Galore International Journal of Applied Sciences and Humanities
Vol. 8; Issue: 4; October-December 2024
Website: www.gijash.com
Research Paper *P-ISSN: 2456-8430*

Effectiveness of Hand Arm Bimanual Intensive Therapy (HABIT) on Postural Control and Functional Independence in Children with Spastic Hemiplegic Cerebral Palsy Between Age Group 4 To 21 Years

Dr Chaitrali Chaudhari (PT)[1], Dr Abhijit Satralkar (PT)[2]

[1]Bachelor of Physiotherapy, [2]Department of Neuro Physiotherapy,
P.E.S. Modern College of Physiotherapy College, MUHS, Pune, India.

Corresponding Author: Chaitrali Shital Chaudhari

DOI: https://doi.org/10.52403/gijash.20240401

ABSTRACT

Title: Effectiveness of hand arm bimanual intensive therapy on postural control and functional independence in children with spastic hemiplegic cerebral palsy between age group 4 to 21 years at the end of 4 weeks.
Aim and objectives: To check the effectiveness of HABIT on postural control using BOT-2 scale (bilateral coordination, balance) and functional independence using WEEFIM scale in children with spastic hemiplegic cerebral palsy.
Method: Subjects were screened according to inclusion and exclusion criteria. Participants were classified into 2 groups. Group A was given conventional therapy along with HABIT and group B was given only conventional therapy. Pre and post data was taken using bot-2 scale (bilateral coordination, balance) and WeeFIM scale. Data was collected and statistically analysed.
Result: The pre and post value within group analysis using paired t test revealed a statistically significant (<0.05) difference among both the groups between pre and post test scores. The mean value of post treatment in WeeFIM scale and in bot-2(bilateral coordination, balance) scale in Group A is more than Group B indicating more improvement in functional independence, coordination and balance in Group A than Group B.
Conclusion: The study concludes that hand arm bimanual intensive therapy (HABIT) along with conventional therapy is more effective to obtain functional independence and postural control in children with spastic hemiplegic cerebral palsy.

Keywords: Spastic Hemiplegic cerebral palsy, HABIT, BOT-2 scale, WeeFIM scale, Functional Independence, Postural Control

INTRODUCTION

Cerebral palsy is a condition caused by problems with brain development or damage that occurs before, during, or shortly after birth. This can happen due to things like infections during pregnancy, being born too early or too small, lack of oxygen during birth, or other injuries. Essentially, it affects movement and coordination because the brain is not working properly. The prevalence rate is about 2.0 to 3.5 per 1000 births.[1]

The clinical symptoms include dyskinesia with or without sensory and mental deficits. The brain pathological changes in cerebral palsy are mainly white matter damage, abnormal brain development,

intracerebral hemorrhage, and brain damage caused by brain hypoxia.[1]

With proper treatment, the function and quality of life of children with cerebral palsy can be considerably improved (1)

Cerebral palsy is the commonly used name for a group of conditions characterized by motor dysfunction due to non-progressive brain damage early in life[2]

Cerebral palsy is most commonly cause of childhood disabilities.[2]

TYPES OF CEREBRAL PALSY

Cerebral palsy typically demonstrates the tone abnormality and distribution of motor abnormalities.

The subtypes of cerebral palsy are:

Spastic diplegic*:* The patient has spasticity and motor difficulties affecting the legs more than the arms. [2]

Spastic hemiplegic*:* The patient has spasticity and motor difficulties affecting one side of the body; the arms are often involved more than the legs.[2]

Spastic quadriplegic*:* The patient has spasticity and motor difficulties affecting all four extremities; often, there is often greater involvement of the upper extremities than the legs [2]

Dyskinetic/hyperkinetic (choreoathetoid): The patient has excessive, involuntary movements characterized as a combination of rapid, dance-like contractions of muscles and slow writhing movements [2]

SPASTIC HEMIPLEGIC CEREBRAL PALSY

Spasticity occurs in approximately 75% of all the children with CP. It is the most common neurological abnormality seen in children with diplegic hemiplegic and quadriplegic CP. [3]

Spasticity is a complex motor abnormality often difficult to describe but a common definition is hypertonia in which resistance to passive movement increases with increasing velocity of movement [3]

HAND ARM BIMANUAL IMNTENSIVE THERAPY(HABIT)

'Hand–arm bimanual intensive therapy' (HABIT), is a form of functional training that takes advantage of the key ingredient of CIMT (constraint induced movement therapy), but focuses on improving coordination by involving both hands during playful activities and practical tasks.

