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Effectiveness of Constraint Induced Movement Therapy Versus Bimanual Training in Children with Unilateral Cerebral Palsy

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ABSTRACT

BACKGROUND: Cerebral palsy is defined as "a series of permanent impairments of the development of movement and posture, generating activity restrictions". This study mainly focusses on improving function of upper extremity by implementing treatment protocols Constraint Induced Movement Therapy and Bimanual Training. The main aim of the study was to compare the effectiveness of constraint induced movement therapy and bimanual training to improve the function of upper extremity in children with Unilateral Cerebral Palsy.
METHODS: Prospective Study Design. 64 subjects were randomly allocated into two groups. Each group containing 32 subjects. Group-I (n=32) Constraint Induced Movement Therapy and Group-II (n=32) Bimanual Training. Participants received 5 sessions per week for 4 weeks. The outcome measures of this intervention were measured by using Jebsen Taylor Hand Function Test.
RESULTS: ANOVA was used to compare the mean significance difference between both groups and within the groups by taking Pre-Test, Intermediate Test and Post-Test scores. Statistical analysis of the data revealed that between the groups and within the group comparison, both groups showed improvement in all parameters. But Constraint Induced Movement Therapy showed significant improvement.
CONCLUSION: From the finding of this study, it can be recommended that the Constraint Induced Movement Therapy may be opted for improving hand function in children with Unilateral Cerebral Palsy as an adjuvant treatment technique for Unilateral Cerebral Palsy children.

Keywords: Constraint Induced Movement Therapy, Bimanual Training, Jebsen Taylor Hand Function Test, Unilateral Cerebral Palsy.

INTRODUCTION

One of the most prevalent neurological conditions in children is cerebral palsy, which is brought on by harm to the developing brain. John Little first gave a description of CP in 1861[1]. A non-progressive disruption that happened in the growing foetus or infant brain is what is known as "series of permanent impairments of the development of movement and posture, generating activity restrictions" in cerebral palsy[2]. The incidence of CP is 2 to 2.5 cases per 1000 live births globally[3]. It is estimated that there are 3 instances per 1000 live births in India.

Although suggestive signs and symptoms may be present at a younger age, the clinical aspects of this entity change over time, and the specific CP syndrome may only be recognised at 3-5 years of age. The causes

of CP are numerous and complex. Common causes of CP include: Causes prior to or following birth are Multiple births, Stroke, intracranial haemorrhage,
intrauterine infections, new born infections, periventricular leukomalacia, intraventricular haemorrhage, bronchopulmonary dysplasia, hypoxic ischemic encephalopathy. Stroke, head trauma, hypoxic incidents like almost drowning, febrile encephalopathy - sepsis, meningitis/ meningoencephalitis, and status epilepticus after effects are among post-neonatal causes[4].

In addition to secondary musculoskeletal issues, the motor impairments of cerebral palsy frequently come with disturbances of sensation, perception, cognition, communication, and behaviour. There are a number of risk factors for cerebral palsy after birth, such as a poor APGAR score, a placenta that is underweight, respiratory issues, infections, and neonatal convulsions[2].

Based on the kind and location of motor abnormalities, CP is categorised. Early indications of CP include: Neurobehavioral symptoms include extreme irritation, lethargy, insufficient sleep, frequent vomiting, difficulty being handled and cuddled, and poor visual attention. The early motor indications may include poor head control, persistent or asymmetric hand fists, and aberrant oro-motor patterns (tongue thrusting/grimacing). The most prevalent type of CP, with a 58 percent bilateral and 30 percent unilateral prevalence, is spastic CP. Patients with spastic syndromes exhibit upper motor neuron symptoms such as extensor plantar response, hyperreflexia (clonus), and spasticity. Spastic diplegia, spastic quadriplegia, and spastic hemiplegia are among them[4].

The main clinical symptom of unilateral CP, hand asymmetry, often does not manifest until the child is 4 to 6 months old. Less severe hand deficits are caused by cortical malformation in the first two trimesters compared to periventricular lesions early in the third trimester[1]. Children with unilateral CP frequently struggle with hand dysfunction in their day-to-day activities. These issues may even have an impact on children's daily activities, professional performance, general well-being, and social inclusion[5].

