

The Effects of MCIMT versus MT in Young Children with Spastic Hemiplegic CP to Improve Hand Function and Strength of the Paretic Arm

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Abstract: ***Background & purpose:** Cerebral palsy is the diagnostic term used to describe a group of motor syndromes resulting from disorders of early brain development. Cerebral palsy is the term used to refer to a non-progressive group of brain disorders resulting from a lesion or developmental abnormality in fetal life or early infancy. Impaired hand function is a major disability in children with hemiplegic cerebral palsy (CP). As a result, children with hemiplegic CP often fail to use the involved upper extremity and learn to perform most tasks exclusively with their non-involved upper extremity. The arm is often more involved than the leg and difficulty in hand manipulation is obvious by one year of age. **Objective:** This study is done to find out whether restraining of the uninvolved limb and use of mirror and use of hand techniques will help to overcome hand function and improve functional activity in spastic hemiplegic cerebral palsy. **Methodology:** Subjects were assigned in two Groups A and B (15 patients in each group by randomized sampling) both are experimental group. Group A is treated with Mirror Therapy (MT), with spastic hemiplegic cerebral palsy were asked to perform a bimanual symmetrical circular movement in three different visual feedback conditions (i.e. mirror-viewing the two arms, viewing only one arm, and viewing one arm and its mirror image), combined with two head orientation conditions (i.e. looking from the impaired and looking from the less-impaired body side) and including hand exercise, passive stretching. Group B is treated with Modified Constraint Induced Movement Therapy (MCIMT), with restrain of un-involved arm for 1 hour per day and the involved arm is given group programs and playing activities for 1 hour per day. Each subject is assessed according to assessment scale. Thirty subjects with spastic hemiplegic cerebral palsy of age group between 6-10 years are taken. Duration of the study is 3 months and data collection is done at day zero and at the end of 12 wks. **Study design:** Experimental design **Outcome measure:** 1. Motor Activity Log Scale (MAL), 2. Quality of Upper Extremity Skills Test (QUEST) **Results:** Data for 30 patients were included in the data analysis. Between group analysis shows significant ($P < 0.01$) improvement in group A. Group B was ($P < 0.00$) less significantly improved among both the groups. **Conclusion:** Data collected through the study showed more improvement in the hand function and functional activities in patients with hemiplegic cerebral palsy in the group A. Thus, it can be concluded that MT are more beneficial in improving hand function for young children with spastic hemiplegic cp. This is one reason in all the literature which emphasizes the importance of above MT over MCIMT.*

Keywords: Modified Constraint Induced Movement Therapy (MCIMT), Mirror Therapy (MT), Motor Activity Log Scale (MAL), Quality of Upper Extremity Skills Test (QUEST)

1. Introduction

Cerebral palsy is the diagnostic term used to describe a group of motor syndromes resulting from disorders of early brain development. CP is caused by a broad group of developmental, genetic, metabolic, ischemic, infectious, and other acquired etiologies that produced a common group of neurologic phenotypes.¹

Cerebral palsy is the term used to refer to a non-progressive group of brain disorders resulting from a lesion or developmental abnormality in fetal life or early infancy.² Children with hemiplegia due to cerebral palsy have difficulty with the timing and co-ordination of reaching movements, grasping, movement planning, and a deficient capacity to modulate postural adjustment during reaching.³ If hemiplegic stroke occurs in-utero, or any time between birth and two years of age, it is considered hemiplegic cerebral palsy.⁴

Impaired hand function is a major disability in children with hemiplegic cerebral palsy (CP). As a result, children with hemiplegic CP often fail to use the involved the upper extremity and learn to perform most tasks exclusively with their non-involved upper extremity.⁴ The arm is often more

involved than the leg and difficulty in hand manipulation is obvious by one year of age. Spastic hemiplegia has a seizure disorder that usually develops during the first year or two.⁵

The ability of the brain to be modulated by experience is called neural plasticity.⁶ Ramachandran and Rogers Ramachandran were the first to introduce the use of the visual illusions created by a mirror for treatment of phantom limb pain. By superimposing the intact arm on the phantom limb using a mirror reflection, patient reported the sensation that they could move and relax the often cramped phantom limb and experienced pain relief. Previous studies in stroke, although undersized and non-sufficiently control suggested that mirror therapy may be beneficial for motor function recovery in the paretic hand. Mirror visual feedback has previously been found to reduce disproportionate inter-limb variability and neuromuscular activity in the arm muscles in children with Spastic Hemi paretic Cerebral Palsy (SHCP).⁷ Modified CIMT, as developed by Page and colleagues, represents a distributed practice pattern in which the mitts worn for several hours each day over a 10-week period and this home-based practice is supplemented with outpatient therapy several times each week.⁸

