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Effects of Modified Constraint Induced Movement Therapy to Improve Lower Extremity Functions among Children with Infantile Hemiplegia

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KEYWORDS
Hemiplegia children,
Modified Constraint Induced Movement Therapy,
Lower Extremity Functions.

ABSTRACT:

Introduction: Infantile hemiplegia refers to brain damage that occurs before or during birth and results in hemiplegia. Juvenile hemiplegia is seen in injured patients older than 1 year. Hemiplegia is the physical manifestation of damage to a certain area of the brain that controls motor activity. Hemiplegia can develop suddenly or develop over days, weeks or months. Some babies who appear normal as newborns may not develop symptoms of hemiplegia until voluntary hand use develops (around 4 to 5 months of age). Hemiplegia can also be short-lived or cause mortality and morbidity. Infections remain an important cause of neurodeficiency, at least in developing countries.

Objectives: To find out the effect of conventional occupational therapy to improve dexterity function in control group**;** To find out the effect of modified constraint induced movement therapy to improve lower extremity function in children with infantile hemiplegia**;** To compare the effect of conventional occupational therapy and modified constraint induced movement therapy between control group and experimental group.

Methods: The study design was done using a quasi-experimental design with a convenient sampling technique was used. Totally 30 students were selected and divided into two groups 15 students in the control group (A) and 15 students in the experimental group (B). Totally 36 sessions were conducted 3 session per week for 45 minutes). The participants were among the age group 6to 10. The sample were selected for the study from Premavasam, Possible rehab centre from mudichur , Kiddos rehab centre from Porur and Shalom therapy centre from Old Perungalathur. Total samples 30 subjects were selected under inclusion and exclusion criteria Before intervention, subjects were screened using GMFM Scale and modified Ashworth scale to get the pre-test values than divided equally in 15 samples in control group and 15 samples in experimental group. The experimental group underwent Modified Constraint Induced Movement Therapy.The therapy consists totally of 36 sessions, on a schedule of 3 sessions a week for 12 weeks. After the sessions the LEFS Scale was again administered to get the post-test values.

Results: The results showed that the comparison of pre and post-test mean GMFM scores of the experimental group were highly statistically significant, as compared to the control group because of the effect of modified constraint induced movement therapy to improve lower extremity functions. Since the p value of 0.001 is lesser than 0.05,.The GMFM measure scores of the pre and post test of the control group were significantly lower that was that of the experimental group after the implementation of modified constraint induced movement therapy for children with infantile hemiplegia.

Conclusions: The current study concludes that there was a significant improvement in the experimental group than the control group after the modified constraint induced movement therapy. Thus, this study proves that modified constraint induced movement therapy can be used as an effective intervention to improve lower

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extremity functions by using Gross motor functional measure scale (GMFM) for children with Infantile Hemiplegia.

1. Introduction

Infantile hemiplegia refers to brain damage that occurs before or during birth and results in hemiplegia. Juvenile hemiplegia is seen in injured patients older than 1 year. Hemiplegia is the physical manifestation of damage to a certain area of the brain that controls motor activity. Hemiplegia can develop suddenly or develop over days, weeks or months. Some babies who appear normal as newborns may not develop symptoms of hemiplegia until voluntary hand use develops (around 4 to 5 months of age). Hemiplegia can also be short-lived or cause mortality and morbidity. Infections remain an important cause of neurodeficiency, at least in developing countries.

Modified Constraint Induced Movement Therapy (mCIMT) is a procedure used to improve upper extremity function and mobility after a stroke. It is used as an alternative to the original movement therapy restrictions due to limitations.

The original CIMT involves immobilizing the upper limbs of a less disabled person with a protective glove. The mitt is left on 90% of the day, during the 2-week intervention period, in one 6-hour day, 5 days a week of task-based training. CIMT is intensive and sometimes difficult to perform, and patients sometimes tire of the glove, which affects adherence to the protocol. The study found that patients preferred a protocol that lasted several weeks with fewer sessions or a shorter time period using restrictive equipment such as gloves. Other barriers to implementation of the original CIMT protocol include the resource intensity and cost of the therapeutic protocol. Therapists identified barriers to using the original CIMT protocol as time requirements, difficulty in developing a challenging 6-hour program, and interference with other tasks and other patients. A modified CIMT (mCIMT) protocol was developed as an alternative to the intensive nature of CIMT and involves less time using constraints over a longer intervention period.

Both mCIMT and CIMT aim to treat learned non-use and motor function impairment in the post-stroke/CVA affected upper limb. Assuming the patient/client uses more of their affected upper limb in daily life, while the less affected upper limb is limited, the patient performs gross motor tasks, fine motor tasks and ADL during the intervention period.

