



Pediatric Constraint Induced Movement Therapy (CIMT)

Minor revision to Exclusions, Introduction and Development
Process sections were incorporated 07-28-2009
Original Publication Date: 02-16-2009

Target Population

Inclusions:

Children over one year of age¹ with:

- unilateral upper extremity impairments associated with neurological conditions (e.g. cerebral palsy, traumatic brain injury, brachial plexus injury)
- 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 children with the following:

- inability to participate in purposeful play or functional activity
- contractures that limit functional arm use
- referred for a constraint device only with therapeutic follow up elsewhere

Target Users

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

- Neurologists
- Occupational therapists
- Patients and families
- Pediatricians
- Physical Therapists
- Physiatrists
- Primary Care Physicians

¹ 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.

Introduction

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

One of three children with cerebral palsy (CP) experiences hemiparesis: impairment affecting one side of the body (*Himmelmann 2005 [D], Hagberg 2000 [O]*). Hemiparesis is also common among children who experience traumatic brain injuries, childhood strokes, and other central nervous system conditions.

Neonatal brachial plexus injury (BPI) caused by a birth or traumatic injury to the brachial plexus (an injury of the peripheral nervous system), occurs in about 1.5 per 1000 live births. (*Foad 2008 [D]*) Similar to children with hemiparesis, these children often present with poor functioning of one arm while the other arm is usually without problems.

Children with impaired functioning of one of their arms can have disabling symptoms affecting play, school, and self-care. Hand and arm functioning may be affected by abnormal muscle tone and flexion synergies, decreased strength, decreased active and passive range of motion, altered sensation, and neglect (*Eliasson 2006 [X]*). Also, children with hemiplegia due to central nervous system damage are often affected by mirror movements--unconscious and uncontrolled movement of one hand following the same pattern as the contralateral hand—impacting the ability to use two hands when the hands are required to do different movements (for example, one hand stabilizes an object while the other acts on the object). (*Eliasson 2006 [X]*)

Current theory suggests that children with unilateral upper extremity impairment must overcome “developmental non-use”, a term indicating that the children never have effectively used the impaired upper extremity (*Gordon 2006 [C]*). Another term frequently used in literature is “learned non-use”, a term referring to hemiplegia in an individual who previously had functional use of the arm (e.g. a person who had an acquired stroke or traumatic brain injury) (*Taub 1999 [S]*).

Traditionally, children with hemiplegia or brachial plexus injury receive occupational therapy and physical therapy services to maximize their functional skills. Conventional treatment approaches focus on a mix of biomechanical, developmental, neurodevelopmental, and rehabilitative (including compensatory) models. (*Deluca 2006 [B], Eliasson 2005 [C], Boyd 2001 [M], Local Consensus [E]*)

A newer therapeutic intervention—constraint induced movement therapy (CIMT)—may be beneficial for children with hemiplegia or BPI. A strong and growing body of evidence supports the use of a constraint on the unimpaired hand along with intensive practice as an effective intervention with adults following stroke or brain injury. A smaller body of evidence is also supportive of the use of constraint with children with hemiplegia. As of this writing, 20 studies of CIMT in pediatrics were identified in the peer reviewed published literature including:

- 7 studies that use a control group (Taub 2007 [B], Charles 2006 [B], Eliasson 2005 [C], Sung 2005 [B], Taub 2004 [B], DeLuca 2003 [O], Willis 2002 [B]);
- 2 cohort studies (Charles 2007 [C], Gordon 2006 [C])
- and 11 case series and case studies (Gordon 2007 [C], Sutcliffe 2007 [O], Bonnier 2006 [C], Miller 2005 [O], Naylor 2005 [C], DeLuca 2003 [O], Karman 2003 [C], Glover 2002 [O], Pierce 2002 [O], Charles 2001 [O], Crocker 1997 [O])

All 20 studies report some positive outcomes of constraint used with children. However, small size and/or lack of randomization are limitations of all of these studies. The strongest studies (those with randomized control groups) have relatively small sample sizes. Eliasson et al 2005 reports on the largest sample size (N=41) but that study used a non-randomized control group. In fact, only 3 studies (Eliasson 2005 [C], Sung 2005 [B], Taub 2004 [B]) met the inclusion criteria for the recent Cochrane Systematic Review of CIMT use in pediatric CP (Hoare 2007 [M]). Further, the many studies report on a variety of constraint protocols (methods of constraint, intensity of use, inclusion or exclusion of supervised practice) and use a variety of outcome measures, all of which have strengths and weaknesses.

Some therapists, doctors, and families are hesitant to engage in CIMT due to concerns related to the possible negative effects on the child. Gordon, et al mentions potential risks associated with constraint use in pediatrics, including the possibility of increased frustration impacting self esteem, and “increased family burden and safety concerns” (Gordon 2005). Two studies specifically looked at the effect of immobilizing the unaffected arm: Sung, et al found “no decline in hand function...or any cases of joint stiffness or skin problems (Sung 2005 [B]) and Willis, et al (2002) reports that “there were no medical complications to casting” (Willis 2002 [B]). Willis, et al does report that some children experienced “irritability and or complaints about wearing the cast” (Willis 2002 [B]). We are unaware of any research that has specifically looked at self esteem and frustration tolerance while using CIMT. In

our pilot experience, the vast majority of children appear to accommodate to the constraint in less than 24 hours (Local Consensus [E]).

