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A Comparative Study on the Effectiveness of Modified Constraint-Induced Movement Therapy and Hand-Arm Bimanual Intensive Therapy on Improving Gross Manual Dexterity and Spontaneous Use of the Affected Right Upper Extremity in Children with Right Spastic Hemiplegic Cerebral Palsy

Running Title: mCIMT vs HABIT in Right Spastic Hemiplegic CP

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Abstract: ***Background and Purpose of the Study: Recent neuro-rehabilitation concepts emphasize real-world activity rather than standardized environments. Activity-based interventions such as Modified Constraint-Induced Movement Therapy (MCIMT) and Hand-Arm Bimanual Intensive Therapy (HABIT) have shown promise in improving hand function [3, 25]. This study compared the effectiveness of MCIMT and HABIT on gross manual dexterity in children with right spastic hemiplegic cerebral palsy. Methodology: Thirty children aged 6–8 years were randomized into two groups: 15 received MCIMT and 15 received HABIT for three months. Gross manual dexterity was assessed using the Box and Block Test [5]. Results: Within- group analysis showed significant improvement ($p < 0.001$). Inter-group analysis revealed no statistically significant difference, though HABIT demonstrated slightly higher mean post-test scores. Conclusion: HABIT demonstrated marginally greater improvement than MCIMT, but both interventions are clinically valuable.***

Keywords: Spastic hemiplegic cerebral palsy CP, Modified constraint induced movement therapy (MCIMT), Hand arm bimanual intensive therapy (HABIT), gross manual dexterity.

1. Introduction

Cerebral palsy (CP) describes a group of disorders of the development of movement and posture causing activity limitation that are attributed to non- progressive disturbances that occurred in developing fetal or infant brain which includes motor disorders accompanied by disturbances of sensation, cognition, communication, perception, behaviour or by seizures disorders[1]. According to WHO (jan 2013) Nearly15-20% of the total physically handicapped children suffer from CP. For India, the estimated incidence is around 3/1000 live births however, being a developing country, the actual figure may be much higher.[2]

The International Classification of Functioning, Disability, and Health (ICF) framework highlights CP's impact on body functions, activities, and participation [23]. Hand impairments often result from motor cortex and corticospinal pathway damage (17). The idea that residual (masked) capability could potentially be tapped into by foced use of the differentiated or impaired limb drove the development of intensive practice-based therapies in humans.

Evidence suggests MCIMT and HABIT improve upper-limb function [3, 25, 26].

MCIMT involves restraining the non-affected limb to encourage use of the impaired limb (4, 9). HABIT emphasizes intensive bimanual task practice [25]. Both interventions promote cortical reorganization and functional recovery [15, 16].

Box and Block test assessment is appropriate to use in various settings, such as in inpatient, rehabilitation, outpatient, or even in the client's home. This test and required material can be transported to any of the mentioned environments where it is necessary to address unilateral gross dexterity. Test does not require any additional qualifications of training. This is a

simple test to administer. The score is the number of blocks carried from one compartment to the other in one minute.

2. Selection Criteria

Inclusion Criteria:
- Children diagnosed as spastic hemiplegic cerebral palsy reported by a physician
- Age:6-8 years
- Both male and female children were included
- Able to attend the tasks and follow simple commands
- Patients who were willing to commit for an intensive therapy program and agree to cease all other upper limb therapeutic intervention for 3 months period of the trial.
- MAS score greater than 1 but lesser than 3
- Wrist at 20 degree flexion and fingers at 10 degree flexion

Exclusion Criteria:
- Visual problems
- Prior upper limb surgery
- Uncontrollable seizures
- Botulinium toxin A injection in the upper limb within 6 months prior to the study.

Study Setting: FFC Family for children, Coimbatore

3. Methods

Design: Comparative study.

Sample: Thirty children aged 6–8 years with spastic hemiplegic CP.

Interventions:
- **MCIMT:** 3 hours/day, 3 days/week for 3 months.
- **HABIT:** 6 hours/day, 3 days/week for 3 months.

Outcome Measure: Box and Block Test [5, 8].

Procedure:
This study was approved by ethical committee of PPG College of physiotherapy Coimbatore. Permission of outcome measure scale (PMAL AND BOX AND BLOCKTEST) was taken by email from the author. Informed conset was got from the participation of the children and their parents prior to the study. The children care givers was interviewed to evaluate how well and how often the children use their affected UE based on 22 functional activities.

30 children who were undergoing conventional physiotherapy as their routine and who met the inclusion criteria participated in the study.15 children were given MCIMT and 15 children were given HABIT.

Modified Constraint Induced Movement Therapy:
Children were restrained of the non involved extremity using a glove and engaged in normal activities. Duration of the intervention is 3 hours per day, 3 days per week for 3 months including therapy time and home program which can be split into different sessions of no less than 30 minutes duration.

Children wore a fairly comfortable glove, as a restraint up to wrist is used which covers fingers, thumb and hand to avoid hand function of unaffected side. The children were however allowed to use the hand for support or for breaking a fall.