2. Objectives

• To find out the effect of modified constraint - induced movement therapy on children in the experimental group of motor function measurement.

• To examine the effects of a conventional occupational therapy program on control group children using a number of motor function measures.

• Compare the results of modified constraint – induced movement therapy with conventional occupational therapy.

3. Methods

RESEARCH DESIGN:

Quasi – Experimental type of design was used to determine the effect of modified constraint induced movement therapy to improve lower extremity functions among children with infantile hemiplegia.

SAMPLING TECHNIQUE SIZE AND SETTING:

SAMPLING TECHNIQUE:

Convenient sampling technique was adopted.

SAMPLE SIZE:

Totally 30 subject techniques were adopted.

Control group consists of 15 members

Experimental group consists of 15 members.

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SAMPLE SETTING:

Premavasam, Gerugambakkam, Chennai

Possible Rehab Centre, Mudichur, Tambaram

Kiddos Rehab Centre, Porur, Chennai

Shalom Therapy Centre, Old Perungalathur

VARIABLE:

INDEPENDENT VARIABLE:

Modified constraint induced movement therapy.

DEPENDANT VARIABLE:

Infantile hemiplegia.

SELECTION CRITERIA:

INCLUSION CRITERIA:

Children with infantile hemiplegia

Children who have scored less than 2 and 3 in Modified Ashworth Scale

Both male and female children are included.

Children who has scored above 40% in GMFM scale.

EXCLUSION CRITERIA:

Children who have scored above 3 in Modified Ashworth Scale.

Children who has scored below 40% in GMFM Scale.

Children with other neurological conditions.

SCALES USED:

GROSS MOTOR FUNCTIONAL MEASURE

- The total score is an estimate of the child's gross motor function. The GMAE provides a standard error and a 95% confidence interval (CI) around the obtained GMFM-66 total score. For example, a child might obtain a total score of 42, with a 95% CI of 39 to 44.
- **highly reliable**, with the intraclass correlation coefficient (ICC)s of greater than . 98 (95% confidence interval=0.965-0.994) and both of them can be used in clinical practice or research.
- Both versions of GMFM also demonstrated high levels of validity, with an intraclass correlation coefficient (ICC) of .99 (95% confidence interval=0.972-0.997), reflecting associations with the GMFM-66.
- **GMFM: 0 – does not initiate, 1 – initiates, 2 – partially completes, and 3 – completed.**

LOWER EXTREMITY FUNCTIONAL SCALE

- **Internal reliability** for the LEFS is excellent (α=0.96). Test-retest reliability estimates were R=.86 (95% lower limit CI=.80) for the entire sample (n=98) and R=.94 (95% lower limit CI=.89) for the subset of patients with more chronic conditions (n=31).
- The LEFS is a **valid** tool as compared to the SF-36.
- LEFS score = SUM (points for all 20 activities) Interpretation: Minimum score: 0 Maximum score: 80 The lower the score the greater the disability. The Minimal Detectable Change (MDC) is 9 scale points. The Minimal clinically Important Difference (MCID) is 9 scale point.

MODIFIED ASHWORTH SCALE

- Spearman's ρ varied from 0.56 and 0.90 at the elbow and between 0.26 and 0.62 at the knee. In daily practice the use of the Modified Ash-worth Scale procedure is quick and easy and is a common tool in the measurement of spasticity. Additionally, the Modified Ashworth Scale is widely used in research, In different patient groups such as stroke, multiple sclerosis and spinal cord injury, moderate to good intra-rater reliability and poor to moderate inter-rater reliability of the scale was found.
- The Ashworth Scale was initially developed as a simple clinical tool to test the efficacy of an anti-spastic drug in patients with multiple sclerosis, Ashworth Scales are measures of spasticity.
- The Modified Ashworth Scale is a 6-point scale. Scores range from 0 to 4, where lower scores represent normal muscle tone and higher scores represent spasticity.

DURATION:

- Session's duration: 30 minutes.
- Session's frequency:

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- Intervention session: 36 sessions
- Intervention duration: 12 weeks.

PROCEDURE FOR DATA COLLECTION:

The sample were selected for the study from Premavasam, Possible rehab centre from mudichur , Kiddos rehab centre from Porur and Shalom therapy centre from Old Perungalathur. Total samples 30 subjects were selected under inclusion and exclusion criteria Before intervention, subjects were screened using GMFM Scale and modified Ashworth scale to get the pre-test values than divided equally in 15 samples in control group and 15 samples in experimental group. The experimental group underwent Modified Constraint Induced Movement Therapy.The therapy consists totally of 36 sessions, on a schedule of 3 sessions a week for 12 weeks. After the sessions the LEFS Scale was again administered to get the post-test values.