Only three studies in the pediatric CIMT literature assessed the use of CIMT with children diagnosed with conditions other than CP: two studies were conducted with children following traumatic brain injury causing hemiparesis (Miller 2005 [O], Karman 2003 [C]) and one following ischemic stroke (Gordon 2007 [C]). No published research is available on conducting CIMT with children with other diagnoses associated with unilateral impairment, such as brachial plexus injury; our experience has shown that CIMT may be beneficial for this population and therefore, they are included in this guideline (Local Consensus [E]).

Overall, ***the use of constraint in pediatrics appears promising yet the evidence is still weak.***

Specifically, the evidence does not yet answer many questions:

- What type of constraint should the child wear?
- How many hours should the constraint be worn daily?
- What is the ideal duration of constraint therapy in order to support lasting functional gains?
- Should therapeutic activities be completed while wearing the constraint and if so, should these activities be supported by a therapist, a caregiver, or some combination?
- At what ages is constraint therapy most beneficial?
- Are there ages or levels of functioning for which constraint therapy is not beneficial?
- Is constraint therapy equally beneficial for children with various diagnoses or functional skill levels?

It will likely be many years until these questions are adequately addressed in the research. While we await answers, we need to provide the best possible care to our current patients with hemiplegia or BPI. Prior to the implementation of this guideline, CIMT has been offered to many children with hemiplegic CP, brain injury, and BPI receiving occupational or physical therapy services at CCHMC. However, the implementation of CIMT varied greatly among therapists; the method of constraint, wearing schedule, duration of treatment, intensity of

structured practice, and frequency of therapy services was determined solely based on the judgment of the therapist and/or referring physician. In addition, standardized assessments were not systematically used before and after intervention in order to determine the effectiveness of CIMT to the child.

As there continues to be many gaps in the knowledge related to use of CIMT with children, this guideline was influenced by the following desires:

- base treatment and assessment on available evidence
- meet the needs and abilities of a diverse population of children and families
- offer services that fit within our current provision of care (facility-based, one hour treatment sessions)
- offer services that are reimbursable by most public and private insurers.

The objectives of this guideline are to:

- improve upper extremity function of the affected arm in children 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 physicians considering referral for CIMT
- maintain and improve family satisfaction.

necessary for successful completion of the CIMT program. (*Adams 2006 [O]*)

3. It is recommended that only an occupational therapist that has training in CIMT theory, EBP clinical guidelines, assessments, and development of home programming materials provide CIMT assessment and treatment (local consensus; United Cerebral Palsy Research & Education Foundation (*Cerebral Palsy International Research 2007 [E]*, *Local Consensus [E]*))
4. It is recommended that an occupational therapy assessment be completed within one month prior to initiating CIMT (*Local Consensus [E]*).
 - Note 1:** The assessment may be part of the initial patient evaluation or may be completed during one or more treatment sessions for a child already receiving occupational therapy.
 - Note 2:** Include standardized tools when appropriate for child's age (see Table 1 and Appendices 1-6).

Protocol Selection

5. It is recommended that the therapist engage in shared decision making and educate parents
 - in the details of the two CIMT treatment protocols described in Table 2, presenting the evidence and discussing the risks and benefits of the different protocols (*Adams 2006 [O]*, *Campbell 2001 [O]*, *Chen 1999 [C]*, *Stenstrom 1997 [C]*)
 - about the option of not implementing CIMT or waiting for implementation at a future date (*Local Consensus [E]*).

Guideline Recommendations

Assessment

Clinical Assessment

1. It is recommended that, for children not meeting the inclusion/exclusion criteria for this guideline, the referring physician be contacted to determine an alternative plan. (*Local Consensus [E]*)
2. It is recommended that in-depth education be provided to families prior to implementing CIMT to assist the families in understanding the commitment

Table 1: Recommended Measurement Tools by Age Group

Tests	1-2 years	3 years	4-7 years	8-18 years	Adult
Canadian Occupational Performance Measure (COPM)(Law 2005 [X])	X Parent Report	X Parent Report	X Parent Report	X Client if Possible	X Client if Possible
Shriners' Hospital Upper Extremity Evaluation (SHUEE)(Pandyan 2003 [X], Bohannon 1987 [X])		X	X	X	
Manual Ability Classification System (MACS)(Eliasson 2006 [X])			X	X	
Gross Motor Functional Classification System, Expanded & Revised (Palisano 2007 [X])	X	X	X	X	X
Confidence Scale(Lorig 2003 [X], Holden 1991 [X])	X	X	X	X	X

See Appendices 1-6 for details of assessment tools.

Table 2: Protocols

	Protocol 1 (Based on Eliasson et al 2005)	Protocol 2 (Based on Willis et al 2002)
Duration of Intervention	8 weeks	4 weeks
Daily Constraint Wear	2 hours per day	24 hours per day
Daily Structured Practice with Caregiver	2 hours per day while wearing constraint	No additional practice required but 2 hours daily practice with caregiver encouraged
Method of Constraint	Ace Wrap Pedi-wrap Splint / Glove Removable Cast	Removable Cast
Frequency of Therapy	1 time per week	1 time per week

Note 1: The choice to not implement CIMT may be viewed as conservative management and is often difficult for families to choose (Elwyn 2001 [O]).

Note 2: “Clients who perceive that they are actively involved in treatment decisions generally have better outcomes. (Adams 2006 [O], Stewart 2001 [O], Greenfield 1988 [A])”

Note 3: Parents may benefit from both verbal and written education about the two protocols. The companion document *Constraint Induced Movement Therapy: Specialty Program* contains a brief description of CIMT based upon this guideline that can be given to parents considering CIMT for their child.