Children with unilateral CP can receive a variety of interventions, such as upper limb splinting, virtual reality, kinesiotaping, constraint induced movement therapy (CIMT), and bimanual training[5]. CIMT and Bimanual Training are less invasive, more recent therapies that are emerging new protocols for managing unilateral CP[2].

Edward Taub created CMIT, which is founded on the notion of "learned non-use. The ability to use functional imaging as a surrogate outcome measure in clinical trials of rehabilitation intervention is presented by CIMT. Three hours per day were spent utilising the successive approximations method to shape the afflicted upper extremity's behaviour as it was being trained for daily living activities. It tries to stop the disregard for developmental process and promote the functional use of the afflicted limb. This technique requires the user to use the affected limb because the unaffected or less affected limb is constrained. This approach developed as a result of the convergence of behavioural brain research, the learning theory, and revelations in the field of neuroscience regarding neuroplasticity. CIMT represents a paradigm shift in the treatment of damage to the central nervous system. It shifts the emphasis away from compensating abilities and toward a desire for partial restoration. The most effective clinical treatment for hemiplegic CP children is to increase their sensory and movement abilities[9].

The majority of our daily tasks are simulated by Bimanual Training, which entails task completion using the affected limb in combination with the less affected limb in symmetrical, alternating movement patterns. This method benefits from limb inter co-ordination and encourages movement in the less-affected limb through the sound limb. When managing a large task

or when both limbs are required for task completion, the bimanual technique is absolutely essential. Because Bimanual Training needs two hands to work together motorically, it has an impact on hand function. The elements affecting grip strength and tactile function have a higher effect on bimanual performance. The quantity and quality of upper extremity use can be improved through Bimanual Training[8].

AIM OF THE STUDY

The aim of the study was to determine the effectiveness of the Constraint Induced Movement Therapy versus Bimanual Training to improve the function of upper extremity in children with Unilateral Cerebral Palsy.

OBJECTIVES OF STUDY

1. To determine the effectiveness of Constraint Induced Movement Therapy in improving the function of upper extremity in children with Unilateral Cerebral Palsy by using Jebson – Taylor Hand Function Test (JTHFT).
2. To determine the effectiveness of Bimanual Training in improving the function of upper extremity in children with Unilateral Cerebral Palsy by using Jebson – Taylor Hand Function Test (JTHFT).
3. To compare the effectiveness of Constraint Induced Movement Therapy and Bimanual Training in improving the function of upper extremity in children with unilateral cerebral palsy.

LITERATURE REVIEW

MH Tervahauta, GL Girolami, et al;2017; The goal of the study is to thoroughly review the data about the effectiveness of bimanual intense training versus constraint-induced movement therapy in children with unilateral cerebral palsy. Ages of the participants ranged from 1.5 to 16. The treatment dose ranged from 24 to 210 hours, and the duration from one week to ten weeks. Their baseline hand function ranged from MACS level I to level III. The studies assessed participation, achievement of personalised goals, and unimanual and bimanual hand and arm performance as study outcomes. The wide 95% confidence intervals showed that the effect sizes were not calculated accurately. The study's final finding is that it is impossible to say which bimanual intensive training or constraint-induced movement therapy is more helpful for children with unilateral cerebral palsy.

Clin Rehabil 2017 Nov;31(11):1445-1456.Epub 2017 Mar 20

Ali Reza JAMALI Msc, Malek AMINI PhD;2018; Children with cerebral palsy and the results of constraint-induced movement therapy; CIMT is an intervention technique that helps improve the hand function of kids with cerebral palsy. A youngster with hemiplegic cerebral palsy (CP) has significant effects on one side of their hands. Using electronic databases like Medline, PubMed, CINAHL, etc., this systematic review was completed between 1990 and 2016. According to the study's findings, a total of 43 articles were discovered, but 28 of them were dropped due to their lack of relevance. Due to redundancy and exclusion criteria, ten items were removed, leaving only 15 to be included. The study's findings ultimately showed that CIMT is superior to no intervention, but there are significant discrepancies with regard to several aspects of CIMT effectiveness, such as its impact on muscular tone and protective extension.