Objectives

1. To study the effectiveness of mirror therapy in improving hand function for young children with spastic hemiplegic cerebral palsy.
2. To study the effectiveness of modified constraint induced movement therapy in improving hand function for young children with spastic hemiplegic cerebral palsy.
3. To compare the effectiveness of modified constraint induced movement therapy versus mirror therapy in improving hand function for young children with spastic hemiplegic cerebral palsy.

Methodology

Study Design – Experimental study design

Samples- 30 subjects with spastic hemiplegic cerebral palsy of age group between 6-10 years are taken. Each subject is evaluated for the study.

Age Group –6 to 10 years.

Inclusion Criteria-

- Age between 6-10 years.⁹
- Spastic hemiplegic cerebral palsy with hand function affected.
- Spasticity with grade two on modified ashworth scale.
- Cause-cord around the neck.¹⁰
- Patients with either (right) or (left) involvement.
- Parent's consent for participation.
- Both genders eligible for study (boys and girls)
- IQ level is good – Below average – 80 to 90.

Exclusion Criteria –

- Associated fractures.
- Mental retardation, Ataxic, Athetoid and Mixed CP.
- Monoplegic, Paraplegic and diaplegic CP.
- Auditory and visual problem.
- Unable to follow commands
- Congenital deformities of upper limb.

2. Procedures

Group A: Will be treated with Mirror Therapy and the involved arm is given group program including hand exercise, passive stretching for 6 hours per day. Children with SHCP were asked to perform a bimanual symmetrical circular movement in three different visual feedback conditions (i.e. mirror-viewing the two arms, viewing only one arm, and viewing one arm and its mirror image), combined with two head orientation conditions (i.e. looking from the impaired and looking from the less-impaired body side).

Group B: Will be treated with MCIMT, with restrain of uninvolved arm for 1 hour per day and the involved arm will be given group programs including hand exercise, passive stretching and playing activities for 1 hour per day.

Each subject is assessed according to assessment scale. Baseline data is collected and support of assistant is made

available to check the performance and to correct the child during group therapy.

Tools used for the study

- Evaluation chart
- Table (large up to chest height) and CP chair
- Plaster cast (Bivalve plaster cast)^{7,14}
- Stopwatch
- Mirror
- Paper, Pen, Pencil, Spoon and Comb
- Ball (sponge ball-small size)
- Rings (different colors, size, shape)
- Dough, Jigsaw
- Posting boxes
- Small objects like toys. (different color, size, shape) – sorting⁸
- Assessment of Modified Ashworth Scale⁵

The patients is seated on CP chair and is strapped to it. Large table is used up to chest height and the exercises are performed hand exercises and passive stretching is given in both groups.

Group A received MT with hand exercises¹¹

All the 15 patients is given will be treated with Mirror Therapy and the involved arm is given group programs including hand exercise, passive stretching for 6 hours per day. Children with SHCP were asked to perform a bimanual symmetrical circular movement in three different visual feedback conditions (i.e. mirror-viewing the two arms, viewing only one arm, and viewing one arm and its mirror image), combined with two head orientation conditions (i.e. looking from the impaired and looking from the less-impaired body side).

Group programs is given to the patients including hand exercises, passive stretching.



Figure 1: Mirror Therapy

Hand exercises for involved arm-

1. Picking up the top of a pen and putting it down again. Patient stretches arm forward, picks up pen top, and releases it on table close to body.
2. Holding a pencil, making rapid dots on a sheet of paper; Patient must do at least two dots a second for 5 sec. patient picks pencil up and positions it without assistance. Patient must hold pen as for writing.

3. Taking a dessert spoon to the mouth. Do not allow head to lower towards spoon. Do not allow liquid to spill.
4. Holding a comb and combing hair at back of head.

Type of activities¹³;

- Functional tasks
- Board games
- Gross motor activities (bowling)
- Puzzles.