Method and Fabrication of Constraint

- It is recommended, for parents who select Protocol 1, that the therapist try one or more methods of constraint with the child and parents to determine the least restrictive method that prevents the ability to grasp while allowing the child to use the arm for support (Cerebral Palsy International Research 2007 [E], Local Consensus [E]).

Note 1: Various constraints have been studied in the literature but there is insufficient evidence to support the use of a specific type (Hoare 2007 [M]).

Note 2: Protocol 1 is based upon the treatment model reported in Eliasson et al 2005. The method of constraint was a “constraining glove” using a volar splint with thumb fixed against index finger inside of a cloth glove, with the goal of preventing “the ability to grasp” while allowing the child to “use the hand for support or for breaking a fall.(Eliasson 2005 [C])”

Note 3: In our experience, some young children do well with ace wrapping their unaffected arm or wearing a Pedi-wrap. However, some toddlers and children require a more robust constraint from which they cannot slip out. These children will likely benefit from a hand splint with a cover (a puppet or sock) or a removable cast. Older children who are able to understand the reason for constraint use may be able to use less restrictive constraints such as ace wrap to the unaffected arm (Local Consensus [E]).

7. It is recommended that the fabrication of removable casts for constraint be completed by occupational therapists with specific training in their fabrication (*Local Consensus [E]*).

Note: Cast fabrication is a skill that, done incorrectly, has potential to cause harm to the child's arm. In our experience, the risk of skin breakdown or discomfort is minimized when fabricated by therapists with training in fabricating casts for constraint (*Local Consensus [E]*).

Frequency of Therapy

8. It is recommended that therapy sessions occur on a weekly basis throughout the CIMT program (*Eliasson 2005 [C]*, *Willis 2002 [B]*).

Note: Treatment subjects in Eliasson 2005 (from which Protocol 1 is based) received weekly intervention with occupational therapists. Treatment subjects in Willis 2002 (from which Protocol 2 is based), "continued their routine visits to occupational and physical therapy (*Willis 2002 [B]*).” Children in the treatment group received an average of 1.4 therapy visits per week.

Treatment sessions

9. It is recommended that treatment (both therapy sessions and structured practice with caregiver) be based on the following 3 principles (*Eliasson 2005 [C]*):
- provide motivation to use the impaired hand by using the child's inner drive to play.
 - select activities of an appropriate level of difficulty so that child can be successful while developing new skills.
 - provide many opportunities for repetition.
10. It is recommended that the treating therapist incorporate the following into each treatment session:
- update home program recommendations to guide structured practice with caregiver.
 - problem solve concerns with caregiver.
 - model interventions.
 - check fit and function of constraint, modifying if needed. (*Local Consensus [E]*)
11. It is recommended that the treating therapist consider simultaneous use of other therapeutic techniques that may complement CIMT, being sure to note the use in progress notes (*Local Consensus [E]*).

Note: Research has not been conducted to assess the simultaneous use of other therapeutic techniques with CIMT. Our clinical experience suggests considering the simultaneous use of orthoses, kinesiotaping, neuromuscular electrical stimulation, Botox, or other therapeutic interventions.

Parent Education / Home Program

12. It is recommended that a home program be developed and updated weekly to guide caregivers' daily structured practice with the child (*Eliasson 2005 [C]*). Features of the home program include:
- it is guided by the principles detailed in recommendation 9 (*Eliasson 2005 [C]*)
 - it includes specific functional activities of interest to the family and child (*Novak 2007 [C]*, *Local Consensus [E]*).
 - it focuses on one specific skill each week (e.g. grasp/release or shoulder flexion) (*Local Consensus [E]*)
 - it picks five activities that target the chosen skill to be practiced during structured practice with the caregiver (*Local Consensus [E]*)
 - it be provided in the form of an activity log to encourage daily follow through with program (*Local Consensus [E]*).

Re-Assessment Following CIMT

13. It is recommended that re-assessment be conducted within 1 week following completion of the CIMT program, using the Canadian Occupational Performance Measure (COPM) and the Shriners' Hospital Upper Extremity Evaluation (SHUEE), in order to measure the outcome of CIMT with the child (*Law 2005 [X]*, *Shriners 2005 [X]*, *Local Consensus [E]*).

Completion of CIMT

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

Note 1: The plan for continued therapy will need to be individualized and may be influenced by family and patient's goals and interests, the therapist's assessment of potential for progress, and the department's Models of Therapy Guidelines and other policies (*Cerebral Palsy International Research 2007 [E]*, *Local Consensus [E]*).

