Changing Function: An Intervention for Children with Hemiplegia

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Disclosure

Margo Prim Haynes, PT, DPT, PCS, C/NDT and Holly Holland, OTR/L, ATP, C/NDT declare no conflict of interest to report that would bias this presentation. No relevant financial relationship exists

Objectives

At the conclusion of this session the learner will be able to:
1. Describe how CIMT / BIT / NDT are combined for skill acquisition with children diagnosed with hemiplegia and the evidence that supports combining the interventions
2. Demonstrate the process of cast fabrication utilized in conjunction with CIMT
Objectives

3. Discuss selected NDT-based therapeutic handling strategies that guide symmetrical postural alignment/symmetry to enhance function in children with a diagnosis of hemiplegia used in this clinical framework

4. Review application of combined CIMT/BIT/NDT clinical practice models

Outline

• Clinical Presentation of Children with Hemiplegia
• Pediatric Constraint Induced Movement Therapy (P-CIMT) with Constraint Cast
• Bimanual Intensive Treatment /Training (BIT)
• Neuro-Developmental Treatment (NDT)
• Clinical Practice Model
• Case Studies

Clinical Presentation: Children with Hemiplegic Cerebral Palsy (CP)
Children with a Diagnosis of Hemiplegic CP

Primary impairments:
- Movement coordination disorders (Richards, Malouin 2013, Shumway-Cook, Woollacott 2001)
- Sensation (Maitre 2013)
- Developmental Disregard (Bialoocerkowski 2013, Zielinski et al 2014)
- Motor neglect

Function

- BOS
  - Alignment/Symmetry
  - Balance
- Movement system
  - 3 planes of movement
    - Sagittal
    - Frontal
    - Transverse
- Body Systems
  - Musculoskeletal
  - Cardiovascular
  - Respiratory
  - Gastro-intestinal
  - Neuromuscular
    - Auditory, Visual, Vestibular
    - Somatosensory

CIMT, BIT and NDT are evidence based interventions for children with hemiplegic CP

Antilla,Autti-Ramo, Suoranta et al 2008
Sakzewski, Ziviani, Boyd 2009
Martin, Baker, Harvey 2010
Cope, Liu,Verbe, et al 2010
Franki, Desloovere, De Cat, et al 2012
Huseyinsinglu BE, Ozdincier AR, Krespi 2012
Haynes, Phillips 2012
Pediatric Constraint Induced Movement Therapy (P-CIMT)

P-CIMT Summary

Key Ingredients:

• Constraint of well functioning limb
• Intensive structured skills practice

DeLuca SC et al 2012

Clinical / Research Questions

• Amount of Practice: 30-60 hours (DeLuca et al 2012)
• Program length: 1 week – 2 months
• Location
Types of Constraints for P-CIMT

- Sling
- Cast
- Resting hand splint (puppet over splint)

Constraint Cast

First Layer 2” terry cloth stockinette
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Second layer thumb spica stockinette

Secure cutting strip

Wrap distal to proximal
Appropriate Positioning

Cast removal

Line the cast

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Secure the strap

Bimanual Intensive Treatment / Training (BIT)

Bimanual Intensive Training / Treatment (BIT):
- HABIT (hand - arm bimanual intensive training) program (Gordon, Charles, Wolf 2010, Gelkop et al 2013, Greaves et al 2010)
- Intensive Intervention Model
- Intensity versus treatment model (Arpino et al 2010)

Clinical / Research Questions

- Amount of Practice: 60-90 hours (de Brito Brandao et al 2012, Facchin 2011)
- Duration (hours / day): 3 hour – 6 hours (de Brito Brandao et al 2012, Facchin et al 2011)
- Program length: 2 week – 10 weeks (Deppe et al 2013, Sakzewski et al 2012)
- Location
CIMT and BIT
**Equally Effective**

- CIMT better at improving unimanual performance
- BIT better at improving bimanual coordination and goal achievement
  
  Dong et al 2013
  de Brito Brandao et al 2012

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Summary of CIMT and BIT Interventions

- Equally effective in improving functional outcomes for children with hemiplegic CP
- Research evidence is strong
- Improvements can last for one year without further intervention
  
  Friel et al 2013
  Dong et al 2013
  Sakzewski et al 2014

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Summary of CIMT and BIT Interventions