Iran J Child Neurol 2018 Fall;12(4):16-27

James C. Grotta, MD; Elizabeth A. Noser, MD; et al;2004; Therapy using constraints to elicit movement enhances recovery from chronic stroke, supports experimental findings about neural plasticity, and validates the value of intense occupational therapy. The ability to use functional imaging as a surrogate outcome measure in clinical trials of rehabilitation intervention is presented by CIMT. It is based on Dr. Edward Taub's original

research from the late 1970s and early 1980s. Its foundation is the concept of "learned non-use. In one of the more recent investigations, van der Lee et al. randomly assigned 66 chronic stroke patients to receive either CIMT or an equally rigorous reference therapy for two weeks while maintaining observer blindness.

2004 Nov;35(11 Suppl 1):2699-701. Epub 2004 Sep 16

Nava Gelkop, Dikla Gol Burshtein, et al;2014; In this study, we looked at the effectiveness of modified constraint-induced movement therapy (CIMT) and hand-arm bimanual intensive therapy (HABIT). Twelve kids (aged 1.5-7) with congenital hemiplegic cerebral palsy were randomly assigned to receive modified CIMT (n = 6) or HABIT (n = 6). Two months before the intervention, right before, right after, and six months after the initial baseline assessment, the Assisting Hand Assessment and Quality of Upper Extremity Skills Test were given. Both groups showed similar improvement after CIMT and HABIT but no change at baseline (p .001), which was kept at the 6-month check-up. The findings imply that modified CIMT and HABIT offered in educational contexts can enhance the calibre of bimanual competence and movement patterns.

Phys Occup Ther Pediatr 2015 Feb;35(1):24-39

Leanne Sakzewski, Jenny Ziviani, et al;2014; This study sought to explore the challenges and opportunities faced by occupational therapists in providing children with unilateral cerebral palsy with evidence-based upper limb interventions. To determine the enablers and hurdles to applying five evidence criteria, semi structured interviews with nine occupational therapists from three teams were undertaken. Although less knowledgeable and proficient, therapists were confident in their ability to give goal-directed bimanual occupational therapy but less so in their ability to deliver constraint therapy. Greater utilisation of home programmes and group-based interventions were recognised as strategies to enhance the dosage of therapy; however, therapists acknowledged the need for additional training and skill development in these areas. In chronological order the results of this study will be utilised to guide context-specific, individually tailored implementation strategies that will boost the uptake of research evidence into practise.

Physical & Occupational Therapy In Paediatrics Volume 32, 2014

MATERIALS & METHODS

STUDY DESIGN: Prospective Study Design

ETHICAL CLEARANCE AND INFORMED CONSENT: The study protocol was approved by Ethical committee of GSL Medical College and General Hospital, the investigator explained the purpose of the study and given the subject information sheet. The participants were requested to provide their consent for participation in the study. All the participants signed the informed consent and the rights of the included participants have been secured.

STUDY POPULATION: Subjects with Unilateral Cerebral Palsy diagnosed by Neurologist.

STUDY SETTING: This study was conducted at Department of Physiotherapy, GSL Medical College and General hospital, Rajamahendravaram and Uma Manovikas Kendram, Kakinada.

STUDY DURATION: This study was conducted during the period between October 2021 – September 2022.

TREATMENT DURATION: 2 hours per session, 5 sessions per week for 4 weeks.

TYPE OF SAMPLING: Systematic Random Sampling.

SAMPLE SIZE: A total of 72 subjects were screened, in that 64 subjects were recruited in the study after meeting the inclusion criteria. Recruited participants were explained the purpose and relevance of the study. The participants were included in the study after obtaining informed consent.

All eligible participants were randomly allocated into Group I (Constraint Induced Movement Therapy) and Group II (Bimanual Training)

MATERIALS USED:

Goniometer, Index cards, Coffee bean, Coins, Wooden checkers, Cans, Sling.