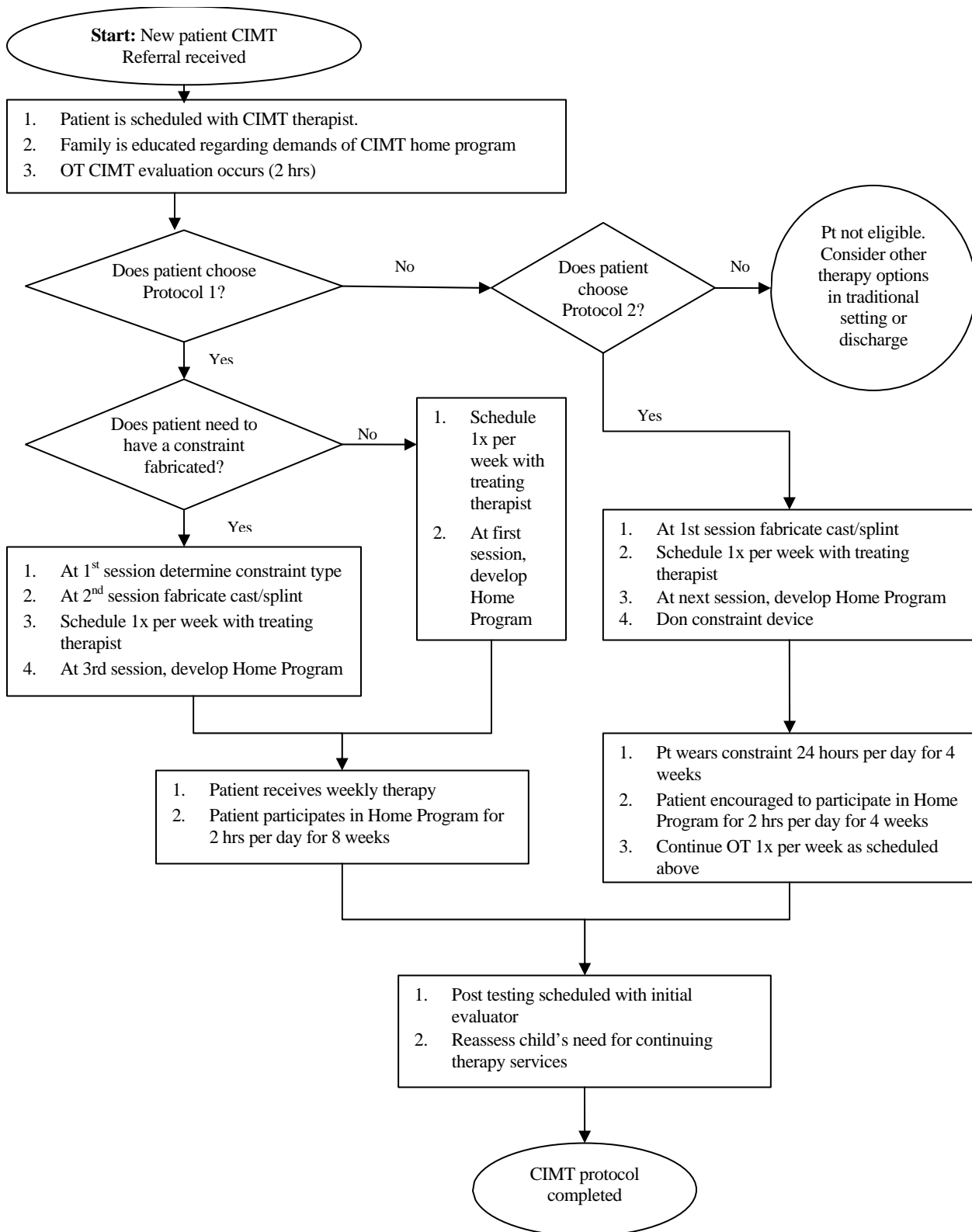
Note 2: A recent study found that children retained and further improved on the use of their affected limbs when parents follow through with at least 30 minutes per day of structured practice following CIMT intervention. *(Taub 2007 [B])*

15. It is recommended that the therapist discuss with the family that repeated trials of CIMT may result in cumulative improvement *(Charles 2007 [C])*.