It uses principles of motor learning (practice specificity, types of practice, feedback) and principles of neuroplasticity (practice-induced brain changes arising from repetition, increasing movement complexity, motivation, and reward) [4]

Children participated in playful and practical activities designed to encourage coordinated use of both hands in a structured way [4]

HABIT methodology focuses on: (1) provision of structured practice increasing in complexity; (2) provision of functional activities that necessitate bimanual hand use; and (3) remaining a child-friendly intervention protocol that takes into account children's goals and parental involvement. [5]

Children with bilateral CP participating in HABIT exhibited greater improvements in the performance and satisfaction with performance of functional goals, functional skills, and caregiver assistance in self-care than children who maintained their customary care routines.

HABIT led to improvements in daily functioning out comes of children with bilateral CP and it focuses on bimanual hand use. [6]

HABIT did not use a physical restraint, but instead, participants were engaged in age-appropriate fine- and gross-motor bimanual activities using motor learning approaches. Activities were selected by considering the role of the paretic hand, increasing in complexity from a non-dominant passive assist (e.g., stabilizing paper while drawing) to active manipulator (e.g., reorienting paper while cutting) Using progressively more complex bimanual coordination based on participants' interests. [7]

HABIT is an intensive training program that promotes cooperation between both hands. Its goal is to enhance functional independence in daily activities. Similar to HABIT, this motor learning-based approach is a key element in various effective protocols that have been shown to improve motor skills in children with cerebral palsy.[8]
Two separate areas of research indicate that the ability to control posture in anticipation of movement, along with the effects of stable posture on reaching, shows that posture starts to work together with purposeful actions in infants quite early on.
An underdeveloped postural system can delay the achievement of various motor skills. [9] Specifically, tasks such as reaching and grasping are impossible to perform without the proper level of postural control [9]
Anticipatory postural responses, where the postural muscles activate prior to the prime mover muscles, are scaled to the movement, and allow stability to be maintained while the task is performed.[9]
Spontaneous arm movements observed in neonates become much more accurate when postural support is provided. [9]
Also, children love fun activities so there is need to study the fun learning technique to achieve the desired goal.
Hence the purpose of this study is to examine the effectiveness of hand arm bimanual intensive therapy on postural control and functional independence among children with cerebral palsy.

MATERIALS & METHODS

Pre post experimental study was done on 42 individuals with spastic hemiplegia and data was collected based on their inclusion and exclusion criteria. Ethical clearance was taken from the ethical committee of the college. The nature of the study was explained and return consent was taken from the parents prior to the study.

1. INCLUSION CRITERIA:

2. Spastic hemiplegics.
3. Both male and female.
4. Age group-4 to 21 years.
5. Children who are able to follow commands.
6. Manual ability classification system (level I to level III)
7. Gross motor function classification system (level I to level III)

EXCLUSION CRITERIA:

1. Parents and children not willing to participate.
2. Auditory, visual and cognitive impairments.
3. Recent fractures.
4. Sensory loss.
5. Musculoskeletal deformity.

PROCEDURE

Functional independence measure for children (WeeFIM) scale was used to measures child's consistent performance in daily functional skills There are 3 main domain of this scale (selfcare, cognition, mobility) It consist of 18 items each, item is evaluated on 7point.
Bruininks-Oseretsky Test of Motor Proficiency Second Edition (BOT-2) scale for Bilateral coordination and Balance was done and total score were calculated.BOT-2(Bilateral coordination) scale measure child's coordination in both the hands and legs. There are 7 subsets with maximum point score 24. BOT-2 (Balance)measures the child's balance. There are 9 subsets with maximum point score 37.

STATISTICAL ANALYSIS

Data was analyzed using Excel and GraphPad for windows.
Statistical measure such as mean, standard deviation (SD), and test of significance were utilized to analyze the data
Paired t test was used to compare the difference between pre and post treatment values of WeeFIM, bot-2 (balance), bot-2 (bilateral coordination). Post treatment comparison between groups A and B was done using Unpaired t test and p-value was kept as <0.05

Table no. 1: DEMOGRAPHIC CHARACTERISTICS OF SUBJECTS

PARAMETERS	INTERVENTION GROUP(n=21)	CONTROL GROUP (n=21)
AGE	10.380 ± 3.106	11.238 ± 4.288
GENDER	M=13 F=8	M=14 F=7
HAND AFFECTED	RIGHT=13 LEFT=8	RIGHT=11 LRFT=10