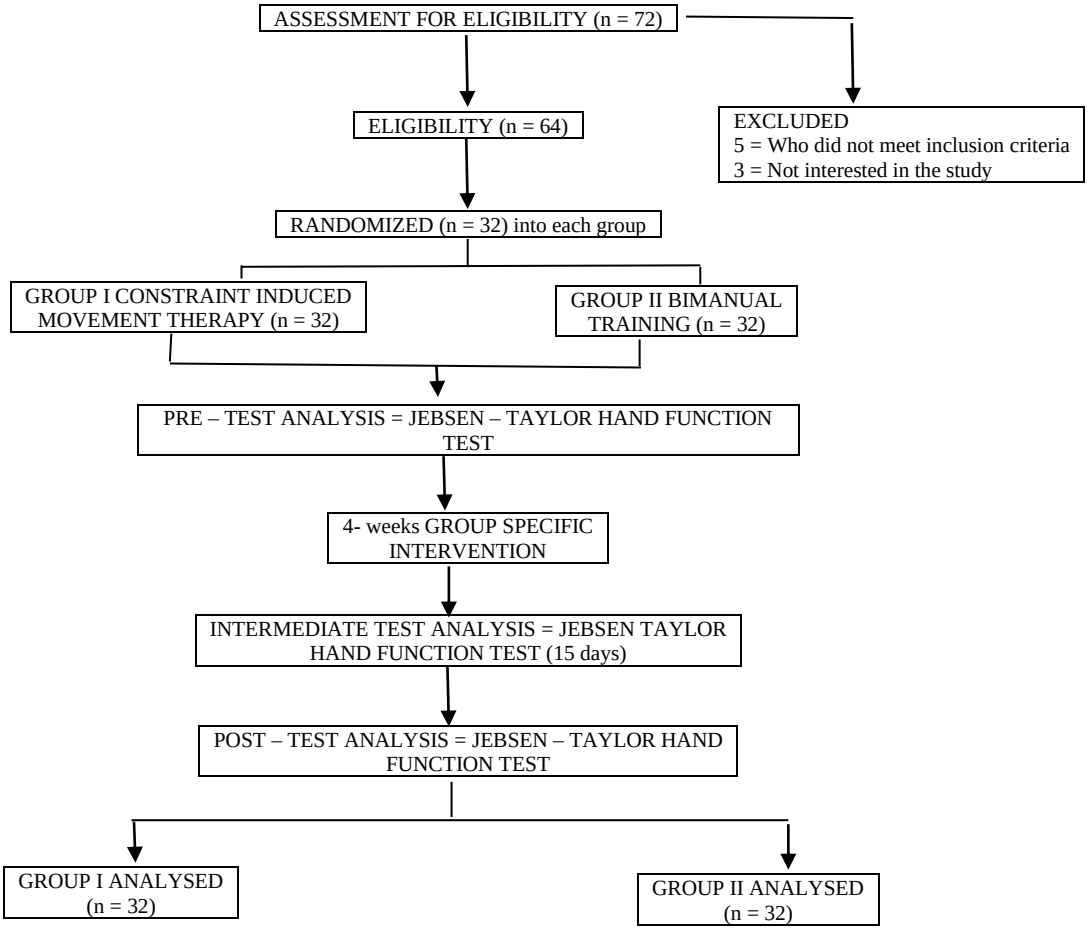
INCLUSION CRITERIA:

- 10-degree wrist extension.
- 10-degree finger extension.
- At least 50% difference between both hands on JTHFT.
- Age: 4 – 10 years.
- Subjects with Unilateral Cerebral Palsy.
- Subjects who come under MACS level II – level IV.
- Minimal ability to grasp with the impaired hand.
- Age-appropriate cognitive ability.

EXCLUSION CRITERIA:

- Surgery on affected hand/arm.
- BOTOX-A in the arm or hand in previous 6 months.
- Bilateral Cerebral Palsy.
- Balance problems precluding use of sling.
- Dystonia.
- Contractures.
- Previous participation in CIMT.