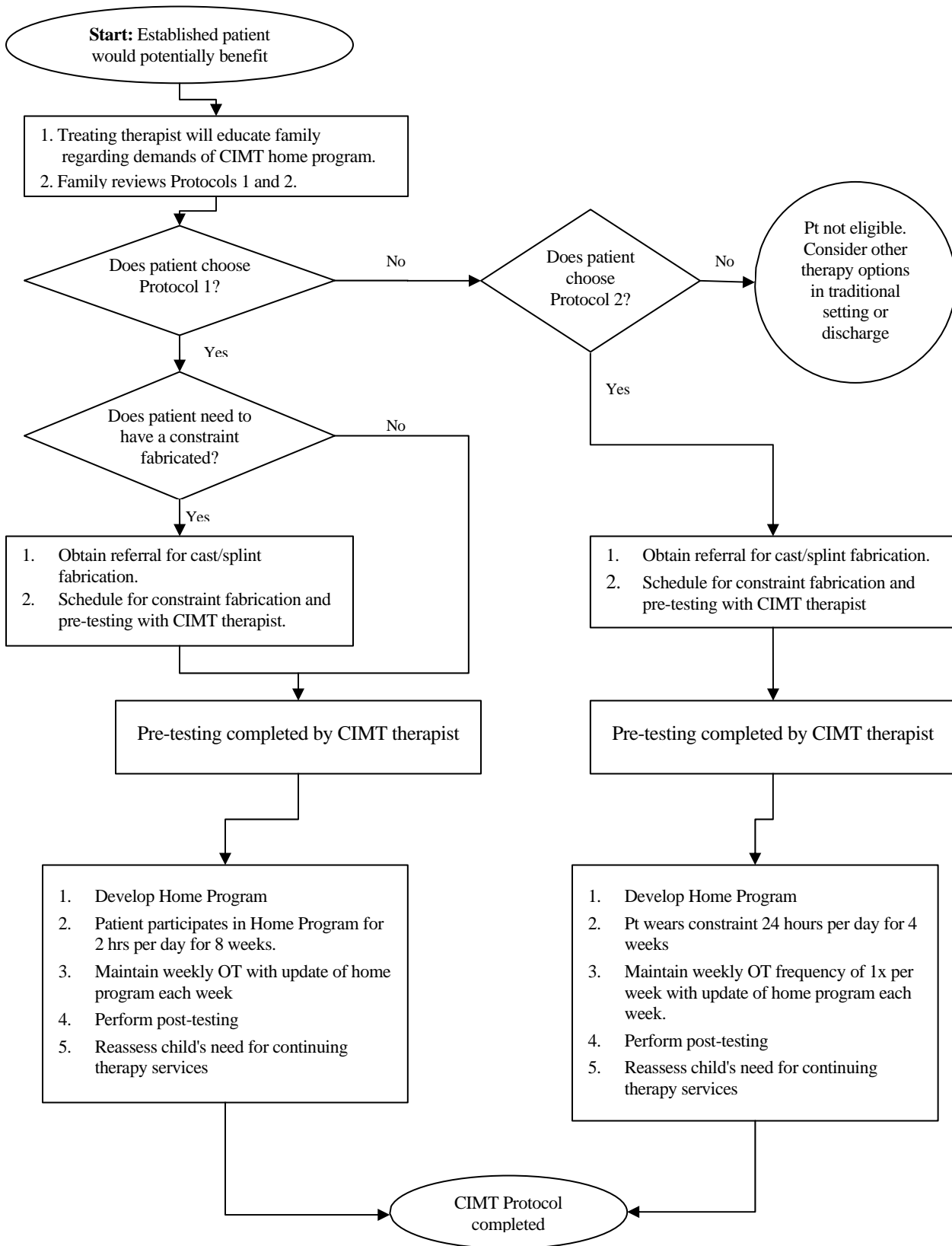
Future Research Agenda

1. In children with hemiplegia or BPI, is one protocol more effective than the other?
2. In children with hemiplegia or BPI who have <20 degrees of active wrist extension, is CIMT or traditional therapy more effective?
3. In children with unilateral impairments other than hemiplegia, is CIMT effective?
4. Are there specific characteristics of certain children (such as age, physiology, personality) that make them better candidates than other children to benefit from CIMT?
5. In children who have used CIMT, would a period of intensive bilateral upper extremity therapy following CIMT improve long-term outcomes?

Algorithm for CIMT – New Patient



Algorithm for CIMT – Established Patient



Appendix 1

Canadian Occupational Performance Measure, 4th edition (COPM) (Law 2005 [X])

Overview:

- Criterion-referenced, individualized outcome measure that can be used with clients of all ages and conditions.
- Client or caregiver is interviewed, using the test 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

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:

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

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 2

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

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:

- Handling objects in daily activities for play, leisure, and self-care

Administration:

- Children with cerebral palsy ages 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.
- About 5 minutes are required to determine classification.

Reliability:

- The intraclass correlation coefficient between therapists was 0.97 (95% confidence interval 0.96-0.98), and between parents 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 3

Shriners' Hospital Upper Extremity Evaluation (SHUEE) (*Shriners 2005 [X]*)

Overview:

- Video-based tool for assessment of upper extremity function in children with hemiplegic cerebral palsy
- Outcome measure to assess effectiveness of intervention on functional performance
- Standardized assessment kit as well as standardized positioning of the video camera
- Assists in goal setting
- Also includes assessment of active and passive upper extremity ROM, tone, and ADLs

Assessment focus:

- Spontaneous use of involved extremity
- Dynamic positional analysis (position of thumb, fingers, wrist, forearm, and elbow during functional activities) of involved extremity
- Grasp and release with wrist in flexion, neutral, and extension
- Active and passive range of motion from shoulder to fingers
- Spasticity (evaluated using the modified Ashworth Scale)
- Caregiver or subject report of independence in selected activities of daily living

Administration:

- Requires approximately 15 minutes to administer, scoring is done separately when time is available to review the video
- Requires a videographer in order adjust camera angles to capture body segment being assessed.
- Evaluation consists of AROM, PROM, spasticity, selected ADLs, client/caregiver goals, spontaneous use of involved extremity, assessment of the segmental alignment of the involved extremity during performance of 16 selected tasks, grasp and release with the wrist held in flexion, neutral and extension.
- Numerical scoring is done to facilitate comparison over time

Reliability:

- Study establishes clinical reliability (*Davids 2006 [B]*)

Validity:

- Study established concurrent validity and construct validity (*Davids 2006 [B]*)

Appendix 4

Modified Ashworth Scale (*Pandyan 2003 [X], Bohannon 1987 [X]*)

Overview:

- 0-5 scale evaluating muscle tone (0 = no increase in tone, 5 = rigid extremity)

Assessment focus:

- Muscle tone

Validity/Reliability:

- One study reports very good interrater and intrarater reliability of the modified Ashworth scale (kappa = .84 for interrater and .83 for intrarater comparisons). However, other studies have found results less reliable.

Appendix 5

Confidence Scale (*Lorig 2003 [X], Holden 1991 [X]*)

Overview:

- 10 point scale used to measure self efficacy and to help empower families in follow through with home programming

Assessment focus:

- Caregiver/Client confidence in ability to complete home programming

Administration:

- After development of home program activity log (and prior to fabrication of CIMT), ask the patient and family to report their confidence in their capability of the home program using a rating scale from 1 to 10 (0 = totally unconfident, 10 = totally confident).
- If the answer is 7 or higher, based on self-efficacy theory, there is a good chance that the home program will be accomplished.
- If the answer is less than 7, problem solving and a more realistic plan might be appropriate to avoid failure.

Validity/Reliability:

- Studies have shown benefit of utilizing this method to determine readiness for home program adherence.

Appendix 6

Gross Motor Functional Classification Scale - Expanded and Revised (GMFCS – E&R) (Palisano 2007 [X])

Overview:

- Systematic method to classify self-initiated movement for children with cerebral palsy
- Emphasis on the child's usual performance in home, school, and community (not best capability)
- Expanded and revised version has added guidelines for classifying youth 12 to 18 years of age and “emphasizes the concepts inherent in the World Health Organization's International Classification of Functioning, Disability and Health (ICF).”

