnaire that includes 29 bimanual activities which patients rate on 3, four-level scales (perceived efficacy of the grasp, time taken to perform the activity, and degree of feeling bothered while engaged in the activity)

#### Assessment Focus:

- Capturing the experience of children and adolescents aged 6 to 18 years in using their affected hand in bimanual activities
- Used to guide treatment planning and develop treatment goals

#### Administration

- Questionnaire completed by the caregiver and/or patient

#### Reliability

- There is no evidence to support the reliability of this tool

#### Validity

- The internal structure of the scales has been confirmed by Rasch analysis

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### Development Process

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The process by which this guideline was developed is documented in the [Guideline Development Process Manual](#); relevant development materials are kept electronically. The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic search and critical appraisal of the literature, using the [Table of Evidence Levels](#) described following the references, and examined current local clinical practices.

To select evidence for critical appraisal by the group for this guideline, the Medline, EmBase and the Cochrane databases were searched for dates of January 2002 to July, 2013 to generate an unrefined, "combined evidence" database using a search strategy focused on answering clinical questions relevant to Pediatric Constraint Induced Movement Therapy and

employing a combination of Boolean human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and “natural language” language searching on words in the title, abstract, and indexing terms. The citations were reduced by: eliminating duplicates, review articles, non-English articles, and adult articles. The resulting abstracts were reviewed by a methodologist to eliminate low quality and irrelevant citations. During the course of the guideline development, additional clinical questions were generated and subjected to the search process, and relevant review articles were identified. July 30, 2013 was the last date for which literature was searched and reviewed for this version of the guideline. The details of that review strategy are not documented. However, all previous citations were reviewed for appropriateness to this revision.

Tools to assist in the effective dissemination and implementation of the guideline may be available online at <http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm>. Experience with the implementation of earlier publications of this guideline has provided learnings which have been incorporated into this revision.

Once the guideline has been in place for five years, the development team reconvenes to explore the continued validity of the guideline. This phase can be initiated at any point that evidence indicates a critical change is needed.

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference and clinical expertise. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

The guideline has been reviewed and approved by clinical experts not involved in the development process, distributed to senior management, and other parties as appropriate to their intended purposes.

The guideline was developed without external funding. All Team Members reviewers and advisors listed have declared whether they have any conflict of interest and none were identified.

Copies of this Evidence-based Care Guideline (EBCG) and any available implementation tools are available online and may be distributed by any organization for the global purpose of improving child health outcomes. Website address:

<http://www.cincinnatichildrens.org/svc/alpha/h/health-policy/ev-based/default.htm>. Examples of approved uses of the EBCG include the following:

- copies may be provided to anyone involved in the organization’s process for developing and implementing evidence based care guidelines
- hyperlinks to the CCHMC website may be placed on the organization’s website
- the EBCG may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- copies may be provided to patients and the clinicians who manage their care

Notification of CCHMC at [HPCEInfo@cchmc.org](mailto:HPCEInfo@cchmc.org) for any EBCG, or its companion documents, adopted, adapted, implemented or hyperlinked by the organization is appreciated.

**NOTE: These recommendations result from review of literature and practices current at the time of their formulations. This guideline does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this guideline is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding the priority of any specific procedure.**

For more information about this guideline, its supporting evidences and the guideline development process, contact the Division of Occupational Therapy and Physical Therapy at: 513-636-4651 or [OTPT@cchmc.org](mailto:OTPT@cchmc.org)

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**Note:** When using the electronic version of this document, “[↗](#)” indicates a hyperlink to the PubMed abstract. A hyperlink following this symbol goes to the article PDF when the user is within the CCHMC network.

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Note: Full tables of evidence grading system available in separate document:

- [Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality](#) (abbreviated table below)
- [Grading a Body of Evidence to Answer a Clinical Question](#)
- [Judging the Strength of a Recommendation](#) (abbreviated table below)

**Table of Evidence Levels** (see note above)

Quality level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5, 5a or 5b	Other: General review, expert opinion, case report, consensus report, or guideline

†a = good quality study; b = lesser quality study

**Table of Recommendation Strength** (see note above)

Strength	Definition
“Strongly recommended”	There is consensus that benefits clearly outweigh risks and burdens (or visa-versa for negative recommendations).
“Recommended”	There is consensus that benefits are closely balanced with risks and burdens.
No recommendation made	There is lack of consensus to direct development of a recommendation.

**Dimensions:** In determining the strength of a recommendation, the development group makes a considered judgment in a consensus process that incorporates critically appraised evidence, clinical experience, and other dimensions as listed below.

1. Grade of the Body of Evidence (see note above)
2. Safety/Harm
3. Health benefit to patient (*direct benefit*)
4. Burden to patient of adherence to recommendation (*cost, hassle, discomfort, pain, motivation, ability to adhere, time*)
5. Cost-effectiveness to healthcare system (*balance of cost/savings of resources, staff time, and supplies based on published studies or onsite analysis*)
6. Directness (*the extent to which the body of evidence directly answers the clinical question [population/problem, intervention, comparison, outcome]*)
7. Impact on morbidity/mortality or quality of life