FLOWCHART



OUTCOME MEASURES

JEBSEN TAYLOR HAND FUNCTION TEST[15]:

The Jebsen Hand Function Test was designed to provide a short, objective test of hand function for activities of daily living. It has 7 items and takes approximately 15-45

minutes to administer. The 7 items included in the assessment were: Writing, Turning over 3-by-5-inch card, Picking up small common objects,
Simulated feeding, Stacking checkers, Picking up large light objects, Picking up large heavy objects
The test was performed with non-dominant hand first and then dominant hand. The results are measured by the time taken to accomplish each task. The tests are always presented in the same order.

PROCEDURE

Subjects who fulfilled the inclusion criteria signed the consent form given. A convenience sampling method was used to allocate the subjects randomly into two groups who were classified according to MACS.
A brief demonstration about the study and treatment protocol was given prior to the study and the experimental procedures were clearly explained to the subjects.

- Group I: Constraint Induced Movement Therapy
- Group II: Bimanual Training

In Group I, CIMT, the child participated 5 days a week in therapeutic sessions. Each session lasted for about 2 hours a day in a structured fashion while using a constraint. The constraint was used for about 6 hours a day apart from treatment session during daily activities.

Restraints Used:

- Sling
- Plaster cast
- Splint
- Glove
- Mitt
- Sling combined with resting hand splint.

In Group II, Bimanual Training the child used the affected limb along with less affected limb through the sound limb. Each session was given for 2 hrs for 5 days a week.
The whole treatment session was 4 weeks for both Groups I and II, the subjects were assessed before the treatment protocol initiation, after 15 days of protocol and finally at the end of the treatment protocol.

INTERVENTION

CIMT ACTIVITIES[7]: CIMT activities involved restraint of non-involved extremity using a sling and engaging the child in unimanual activities with the involved extremity 2 hours a day for 5 days in a week. The treatment session was for 4 weeks. The sling was strapped to the child's trunk and the end sewn shut to prevent using the uninvolved has as an assist. The sling was worn continuously throughout the treatment period.
Specific activities were selected by considering: Joint movements with pronounced deficits, joint movements which have greatest potential for improvement, child preference for activities that have similar potential for improving identified movements.
Task were made progressively more difficult as the child improves in performance by requiring greater speed or accuracy, increasing movement repetitions, or performance sensitive adaptations. The session should always begin with quick task that results in successful completion and builds confidence in child.
Most of the tasks should be used for repetitive practice. In shaping, approaching a behavioural objective in small steps by successive approximation. The task was made more challenging, taking into consideration of his/her abilities[9].

BOARD GAMES:

ACTIVITY	TARGETED MOVEMENTS	GRADED CONSTRAINTS
Connect Four	Supination, wrist extension, precision grasp, maintaining grasp through changes in spatial orientation.	Active Wrist extension: position deck of cards to elicit wrist extension and grade difficulty by changing position of deck.
Jenga		

CARD GAMES:

ACTIVITY	TARGETED MOVEMENTS	GRADED CONSTRAINTS
Zingo UNO	Supination, precision grasp	Precision grasp: less difficult When cards are bevelled on deck for easier grasp. Increase difficulty by not bevelling cards.

ARTS AND CRAFTS:

ACTIVITY	TARGETED MOVEMENTS	GRADED CONSTRAINTS
Drawing Painting Clay moulding	Supination, precision grasp, maintaining grasp through changes in spatial orientation	Maintaining grasp: begin child at an easier level with a built-up brush, and increase difficulty by removing assist.

FUNCTIONAL TASKS:

ACTIVITY	TARGETED MOVEMENTS	GRADED CONSTRAINTS
Eating Cleaning table Dressing	Wrist extension, supination, and pronation.	Supination and pronation: for turning key in lock, vary starting position of key to grade from using only supination to using both supination and pronation.

GROSS MOTOR ACTIVITIES:

ACTIVITY	TARGETED MOVEMENTS	GRADED CONSTRAINTS
Bowling	Shoulder flexion, abduction, ext. rotation, wrist extension	Elicit shoulder flexion by moving child from easier position stabilised against a wall, to free-standing position require more control.

