

Introduction

A relatively new approach in the treatment of hemiparesis, constraint induced movement therapy (CIMT), has been developed based on concurrent discoveries in the areas of neuroplasticity and behavioral theory (Brady & Garcia, 2009). The purpose of this study was to review the theoretical framework of CIMT, to describe the successful administration of CIMT in an out-patient pediatric setting for a child with hemiparesis, and to discuss the measured outcomes.

CIMT was developed by a behavioral neuroscientist, Dr. Edward Taub, PhD, and was based on basic behavioral neuroscience research observations made during studies with deafferented primates (UAB CI Therapy Research Group, 2011). This series of studies led Dr. Taub to the hypothesis of "use-dependent cortical reorganization" which is the neural foundation for a permanent increase in the use of the affected upper extremity via focused use (UAB CI Therapy Research Group, 2011, p. 5). This intervention approach involves three essential components: 1) the immobilization of the unaffected upper extremity by some method of constraint (primarily the use of a removable cast which is split on two sides and reattached by some means to create a bi-valve cast), 2) intensive focused use of the involved upper extremity, 3) behavioral techniques in the form of shaping and transfer of acquired skills utilizing a home exercise program.

CIMT differs significantly in the aspects of duration, intensity and frequency from traditional physical therapy (PT) treatment. While traditional PT treatment may be offered up to one hour a day, three times a week or less, CIMT is an intense training for prolonged periods of time (up to 6 hours), offered daily for several weeks. This treatment approach also consists of a one-time intensive therapy program in which rapid gains are made, rather than a consistent long term treatment approach in which gains are achieved slowly over time. During this intense training of CIMT activities are structured to include "shaping" and repetitive tasks (Taub, Ramey, DeLuca, & Echols, 2004). These shaping tasks provide positive reinforcement by allowing the subject to experience success using their affected limb before progressing to more challenging tasks (DeLuca et al., 2003).

Based on extensive studies conducted by Dr. Taub in conjunction with UAB an out-patient clinic protocol has been advocated (UAB CI Therapy Research Group, 2011; Page, Levine, Leonard, Szaflarski, & Kisselain, 2008; Ploughman, Shears, Hutchings, & Osmond, 2008). The intensive and time consuming nature of this intervention can be prohibitive for many smaller out-patient clinics.

Methods

The protocol consists of three main components:

- Uni-valve casting of the unaffected upper extremity which is worn 23 hours per day
- One-on-one intensive therapy treatment three hours per day for fifteen visits over a period of three weeks
- Transfer of skills to the home setting via a daily home exercise program (HEP) with appropriate parental follow through.

(UAB Research Group, 2011)

Case Patient

TS was an appropriate candidate for CI therapy intervention based on the following criteria:

- Two year, one month old male who suffered a congenital stroke resulting in left side hemiplegia.
- Presentation of developmental disregard of the left upper extremity and hand.
- His mother was very involved as an active participant in his PT and OT services. Her interest, understanding, and pursuit of CI therapy indicated that she supported this intensive therapy approach.
- TS was a first and only child for the family at the time of the intervention, which reduced parental distraction.

Examination

•Pediatric Motor Activity Log (PMAL) is a structured interview which assesses upper extremity and hand function during activities of daily living for children between the ages of two and eight (UAB CI Therapy Research Group, 2011).

•At the initial treatment TS scored below 1 on the PMAL. This indicated that TS used the involved upper extremity very rarely (5-10% of the time) or not at all.

•The Pediatric Arm Function Test (PAFT) was also utilized as a measure of spontaneous upper extremity movement in play situations (UAB CI Therapy Research Group, 2011)

•At the onset of CI therapy, TS scored a one which indicated that the involved upper extremity had very poor function (UAB CI Therapy Research Group, 2011).



Conclusions

The established CI therapy protocol was successfully implemented as an effective intervention in the clinical setting for this case patient. Reidy et al. suggested that outcomes such as these may indicate the potential of a paradigm shift in the use of rehabilitation resources away from the traditional long term care and toward short bursts of intensive therapy (2012).

In this case, the intensive therapy approach helped this child with hemiplegia overcome a perceived plateau in upper extremity use.

Further studies are needed to examine the impact of CI therapy on other areas of development such as gait, balance, and speech. Additional research is needed to further identify retention of the gained use and functional ability after the CI therapy intervention has been performed.

Bibliography

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Table 1

Times	Activities
8:00- 8:30	Stretching: Shoulder Internal Rotation, external rotation, abduction, supination, thumb abduction
8:30- 8:45	Activity 1: side sit with bubble play
8:45- 9:00	Snack in sitting at table
9:00- 9:15	Clean up and ADLs after snack
9:15- 9:30	Activity 2: puzzle with focus on supination x3
9:30- 9:45	Activity 3: foam puzzle- pushing pieces out with pointer finger and co-ban to isolate pointer finger
9:45- 10:00	Activity 4: upright activity on easel for wrist extension
10:00- 10:15	Activity 5: ambulation activity pushing weighted lawn mower in the hall with the left hand
10:15- 10:30	Activity 6: water play with squeeze toys for supination, wrist extension grasp and release
10:30- 11:00	Review of PMAL HW scale and issuing HEP

Table 1

Results

TS exhibited improved left upper extremity arm and hand function upon completion of CI Therapy. TS scored a three on the PMAL when retested after the cast was removed. This score indicated that he used the affected upper extremity approximately fifty percent of the time, but it was only half as strong as the uninvolved upper extremity (UAB CI Therapy Research Group, 2011). On the PAFT TS scored a three which indicated he presented with a moderate amount of synergy or performed tasks somewhat slowly or with increased effort (UAB CI Therapy Research Group, 2011). This score reflected a rating of fair function.

Clinical Impression

The outcomes of the PAFT and PMAL reflected a significant improvement in the overall hand and arm function of TS. He was able to open the door with his left hand upon leaving the facility on the final day of CI therapy which was an important goal which was set by the family. TS's mother reported that in her opinion CI therapy was "very difficult but worth the effort".