Performance areas:

- Gross motor movement including sitting, transfers, and mobility needed for activities of daily living (ADL), instrumental activities of daily living (IADL), play, leisure, and social participation.

Administration:

- GMFCS level should be determined based on report from individuals who know the child's typical performance in the child's natural settings.
- Determine which of five levels most accurately describes the child's performance. Distinctions between levels in provided.
- Requires about 5 minutes to determine classification

Reliability: Palisano 1997 establishes inter-rater reliability of GMFCS. Authors have submitted an article reporting on the GMFCS-E&R.

Validity: Palisano 1997 establishes validity of GMFCS. Authors have submitted an article reporting on the GMFCS-E&R.

Members of the Pediatric Constraint Induced Movement Therapy (CIMT) Evidence Based Practice Team

Division of Occupational Therapy and Physical Therapy

Amy C. Klein, OTR/L, MS, MPP, Team Leader, Division of Occupational Therapy and Physical Therapy

Allison Allgier, OTR/L, Division of Occupational Therapy and Physical Therapy

Carol Burch, DPT, Division of Occupational Therapy and Physical Therapy

Pamela Little-Hayes, MS, OTR/L, Division of Occupational Therapy and Physical Therapy

Rebecca Reder, OTD, Division of Occupational Therapy and Physical Therapy

Division of Health Policy & Clinical Effectiveness Support

Eduardo Mendez, RN, MPH, Dir. Evidence-Based Care

Carol Tierney, RN, MSN, Education Coordinator

All Team Members and Clinical Effectiveness support staff listed above have signed a conflict of interest declaration and none were identified.

CCHMC Physician Reviewer

Linda Michaud, MD, Director, Division of Physical Medicine and Rehabilitation; Pediatric Rehabilitation Medicine Fellowship

Ad hoc Advisors

Eloise Clark, MPH, MBA, Guidelines Program Administrator

Mary Gilene, MBA, Division of Occupational Therapy and Physical Therapy

Michelle Kiger, OTR/L, Division of Occupational Therapy and Physical Therapy

Andrew Gordon, PhD, Professor of Movement Sciences, College of Physicians and Surgeons, Columbia University, New York

Development Process

The process by which this guideline was developed is documented in the Guideline Development Process Manual; a Team Binder maintains other relevant development materials. The recommendations contained in this guideline were formulated by an interdisciplinary working group which performed systematic and critical literature reviews, using the grading scale that follows, and examined current local clinical practices.

To select evidence for critical appraisal by the group for the update of this guideline, the Medline and the Cochrane databases were searched for dates of January 1990 to December 2007 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 searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on searching on human-indexed thesaurus terms (MeSH headings using an OVID Medline interface) and "natural language" searching on

M	Meta-analysis or Systematic Review	O	Other evidence
A	Randomized controlled trial: large sample	E	Expert opinion or consensus
B	Randomized controlled trial: small sample	F	Basic Laboratory Research
C	Prospective trial or large case series	L	Legal requirement
D	Retrospective analysis	Q	Decision analysis
S	Review article	X	No evidence

words in the title, abstract, and indexing terms. The citations were reduced by: eliminating duplicates, review articles, non-English articles, and adult articles. During the course of the guideline development, some additional resources were identified through other authors reviews of this subject. November 30, 2007 was the last date for which literature was reviewed for the current version of this guideline.

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>.

The Pediatric Constraint Induced Movement Therapy Evidence Based Practice Team will remain in place in the Division of Occupational Therapy and Physical Therapy. This team has been charged with continually exploring the literature for potential revisions to the guideline and to the Home Treatment Programs. At the three-year point the Team will reconvene to explore the continued validity of the guideline. This phase will be initiated at any point that Team finds evidence that indicates a critical change is needed. Feedback received for this version during the external review process (see AGREE² scores below) will be taken into full consideration at that time.

The guideline was externally appraised by three reviewers using the AGREE instrument and the results by domain are:

- Scope and Purpose 81%
- Stakeholder Involvement 72%
- Rigor of Development 46%
- Clarity and Presentation 58%
- Applicability 52%
- Editorial Independence 94%

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.

² AGREE = Appraisal of Guidelines Research & Evaluation

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

Copies of this Evidence-based Care Guideline (EBCG) and its 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 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 office at: 513-636-4651 or OTPT@cchmc.org

References

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.