BIMANUAL TRAINING ACTIVITIES[12]:

Subjects were instructed to do the bimanual activities in treatment session. The activities were given accordingly during the 4 consecutive weeks of intervention. Each activity was made to increase in difficulty, considering in this shaping the constant use of both hands. The level of difficulty was individualised for each child but was always challenging the use of upper and lower extremities.

FINGER ISOLATION:

- Typing on a keyboard
- Stabilising the phone
- Stabilising the punch pad to play a video game
- Poking holes into the clay using each finger of both hands
- Pressing individual keys on the piano.

PINCH:

- Use both hands to orient the pipe cleaners to pre-set the shapes.
- Button and unbutton different sized buttons on a strip
- Stabilise the zip lock bag open and close
- Button and unbutton different sized buttons on a strip

COMPLEX PINCH:

- Stabilise the cards with one hand, thread the shoelaces into the holes by lacing up the cards.
- Stabilise the bag with one hand and twist the tie around the bag with the other hand.
- Stabilise the bolt with one hand and twist the nut on and off with the other hand.
- Stabilise the lock with one hand, use the key with other hand to open the lock.

GRASP:

- Plug 2 extension cords together and separate them using the both hands.
- Using both hands, separate nesting boxes and place inside each other.
- Squeeze the glue out of a large using both hands to create preset designs on paper.
- Build legos by attach together and separate them using both hands.
- Shape clay into predetermined shapes.

COMPLEX GRASP:

- Squeeze the handle of can opener with one hand while rotating the lever with the other hand.

- Stabilising the container with one hand, scoop sugar out of the container into another one.
- Stabilising container with one hand, unscrew the lid of the container with the other hand.
- Use 2 soda cans at one time, rotate both cans upside down simultaneously.

STATISTICAL ANALYSIS

- Statistical analysis was performed by using SPSS software version 20.0 and MS- excel -2007.
- Descriptive data was represented as mean +/- standard deviations and percentages.
- Data was tabulated and graphically represented.
- ANOVA test was used to compare the means of two groups analysing within the groups and between the groups.
- $P \leq 0.05$ was considered as statistically significant.

The aim of the study was to find the effectiveness of Constraint Induced Movement Therapy and Bimanual Training in children with Unilateral Cerebral Palsy. The consort flow chart of the study showed the organization in terms of subjects screening, random allocation and analysis following the intervention.

A total of 72 subjects were screened for eligibility, among them 64 subjects were found to meet the inclusion criteria. All the subjects underwent baseline assessment and included subjects were randomized into two groups consisting of 32 children in each group.

In this study the treatment sessions were given for 4 weeks, 64 participants completed the treatment session; with 32 subjects completed training in Group-I and 32 subjects completed training in Group-II.

Both the groups showed statistically significant scores in the Jebsen Taylor Hand Function Test, where p-value was set at $p<0.05$ was significant.

RESULT

Group I CIMT		**Mean**	**Std. Deviation**	**P Value**	**Inferences**
Non-Dominant Hand	Pre-Test	108.375	6.9270	0.0001	Highly Significant
	Intermediate Test	95.188	5.2452		
	Post-Test	82.969	5.9269		
Dominant Hand	Pre-Test	66.250	6.4807	0.0001	Highly Significant
	Intermediate Test	57.531	6.4307		
	Post-Test	48.219	8.6946		
Group II BMT		**Mean**	**Std. Deviation**	**P Value**	**Inferences**
Non-Dominant Hand	Pre-Test	109.250	6.6138	0.0001	Highly Significant
	Intermediate Test	98.719	6.2488		
	Post-Test	88.188	4.5892		
Dominant Hand	Pre-test	66.938	5.0796	0.0001	Highly Significant
	Intermediate Test	60.250	5.2363		
	Post-Test	54.313	4.9931		

Analysis of mean scores of JTHFT in non-dominant and dominant hands in within the groups