INTERVENTION PROTOCOL

Session 1-6: Assessment and Goal Setting

1. Perform an initial assessment to assess the child's motor skills, functional limitations, and goals.

2. Work with the child and family to set specific, measurable, achievable, relevant and time-bound (SMART) goals for therapy sessions.

Session 7-12: Preparing for the mCIMT

1. Educate the child and family about the purpose and process of mCIMT. 2. Provide guidance and direction on homework and activities related to mCIMT preparation. 3. Begin wearing a knee mobilizer on the unaffected limb during functional activities to encourage use of the affected limb.

Sessions 13-24: mCIMT therapy sessions

1. Conduct structured therapy sessions that focus on the affected hand/arm for a specific amount of time.

2. Engage the child in repetitive and functional activities that challenge the affected hand/arm while preserving the unaffected hand/arm.

3. Provide support, encouragement and cues to promote the child's active participation and use of the affected limb.

4. Gradually increase the complexity and difficulty of activities to promote the acquisition and generalization of motor skills.

5. Organize breaks and rest periods if necessary to avoid fatigue.

6. Lower extremity activities include: tandem walking, walking on the balance beam, climbing up on stairs & climbing down on stairs (with and without support), side walking by holding grab rails, Symmetrical weight bearing training, Weight shifting, Step training(swinging/clearance), Heel strike, Single leg standing, Push off/ Calf rise

Sessions 25-30: Transfer and Generalization

1. Facilitates transfer of skills learned in therapy sessions to daily life and routine.

2. Encourage the child to use the affected limb at home, at school and in other appropriate tasks.

3. Work with the child's family and teachers to incorporate the use of the affected hand/arm into the child's daily activities and routine.

Sessions 31-36: Monitoring and evaluating progress

1. Assess the child's progress toward your goals and make necessary changes to the therapy plan.

2. Provide feedback and suggestions to the child and family for continued practice and skill development after the intervention sessions.

3. Discuss possible long-term strategies and tools to support the child's ongoing motor development.

4. Evaluate the post – test.

4. Results

TABLE 4.1 - Statistical analysis of pre- test and post-test in control group

Test	Mean	SD	N	Z value	p value
Cntr_Pre	34.4667	13.29268	15	-2.288	0.022*
Cntr_Post	36.3333	13.38265	15		

*** Significant at 5% alpha level**

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Since the p value of 0.022 is lesser than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference between pre- test and post test scores in the Control Group of the LEFS. This suggests that the intervention received by the control group had significant improvement.

FIGURE NO 4.1 - Comparison of pre – test and post – test values of the control group.

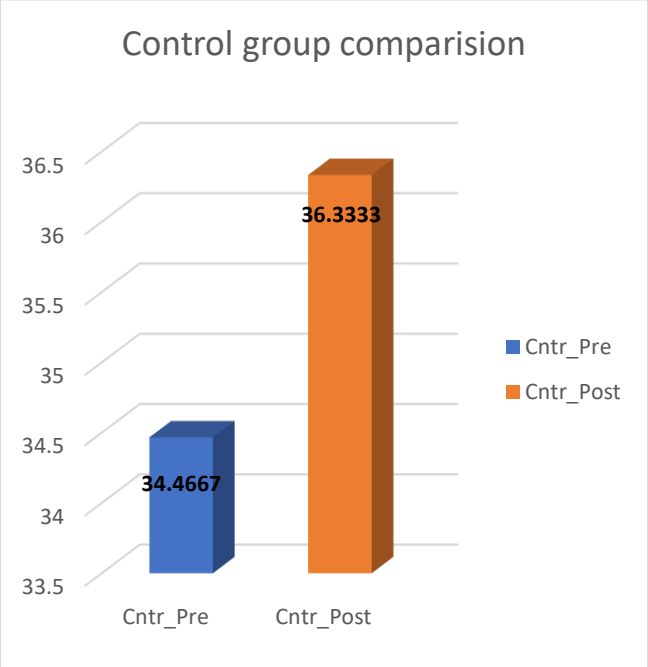

TABLE 4.2 - Statistical analysis of pre- test and post-test in experimental group

Test	Mean	SD	N	Z value	p value
Expt_Pre	34.6	13.13012	15	-3.418	0.001*
Expt_Post	49.7333	11.00952	15		

***Significant at 5% alpha level**

In the Experimental group, since the p value of 0.001 is less than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in Experimental Group between pre-test and post test scores of LEFS. This suggests that the intervention received by the experimental group had significant improvement.