1. **Adams, J. R., and Drake, R. E.:** Shared decision-making and evidence-based practice. *Community Ment Health J*, 42(1): 87-105, 2006, [O] [_____](#)  [_____](#).
2. **Bohannon, R. W., and Smith, M. B.:** Interrater reliability of a modified Ashworth scale of muscle spasticity. *Phys Ther*, 67(2): 206-7, 1987, [X] [_____](#)  [_____](#).
3. **Bonnier, B.; Eliasson, A. C.; and Krumlinde-Sundholm, L.:** Effects of constraint-induced movement therapy in adolescents with hemiplegic cerebral palsy: a day camp model. *Scand J Occup Ther*, 13(1): 13-22, 2006, [C] [_____](#)  [_____](#).
4. **Boyd, R. N.; Morris, M. E.; and Graham, H. K.:** Management of upper limb dysfunction in children with cerebral palsy: a systematic review. *Eur J Neurol*, 8 Suppl 5: 150-66, 2001, [M] [_____](#)  [_____](#).
5. **Campbell, R.; Evans, M.; Tucker, M.; Quilty, B.; Dieppe, P.; and Donovan, J. L.:** Why don't patients do their exercises? Understanding non-compliance with physiotherapy in patients with osteoarthritis of the knee. *J Epidemiol Community Health*, 55(2): 132-8, 2001, [O] [_____](#)  [_____](#).
6. **Cerebral Palsy International Research:** Fact Sheet 2007. 2007, [E] [_____](#)  [_____](#).
7. **Charles, J.; Lavinder, G.; and Gordon, A. M.:** Effects of constraint-induced therapy on hand function in children with hemiplegic cerebral palsy. *Pediatr Phys Ther*, 13(2): 68-76, 2001, [O] [_____](#)  [_____](#).
8. **Charles, J. R., and Gordon, A. M.:** A repeated course of constraint-induced movement therapy results in further improvement. *Dev Med Child Neurol*, 49(10): 770-3, 2007, [C] [_____](#)  [_____](#).
9. **Charles, J. R.; Wolf, S. L.; Schneider, J. A.; and Gordon, A. M.:** Efficacy of a child-friendly form of constraint-induced movement therapy in hemiplegic cerebral palsy: a randomized control trial. *Dev Med Child Neurol*, 48(8): 635-42, 2006, [B] [_____](#)  [_____](#).
10. **Chen, C. Y.; Neufeld, P. S.; Feely, C. A.; and Skinner, C. S.:** Factors influencing compliance with home exercise programs among patients with upper-extremity impairment. *Am J Occup Ther*, 53(2): 171-80, 1999, [C] [_____](#)  [_____](#).
11. **Crocker, M. D.; MacKay-Lyons, M.; and McDonnell, E.:** Forced use of the upper extremity in cerebral palsy: a single-case design. *Am J Occup Ther*, 51(10): 824-33, 1997, [O] [_____](#)  [_____](#).
12. **Davids, J. R.; Peace, L. C.; Wagner, L. V.; Gidewall, M. A.; Blackhurst, D. W.; and Roberson, W. M.:** Validation of the Shriners Hospital for Children Upper Extremity Evaluation (SHUEE) for children with hemiplegic cerebral palsy. *J Bone Joint Surg Am*, 88(2): 326-33, 2006, [B] [_____](#)  [_____](#).
13. **DeLuca, S. C.; Echols, K.; Law, C. R.; and Ramey, S. L.:** Intensive pediatric constraint-induced therapy for children with cerebral palsy: randomized, controlled, crossover trial. *J Child Neurol*, 21(11): 931-8, 2006, [B] [_____](#)  [_____](#).
14. **DeLuca, S. C.; Echols, K.; Ramey, S. L.; and Taub, E.:** Pediatric constraint-induced movement therapy for a young child with cerebral palsy: two episodes of care. *Phys Ther*, 83(11): 1003-13, 2003, [O] [_____](#)  [_____](#).
15. **Eliasson, A. C.; Krumlinde-Sundholm, L.; Rosblad, B.; Beckung, E.; Arner, M.; Ohrvall, A. M.; and Rosenbaum, P.:** The Manual Ability Classification System (MACS) for children with cerebral palsy: scale development and evidence of validity and reliability. *Dev Med Child Neurol*, 48(7): 549-54, 2006, [X] [_____](#)  [_____](#).
16. **Eliasson, A. C.; Krumlinde-sundholm, L.; Shaw, K.; and Wang, C.:** Effects of constraint-induced movement therapy in young children with hemiplegic cerebral palsy: an adapted model. *Dev Med Child Neurol*, 47(4): 266-75, 2005, [C] [_____](#)  [_____](#).
17. **Elwyn, G., and Charles, J. R.:** Shared decision making: the principles and the competences. In *Evidence-based patient choice – inevitable or impossible?*, pp. 118-143. Edited, Oxford, Oxford University Press, 2001, [O]  [_____](#).
18. **Foad, S. L.; Mehlman, C. T.; and Ying, J.:** The epidemiology of neonatal brachial plexus palsy in the United States. *J Bone Joint Surg Am*, 90(6): 1258-64, 2008, [D] [_____](#)  [_____](#).
19. **Glover, J. E.; Mateer, C. A.; Yoell, C.; and Speed, S.:** The effectiveness of constraint induced movement therapy in two young children with hemiplegia. *Pediatr Rehabil*, 5(3): 125-31, 2002, [O] [_____](#)  [_____](#).
20. **Gordon, A.; Connelly, A.; Neville, B.; Vargha-Khadem, F.; Jessop, N.; Murphy, T.; and Ganesan, V.:** Modified constraint-induced movement therapy after childhood stroke. *Dev Med Child Neurol*, 49(1): 23-7, 2007, [C] [_____](#)  [_____](#).
21. **Gordon, A. M.; Charles, J.; and Wolf, S. L.:** Efficacy of constraint-induced movement therapy on involved upper-extremity use in children with hemiplegic cerebral palsy is not age-dependent. *Pediatrics*, 117(3): e363-73, 2006, [C] [_____](#)  [_____](#).
22. **Gordon, A. M.; Charles, J.; and Wolf, S. L.:** Methods of constraint-induced movement therapy for children with hemiplegic cerebral palsy: development of a child-friendly intervention for improving upper-extremity function. *Arch Phys Med Rehabil*, 86(4): 837-44, 2005, [_____](#)  [_____](#).
23. **Greenfield, S.; Kaplan, S. H.; Ware, J. E., Jr.; Yano, E. M.; and Frank, H. J.:** Patients' participation in medical care: effects on blood sugar control and quality of life in diabetes. *J Gen Intern Med*, 3(5): 448-57, 1988, [A] [_____](#)  [_____](#).
24. **Hagberg, B.:** Lessons and indications from three decades of West-Swedish Cerebral Palsy data. *Neuropediatrics*, 31(6): 284-6, 2000, [O] [_____](#)  [_____](#).