JTHFT			**Mean**	**Std. Deviation**	**P- Value**	**Inferences**
Pre-Test	Group I	Non-Dominant Hand	108.375	6.9270	0.0001	Highly Significant
		Dominant Hand	66.250	6.4807		
	Group II	Non-Dominant Hand	109.250	6.6138		
		Dominant Hand	66.938	5.0796		

Analysis of mean scores of pre-test, intermediate test, post-test values of JTHFT in non-dominant and dominant hands in between the groups

Intermediate Test	Group I	Non-Dominant Hand	95.188	5.2452	0.0001	Highly Significant
		Dominant Hand	57.531	6.4307		
	Group II	Non-Dominant Hand	98.719	6.2488		
		Dominant Hand	60.250	5.2363		
Post-Test	Group I	Non-Dominant Hand	82.969	5.9269	0.0001	Highly Significant
		Dominant Hand	48.219	8.6946		
	Group II	Non-Dominant Hand	88.188	4.5892		
		Dominant Hand	54.313	4.9931		

DISCUSSION

Many recent studies have been demonstrated that in children with Cerebral Palsy Constraint Induced Movement Therapy and Bimanual Training have shown equal effects individually in improving the hand function but the studies showing comparison between these two interventions in a particular group were not explained clearly and was explained that either of the treatment protocol is effective to improve the hand function. So, this study was conducted to discuss about the effectiveness of Constraint Induced Movement Therapy and Bimanual Training in children with Unilateral Cerebral Palsy to improve the hand function. In this study, 64 subjects were included with Unilateral Cerebral Palsy who were divided into two groups 32 in each group. Significant differences in JTHFT individually after Pre-Test, Intermediate Test (15 days) and Post-Test were observed in Group I (CIMT) and Group II (BMT). The mean differences between non-dominant hand and dominant hand in Group I (CIMT) individually and Group II (BMT) individually showed large differences. The mean values of Pre-Test, Intermediate Test and Post-Test between Group I (CIMT) and Group II (BMT) showed significant differences. In this study, BMT displayed relatively less improvement in hand function as compared to CIMT. In BMT there is use of unaffected hand to support affected hand with limits the activity of affected hand as it relatively shares the task completion, which may help in doing an activity but usage of dominant hand over non-dominant hand occurs. Bimanual Training maybe indicated to facilitate bimanual hand use. But CIMT maybe more appropriate to facilitate the use and strength of affected hand[13].

Upper limb abnormalities in children with Unilateral Cerebral Palsy can range from stiffness to sensory deficiencies, synkinetic movements, a lack of selective motor control, and issues with motor planning[10]. The CIMT group received therapy that reinforced the use of the affected upper extremity while also wearing a glove on the non-affected upper extremity for 90% of the waking hours. Three hours per day were spent utilising the technique of consecutive approximations to shape the affected upper extremity's behaviour as it was trained to do a variety of everyday living activities[6].

In the past, children with Unilateral CP have undergone upper limb dysfunction rehabilitation utilising a neurodevelop-mental approach that aims to reduce underlying impairments and encourage more normal behaviours. It is anticipated that this would result in more independence and better daily activity performance. Based on motor learning theory, neuroscientific research, and a better understanding of the mechanisms of usage dependent neuroplasticity, Schertz & Gordon et al, developed contemporary rehabilitation methods such as CIMT, intense Bimanual Training, and task-oriented therapy. Recent systematic reviews of all non-surgical upper-limb treatments for kids with Unilateral CP found moderate to strong evidence that modern motor learning-based methods outperformed standard occupational therapy treatment in terms of improving upper-limb outcomes[11]. There was insufficient evidence to support traditional neurodevelopmental treatment (NDT). Important components of modern approaches include therapy that uses: (1) intense structured task repetition; (2) progressive incremental challenges of increasing difficulty; and (3) a goal-directed framework that increases motivation and engagement in therapies. Pediatric therapists were polled in 2005 and 2008, and the results showed that NDT was often employed in everyday clinical practise. Multiple upper limb treatments have demonstrated the value of goal-directed training, which involves collaborative goal-setting between the therapists and the child or caregiver; Sakzewski et al., and is consistent with the ideals of family-centered practise. King et al. Common challenges included therapists' self-confidence in their ability to offer this intervention and

knowledge and skill gaps, particularly with regard to the use of modified CIMT. Therapists were aware of more recent motor learning-based techniques like CIMT, but the majority had either utilised it infrequently or unsuccessfully. Children with Unilateral CP were treated mostly with goal-directed bimanual occupational therapy[11].