FIGURE NO 4.2 – Comparison of pre – test and post – test values of the experimental group.

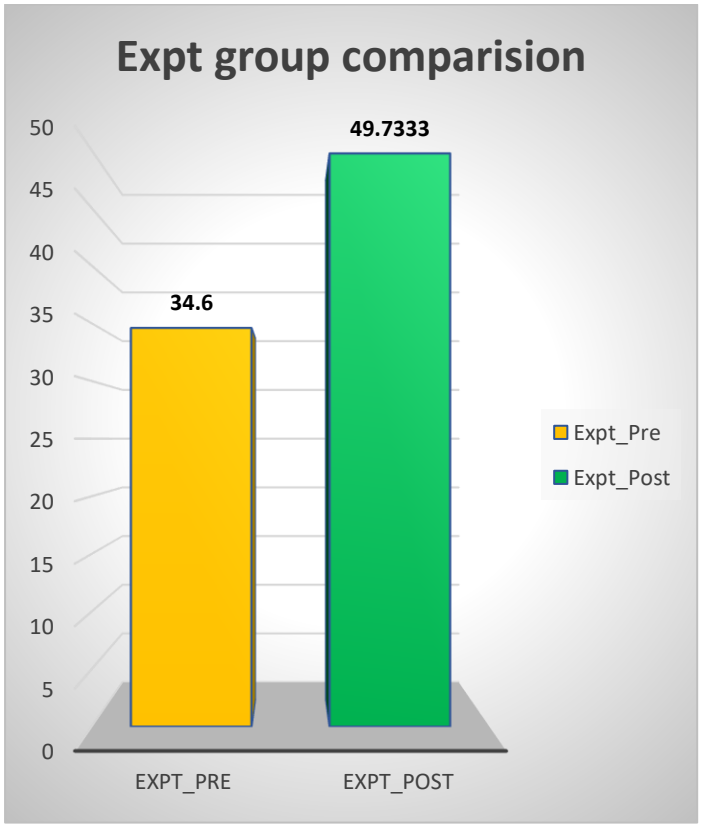

TABLE 4.3 - Statistical analysis between the post- test scores of the control and experimental group

Group	Mean	SD	N	Z value	p value
Cntr_Post	36.3333	13.38265	15	-2.302	0.021*
Expt_Post	49.7333	11.00952	15		

***Significant at 5% alpha level**

Since the p value of 0.021 is lesser than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in post test scores between Experimental and Control Group of the LEFS. This suggests that the intervention received by the experimental group had more improvement when compared to the control group.

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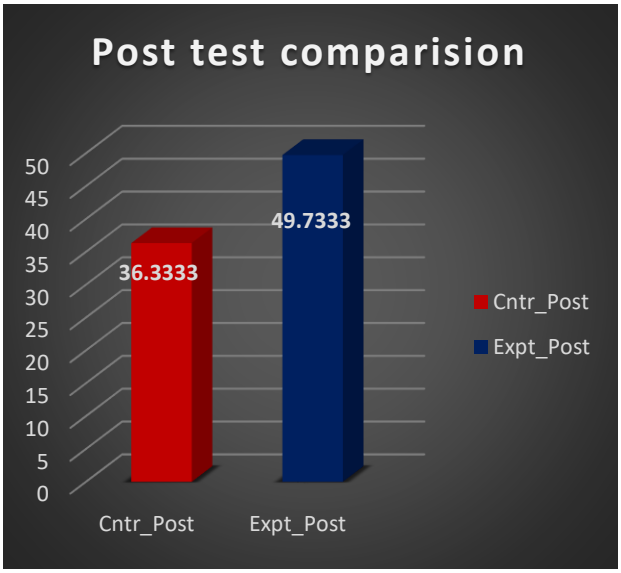
FIGURE NO 4.3- Comparison of post – test values of the control and experimental group.



5. Discussion

Hemiplegia is the paralysis of the muscles of the lower face, arm and leg on one side of the body. It is the weakness of half of the body. In most severe form hemiplegia leads to the paralysis of half portion of the body that is affected by a disease.

The study was conducted for a period of 36 sessions among hemiplegia children. A total number of 30 hemiplegia children were selected for the study using the screening tool Gross motor function classification system and they were randomly divided into an experimental group and a control group. The pre-test was done for both groups respectively using LEFS Scale. The experimental group underwent Modified Constraint Induced Movement Therapy and the control group underwent a conventional occupational therapy. After the 36-session period of intervention, the post-test was conducted using the LEFS Scale for the experimental and control group respectively and it was statistically analyzed.