- Practice and intensity are key factors in improving outcomes
- Cortical reorganization has been shown
- Intervention can be performed by trained volunteers
  
  Friel et al 2013
  Dong et al 2013
  Sakzewski et al 2014
Neuro-Developmental Treatment (NDT)

NDT Process…..
Trained in problem solving strategies:
– Observe
– Analyze
– Consider the relationship between the person, task, environment

NDT Research- Postural System

- Postural System
  – Alignment
  – Symmetry
  – Base of Support (BOS)

Evans-Rogers et al 2015
Arndt et al 2008
Girolami et al 1994, 2011
Clinical / Research Questions

- Amount of Practice: 2-4 hours (Evans-Rogers et al 2015), 15 hours (Arndt et al 2008)
- Program length: 1-2 weeks (Evans-Rogers et al 2015), 3 weeks (Arndt et al 2008)
- Location
Clinical Practice Model

Clinical Practice Model includes…

- Functional Outcome Directed Practice
  - Targeted unilateral and bilateral play (Geerdink et al 2015)
  - Child specific
  - Practice variation – with NDT (Haynes, Phillips 2012, Cope et al 2010)
  - Multiple players
Clinical Practice Model includes…

- Motor Learning (Gordon 2005, Geerdink et al 2013)
  - Practice, Practice, Practice
  - Specificity of Training
- Functional Outcomes (age specific)
- Skill acquisition … continues

Remember….. Postural System

- Alignment (symmetry)
  - Ongoing midline orientation
- Feet part of the postural system
- Trunk rotation

Remember : Start with Symmetry
Putting it Together

Practice in Play

Case Studies

Summary

Clinical Practice Model for Children with Hemiplegia

- Emphasize P-CIMT and NDT to acquire new skills and use of involved extremities
  - Constraint
  - Intensity
  - Functional Practice
- Integrates BIT and NDT for acquisition of new functional bimanual skills
Cerebral Palsy (CP)

- CP is a disorder of the development of movement and posture, causing activity limitations attributed to non-progressive disturbances of the fetal or infant brain that may also affect sensation, perception, cognition, communication, and behavior.

Rosenbaum, 2006
Richards CI, Malourin F, 2013
Constraint-Induced Movement Therapy (CIMT)

- Less impaired upper extremity is restrained
- More impaired upper extremity is engaged in intensive and goal directed, repetitive practice of functional tasks for an extended period (Taub et al 2007)

Bilateral Intensive Training

Upper extremities are engaged in structured bimanual goal directed, repetitive practice of functional tasks for an extended period (Charles, Gordon 2006, Gordon, Charles, Wolfe 2010)

NDTA Treatment Definition

NDT is a holistic and interdisciplinary clinical practice model informed by current and evolving research that emphasizes individualized therapeutic handling based on movement analysis for habilitation and rehabilitation of individuals with neurological pathophysiology. Using the ICF model, the therapist applies a problem-solving approach to assess activity and participation to identify and prioritize relevant integrities and impairments as a basis for the establishment of achievable outcomes with clients and caregivers.
NDTA Treatment Definition

An in-depth understanding of typical and atypical development, and expertise in analysis of postural control, movement, activity, and participation throughout the lifespan, form the basis for examination, evaluation, and intervention. Therapeutic handling, used during evaluation and intervention, consists of a dynamic reciprocal interaction between the client and therapist for activation of optimal sensorimotor processing, task performance, and skill acquisition for achievement of participation in meaningful activities. (Cayo et al 2015)

Recommended Casting Materials

- DELTA-CAST CONFORMABLE CAST TAPE
- TERRY-NET THUMB SPICA STOCKINETTE – SHORT/LONG
- DELTA TERRY NET STOCKINETTE 2”
- ADHESIVE FLEECE EDGER 1-1/4”
- STRETCH LOOP 1”
Outcome measures

- SHUE- Shriners Hospital upper extremity assessment
- AHA - Assisting hand assessment
- Melbourne - Assessment of unilateral upper limb function
- Quest - Quality of upper extremity skills test
- PROMIS- Patient reported outcomes measurement
- Modified HOUSE - Orthopedic assessment of upper extremity
- Revised VOAA-DDD

References


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- Gordon A.M. Two hands are better than one: bimanual skill development in children with hemiplegic CP. Dev Med Child Neurol. 2010; 52: 315.