Another developing technique for the management of Unilateral Cerebral Palsy for upper extremity training is Bimanual Training. Task performance involves using the afflicted limb in symmetrical or alternate movement patterns, simulating the majority of our daily tasks. This method benefits from limb inter-coordination and encourages movement in the less-affected limb through the sound limb. When managing a heavy task that requires the engagement of both limbs to complete, the bimanual technique is extremely important. Due to the need for two hands to coordinate their movements, bimanual jobs are particularly detrimental to hand function. Children with Unilateral CP had aberrant shoulder abduction and rotation, less elbow extension, less supination, and more wrist flexion on their affected side, according to previous studies[10].

Bimanual function appears to be more affected by distal joint mobility than proximal joint mobility (shoulder and trunk). In fact, the child's ability to strategically place his or her forearm to stabilise an object in the handicapped hand so that the non-impaired hand can utilise it is likely related to how well the aiding hand performs. These results provide credence to the idea that the corticospinal tracts have a disproportionate influence over distal function. Deviations in the trunk and shoulder appear to be compensatory mechanisms meant to aid in the proper alignment of the hemiplegic hand and forearm. The upper limb's capabilities are not limited to a single task but rather include a wide range of options, including gripping, manipulating, and reaching[10].

The two arms are engaged in a concerted spatial and temporal interrelationship that characterises bimanual coordination; Howard, Ingram, et al; This coordination between two upper extremities makes actions skillful because each arm contributes to an action component while interacting with the other in a fine spatial and temporal manner to ensure that the action is accurate and efficient; Coordinating two limbs each having multiple degrees of freedom, to accomplish an array of functional tasks under varied environment conditions poses a clear challenge for the human sensorimotor system[14].

Level II evidence from nine randomised controlled trials comparing the efficacy of Constraint Induced Movement Therapy to Bimanual Intense Training in children with Unilateral Cerebral Palsy makes up the majority of the body of evidence in the systematic review by MH Tervahauta et al. The results of the a forementioned systematic review revealed that they do not support their training-specificity hypothesis, which predicted that Constraint-Induced Movement Therapy would be more effective at enhancing unimanual function and bimanual intensive training would be more effective at enhancing bimanual function. The MACS level affects the degree of skill gain. Compared to children at MACS level III, children at MACS levels I and II grow more quickly and attain 90% of their developmental limit early[7].

Bimanual Training and Constraint-Induced Movement Therapy both aim to increase the affected hand's spontaneous use, reduce developmental disregard, and ultimately increase participation. Therefore, it may be more appropriate to assess the effectiveness of the interventions with regard to this outcome of interest using both performance-based instruments that evaluate actual use of the affected hand in meaningful daily activities and capacity-based instruments that evaluate what the child is capable of doing in a standardised environment[7].

CONCLUSION

The present study concluded that four weeks of treatment session of Constraint Induced Movement Therapy and Bimanual Training were shown to be statistically significant in improving hand function in children with Unilateral Cerebral Palsy. Both the groups responded well with the treatment sessions. However, more improvement was seen in the Group-I which received Constraint Induced Movement Therapy.

From the finding of this study, it can be recommended that the Constraint Induced Movement Therapy may be opted for improving hand function in children with Unilateral Cerebral Palsy as an adjuvant treatment technique for Unilateral Cerebral Palsy children.

LIMITATIONS

- This study has small sample size.
- This study included only hand function but maybe other components can also be studied to improve the recovery of upper limb.
- Bilateral Cerebral Palsy should also be studied.

RECOMMENDATIONS

- Longer treatment duration maybe recommended for better results.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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