25. **Himmelmann, K.; Hagberg, G.; Beckung, E.; Hagberg, B.; and Uvebrant, P.:** The changing panorama of cerebral palsy in Sweden. IX. Prevalence and origin in the birth-year period 1995-1998. *Acta Paediatr*, 94(3): 287-94, 2005, [D] _____
26. **Hoare, B. J.; Wasiak, J.; Imms, C.; and Carey, L.:** Constraint-induced movement therapy in the treatment of the upper limb in children with hemiplegic cerebral palsy. *Cochrane Database Syst Rev*, (2): CD004149, 2007, [M] _____
27. **Holden, G.:** The relationship of self-efficacy appraisals to subsequent health related outcomes: a meta-analysis. *Soc Work Health Care*, 16(1): 53-93, 1991, [X] _____
28. **Karman, N.; Maryles, J.; Baker, R. W.; Simpser, E.; and Berger-Gross, P.:** Constraint-induced movement therapy for hemiplegic children with acquired brain injuries. *J Head Trauma Rehabil*, 18(3): 259-67, 2003, [C] _____
29. **Law, C. R.; Baptiste, S.; Carswell, A.; McColl, M.; Polatajko, H.; and Pollock, N.:** (2005) *Canadian Occupational Performance Measure*. Ottawa, 2005, [X] _____
30. **Local Consensus:** During BEST development timeframe. [E].
31. **Lorig, K. R., and Holman, H.:** Self-management education: history, definition, outcomes, and mechanisms. *Ann Behav Med*, 26(1): 1-7, 2003, [X] _____
32. **Miller, R., and Hale, L.:** Constraint-induced movement therapy for a youth with chronic traumatic brain injury. *New Zealand Journal of Physiotherapy*, 33(3): 85-90, 2005, [O] _____
33. **Naylor, C. E., and Bower, E.:** Modified constraint-induced movement therapy for young children with hemiplegic cerebral palsy: a pilot study. *Dev Med Child Neurol*, 47(6): 365-9, 2005, [C] _____
34. **Novak, I.; Cusick, A.; and Lowe, K.:** A pilot study on the impact of occupational therapy home programming for young children with cerebral palsy. *Am J Occup Ther*, 61(4): 463-8, 2007, [C] _____
35. **Palisano, R.; Rosenbaum, B.; Bartlett, D.; and Livingston, M.:** Gross Motor Function Classification System - Expanded and Revised. *McMaster University*: Hamilton, ON, Canada. 2007, [X].
36. **Pandyan, A. D.; Price, C. I.; Barnes, M. P.; and Johnson, G. R.:** A biomechanical investigation into the validity of the modified Ashworth Scale as a measure of elbow spasticity. *Clin Rehabil*, 17(3): 290-3, 2003, [X] _____
37. **Pierce, S. R.; Daly, K.; Gallagher, K. G.; Gershkoff, A. M.; and Schaumburg, S. W.:** Constraint-induced therapy for a child with hemiplegic cerebral palsy: a case report. *Arch Phys Med Rehabil*, 83(10): 1462-3, 2002, [O] _____
38. **Shriners, H. f. C.:** *Shriners' Hospital Upper Extremity Evaluation (SHUEE)*. 2005, [X] _____
39. **Stenstrom, C. H.; Arge, B.; and Sundbom, A.:** Home exercise and compliance in inflammatory rheumatic diseases--a prospective clinical trial. *J Rheumatol*, 24(3): 470-6, 1997, [C] _____
40. **Stewart, M. A., and Brown, J.:** Patient-centeredness in medicine. In *Evidence-based patient choice: Inevitable or impossible?* Edited by Elwyn, G., and Edwards, A., New York, Oxford University Press, 2001, [O] _____
41. **Sung, I. Y.; Ryu, J. S.; Pyun, S. B.; Yoo, S. D.; Song, W. H.; and Park, M. J.:** Efficacy of forced-use therapy in hemiplegic cerebral palsy. *Arch Phys Med Rehabil*, 86(11): 2195-8, 2005, [B] _____
42. **Sutcliffe, T. L.; Gaetz, W. C.; Logan, W. J.; Cheyne, D. O.; and Fehlings, D. L.:** Cortical reorganization after modified constraint-induced movement therapy in pediatric hemiplegic cerebral palsy. *J Child Neurol*, 22(11): 1281-7, 2007, [O] _____
43. **Taub, E.; Griffin, A.; Nick, J.; Gammons, K.; Uswatte, G.; and Law, C. R.:** Pediatric CI therapy for stroke-induced hemiparesis in young children. *Dev Neurorehabil*, 10(1): 3-18, 2007, [B] _____
44. **Taub, E.; Ramey, S. L.; DeLuca, S.; and Echols, K.:** Efficacy of constraint-induced movement therapy for children with cerebral palsy with asymmetric motor impairment. *Pediatrics*, 113(2): 305-12, 2004, [B] _____
45. **Taub, E.; Uswatte, G.; and Pidikiti, R.:** Constraint-Induced Movement Therapy: a new family of techniques with broad application to physical rehabilitation--a clinical review. *J Rehabil Res Dev*, 36(3): 237-51, 1999, [S] _____
46. **Willis, J. K.; Morello, A.; Davie, A.; Rice, J. C.; and Bennett, J. T.:** Forced use treatment of childhood hemiparesis. *Pediatrics*, 110(1 Pt 1): 94-6, 2002, [B] _____