Table 4.1 and Figure 4.1 shows that p value of 0.022 is lesser than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference between pre-test and post test scores in the Control Group of the LEFS. This suggests that the intervention received by the control group had significant improvement. These findings were accordance with the previous study done **R 1. JENNIFER SCHRANK et.al (2013):** The purpose of this case report is to describe the physical therapy interventions used and the general motor functional results achieved through 3 weeks of restriction-induced movement therapy in a child with cerebral palsy. A 10-year-old boy with spastic trigeminal cerebral palsy underwent fine and gross motor procedures that required the use of left and right lower limbs. 1.-2. week, he received 2 occupational and physical therapy sessions each week. For 3-5 weeks, he participated in limited movement therapy and wore a cast 90% of his waking hours. Motor function measurement score 88 increased from 44.55 percent to 62.35 percent after treatment. Although he improved in one area of the Children's Functional Independence Measure, he showed significant progress in his ability to bear weight and shift weight in various developmental positions.

Table 4.2 and Figure 4.2 shows that p value of 0.001 is less than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in Experimental Group between pre-test and post test scores of LEFS. This suggests that the intervention received by the experimental group had significant improvement. These findings were accordance with the previous study done **R 15. SEZEN TEZCAN et.al (2021):** Study of the effect of modified forced movement therapy (mCIMT) administered on consecutive or alternate days on upper limb function in children with hemiparetic cerebral palsy (CP). Thirty-three children with hemiparetic CP (age 5–18 years) were divided into three groups: sequential mCIMT group (n = 11), intermittent mCIMT group (n = 11), control group (n = 11). Outcome measures include the Total Motor Function Classification System and#40;GMFCSand#41;, Manual Classification System and#40;MACSand#41;, Pediatric Balance Scale (PBS), Modified Tardieu Scale (MTS), Jebsen-Taylor Hand. Functional Test (JTHFT), Children's Hand Experience Questionnaire (CHEQ), Abilhand Kids Questionnaire, Surface Electromyography (sEMG). Assessments were performed at baseline, 10 days post-treatment, 5 weeks post-treatment. Improvements were achieved in all groups. Use of upper limbs in daily activities (p andlt; 0.01), speed of performance of activities (p andlt; 0.001), gripping efficiency (p andlt; 0.001), extent of reduction of child discomfort while performing activities (p andlt; 1)0. . affected side in both mCIMT groups were better

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than the control group. Addition levels in the mCIMT groups were similar ($p > 0.05$). Administering mCIMT on random days facilitates the child's adaptation, has been found to be a more tolerable method, and may be more effective.

Table 4.3 and Figure 4.3 shows that p value of 0.021 is lesser than 0.05, alternate hypothesis is accepted. Hence, there is statistically significant difference in post test scores between Experimental and Control Group of the LEFS. This suggests that the intervention received by the experimental group had more improvement when compared to the control group. These findings were accordance with the previous study done **R 14. JOAN E. GLOVER et.al (2009):** Limited movement therapy (CIMT) in hemiplegia involves limiting use of the unaffected limb while providing intensive conditioning and movement training of the hemiplegic limb. This technique has been shown to be very effective in improving upper extremity function in adults after stroke, but there is little literature on the use of this procedure in children. This article provides a brief overview of the theory and background of this procedure and a review of the literature on children's technology use. Detailed case reports of two hemiplegic children aged 19 and 38 months who both underwent CIMT are then presented. Both children showed significant improvement in upper arm function, which was reflected in many domains, including daily functional use of the limbs. Benefits were maintained to varying degrees, and some unexpected new gains were observed after the discontinuation of CIMT. Practical challenges for children, parents, and therapists in implementing this intensive but promising intervention are also discussed

6. Conclusion

The study was conducted over an intervention period of three (3) months. Totally Thirty (30) hemiplegia children were selected for the study, fifteen (15) population in experimental and fifteen (15) population in control group. Pre-test and Post-test were conducted for both the groups using scale by LEFS Scale. The experimental group undergoes Modified constraint induced movement therapy whereas control group received only conventional occupational therapy.

The result showed that there was a high significant difference between the post scores of control and experimental group. It indicated that there in a high significant improvement in experimental group as because of Modified constraint induced movement to improve lower limb functions. From this study, the result suggests that mCIMT can be incorporated into occupational therapy management for other conditions.

LIMITATION AND RECOMMENDATION

LIMITATIONS

1. The duration of the study was shorter.
2. Study was done on a small sample size.
3. The duration of the sessions was shorter.

RECOMMENDATION

1. The study can be done with different age groups.
2. The study can be done with a larger sample.
3. The study can be carried out for longer duration.
4. The study can be done with different age criteria.

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