Treatment Protocol
- Reach out activities (forward, Lateral and backward reach)
- Grasping and releasing activities (different sized & shaped things e.g. Pencil, toys,
- Fine motor movements
- For improving strength Hand weight bearing exercise (forward, lateral, backward)
- Functional ADL and play activities
- Goal oriented activities

Logbook (Work diary) - was given to primary care giver for collecting details of child activity during that 3 hour time period.

Hand –Arm Bimanual Intensive Training:
HABIT retains the two elements of paediatric CIMT and similarly engages the child in bimanual activities 6 hours per day for 3 days per week for 3 months

4. Data Analysis and Results

This study comprised of two groups, GROUP-A and GROUP –B with 15 subjects in each group. For both the group age range was between 6-8. Statistics was done by using SPSS 20 version. The independent t-test was used for within group analysis. Pre and post mean with standard error mean, t-values and p values of MCIMT and HABIT are given in the table -Their p value was 0.00. The result showed there was significant improvement in within group analysis. Independent t-test was used to compare the pre –post values of both the groups. The Pre-test values of both the group for the Box and Block test outlining the F-value and P- value were given in Table -2. The result showed that there was no homogenisity among the group. The post test values of both the group were calculated. The mean values, F value and p value of Box and Block test are given in Table -2. The result showed that there were significant difference between the two groups.

5. Results

Both groups showed significant improvement ($p < 0.001$). HABIT demonstrated slightly higher mean post-test scores compared to MCIMT, though differences were not statistically significant.

6. Discussion

Dexterity tasks provide sensitive measures of CP-related impairments [6]. MCIMT promotes cortical reorganization through forced use [9, 13], while HABIT enhances bimanual coordination [25, 28]. Previous studies support both interventions [26, 28]. In this study, HABIT showed marginally greater improvement, consistent with evidence that bimanual training reflects real-life functional demands [14].

7. Conclusion

HABIT demonstrated slightly more significant improvement than MCIMT in enhancing gross manual dexterity among children with spastic hemiplegic CP. Both interventions are clinically valuable and can be incorporated into rehabilitation practice

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Within Group Analysis

Table 1: Within Group Analysis of Group A and Group B

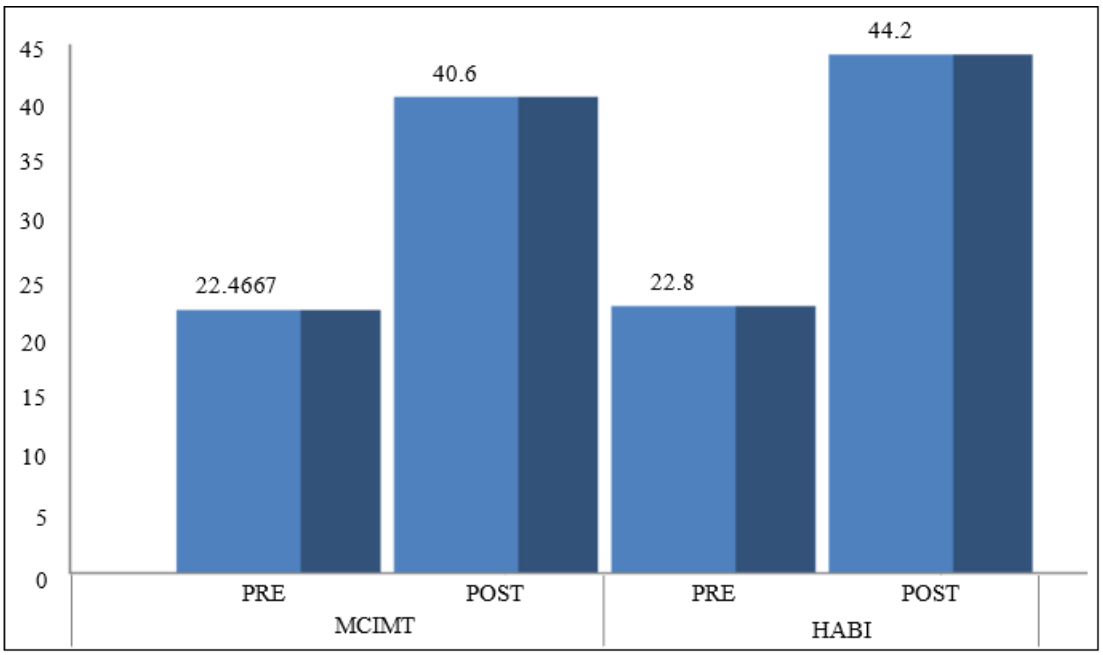
	Mean ±standard error mean	"t" value	"p" value
MCIMT PRE	22.4667±0.54219	-26.053	.000
MCIMT POST	40.6000±1.14974		
HABIT PRE	22.8000±.57900	-19.788	.000
HABIT POST	44.2000±1.52190		

Intra Group Analysis

Table 2: Intra Group Analysis of Group A and Group B

Test	Groups	Mean ±Standard Error Mean	F-Value	Significant Value
Pre Values	MICMT	22.4667±.54219	10.913	.000
	HABIT	22.8000±.57900		
Post Values	MICMT	40.6000±1.14974	12.693	.000
	HABIT	44.2000±1.52190		

Graphical Representation



Graph 1: Graphical Representation of Both Groups

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