Group B received MCIMT with hand exercises¹²

All the 15 patients is given gentle restraint using bivalve plaster cast of the non-involved extremity from shoulder to fingertips for 1 hour per day and group programs is given to the patients including hand exercises, passive stretching and providing structured practice of involved arm that includes playing activities for 1 hour per day.¹⁵

Constraint of the unaffected arm were achieve by gentle restraint, with the help of an assistant holding the child's unaffected hand during activities. After that, they were not restrained, but were allowed to have both hands free. Children were also encouraged verbally to use their other hand.¹⁶



Figure 2: MCIMT

Playing activities¹⁶:

Instructions on how the child should perform each activity is given.

1. Play with dough-If the child is unable to open out their hand, the therapist will facilitate hand opening and place the play dough into the child's hand.
2. Posting boxes-is used and different items is posted using the affected hand.
3. Jigsaws-Form boards is use and child is asked to place all the pieces back into it.
4. Sorting-The child is asked to sort a number of small objects by picking them up and placing them into different bowls.
5. Ending with session- A ball game is played, pushing a ball from one child to another using the affected hand. The program will be conducting by the child's regular therapist and on other days as a home program by parents.

Data Analysis

Statistical analysis of data was done with---

- 1) Wilcoxon Signed Ranks Test
- 2) NPar tests
- 3) Mann-Whitney Test.

3. Results

Table 1: Group analysis within Group A and Group B of Quest scale

Outcome measures	Day 0 N=15 M±SD	Day 90 N=15 M±SD	Repeated Measures ANOVA	Z	Post-Hoc ANOVA (P=)	
						P
Quest scale	Group A	42.73±7.27	55.20±7.23	.001	-3.42	.001
	Group B	41.80±6.31	49.60±6.84	.001	-3.42	.001

Table 2: Group analysis within Group A and Group B of QOM scale

Outcome measures	Day 0 N=15 M±SD	Day 90 N=15 M±SD	Repeated Measures ANOVA	Z	Post-Hoc ANOVA (P=)	
						P
QOM scale	Group A	1.80±0.41	3.20±0.67	.000	-3.52	.000
	Group B	1.33±0.45	2.40±0.50	.000	3.77	.000

Table 3: Group analysis within Group A and Group B of AOU scale

Outcome measures	Day 0 N=15 M±SD	Day 90 N=15 M±SD	Repeated Measures ANOVA	Z	Post-Hoc ANOVA (P=)	
						P
AOU scale	Group A	1.93±0.25	3.27±0.45	.000	-3.54	.000
	Group B	1.73±0.45	2.87±0.35	.000	-3.69	.000

4. Discussion

The study of 3 months structured, MT had shown improvement in spastic hemiplegic CP gains were observed in prognosis of upper limb hand function. The present study was undertaken to determine the effect of the MT and MCIMT of specific spastic hemiplegic CP child.

The most objective of the study was to compare the improvement in hand function between Group A and Group B subjects. When we analyze the mean value for pre and post test, it is found that their results showed that patients treated with MT had their hand functions improved significantly more. When comparing the improvement of hand function between the Group A and Group B subjects, it is found that mean difference is,

- 1) In QUEST scale are 12.47 and 7.80 for Group A and Group B subjects respectively and is found to be a statistically Group A is more significant (p<0.001).
- 2) In QOM scale are 1.40 and 1.07 for Group A and Group B subjects respectively and is found to be a statistically Group A is more significant (p<0.000).
- 3) In AOU scale are 1.34 and 1.14 for Group A and Group B subjects respectively and is found to be a statistically Group A is more significant (p<0.000).

From the results, it is evident that patients receives treatment of MT (Group A) showed more improvement in hand functions for young children with spastic hemiplegic CP when compared with patients who received treatment of MCIMT (Group B).It can be seen that use of MT and MCIMT in patients with spastic hemiplegic cerebral palsy is

beneficial. This can be used to enhance the functional outcome of these patients. Hence alternate hypothesis is accepted at $p = 0.00$ and the null hypothesis is rejected.

5. Conclusion

It has been recorded from the study that use of MT and MCIMT produces significant improvement in hand function for young children with spastic hemiplegic cerebral palsy. It can be seen that use of MT and MCIMT in patients with spastic hemiplegic cerebral palsy is beneficial. This can be used to enhance the functional outcome of these patients. So, MT is more beneficial than MCIMT in young children with spastic hemiplegic cerebral palsy.

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