Table no. 2: PRE AND POST COMPARISON OF WEEFIM SCALE OF GROUP A AND

	GROUP A	GROUP B
PRE TREATMENT	48.80952 ± 10.74997	45 ± 8.325104
POST TREATMENT	56.66667 ± 9.640194	45.90476 ± 8.478825
t value	t=10.09,	t= 2.423
P value	<0.05	<0.05
RESULTS	Highly significant	Highly significant

Table no.3: PRE AND POST COMPARISON OF BOT-2 SCALE (BILATERAL COORDINATION)

	GROUP A	GROUP B
PRE TREATMENT	10.90476 ± 3.645611	12.7619 ± 3.2389
POST TREATMENT	14.52381 ± 4.178744	13.33333 ± 3.18329
t value	t=8.684	t=4.564
p value	<0.05	<0.05
RESULTS	Highly significant	

Table no.4: PRE AND POST COMPARISON OF BOT-2 SCALE(BALANCE)

	GROUP A	GROUP B
PRE TREATMENT	11.61905 ± 5.435772	12 ± 3.577709
POST TREATMENT	16.42857 ± 6.492853	12.28571±3.164
t value	t=8.604	t=2.034
p value	<0.05	<0.05
RESULTS	Highly significant	Not significant

DIFFERENCE IN PRE AND POST RESULTS OF GROUP A AND GROUP B.

Table no. 5: WEEFIM SCALE

	DIFFERENCE
GROUP A	7.52381 ± 3.435113
GROUP B	0.71429 ±0.56061
P VALUE	<0.05
T VALUE	t=8.943
RESULT	Highly significant

Table no.6: BOT-2(BILATERAL COORDINATION)

	DIFFERENCE
GROUP A	3.66667 ± 1.92217
GROUP B	0.714286 ± 0.717137 ±
P VALUE	<0.05
T VALUE	t=6.725
RESULT	Highly significant

Table no.7 BOT-2(BALANCE)

	DIFFERENCE
GROUP A	4.809524 ± 2.188487
GROUP B	0.38095 ± 0.58959±
P VALUE	<0.05
T VALUE	t=7.721
RESULT	Highly significant

RESULT

42 Subjects were divided into two groups. Group A was given HABIT along with conventional therapy and Group B received only conventional therapy.

The pre and post data within group analysis using paired t test revealed a statistically significant (<0.05) difference among both the groups test scores.

The mean value of post treatment in WeeFIM scale in Group A is more than Group B indicating more improvement in functional independence in Group A than Group B

The mean value of post treatment in bot-2(bilateral coordination) and bot-2(balance) scale in Group A is more than Group B indicating more improvement in coordination and balance (postural control) in Group A than Group B

DISCUSSION

The objective of the study was to study the effect of functional independence and postural control in children with spastic hemiplegic cerebral palsy using Hand Arm Bimanual Intensive Therapy.

The development of many motor milestones such as reaching and locomotion depends to a large degree on the coordination between posture and goal-directed behaviors. Two separate research areas - one on how we anticipate posture and another on how stable posture affects reaching, suggest that posture starts to play a role in purposeful movements early in infancy.

Habit works on principle of motor learning and neuroplasticity.

Neuroplasticity is brain's ability to reorganize itself by forming new neural connections throughout life. It allows the brain to adapt to changes, learn new information, and recover from injuries.

Bimanual exercise has shown to have direct effect on promoting cortical neural plasticity. Founded on behavioral and neuroplasticity mechanism bilateral movement training has shown great progress in manual control.

Hand arm bimanual intensive therapy (HABIT) can have significant effects on the brain, particularly in promoting neuroplasticity. By engaging in intensive, coordinated movements with both hands, this therapy stimulates various regions of the brain involved in motor control, sensory processing, and coordination

1. Motor Cortex Changes: HABIT can lead to changes in the motor cortex, the area of the brain responsible for voluntary movement. This therapy promotes the activation of neurons in the motor cortex, potentially leading to the formation of new neural connections and improved motor function.
2. Sensorimotor Integration: HABIT involves the integration of sensory information with motor output. This process can enhance the connectivity between sensory areas and motor areas of the brain, improving coordination and motor planning.
3. Cortical Reorganization: which means, preserved brain tissue taking on a new functional role. Intensive therapy can trigger cortical reorganization, where the brain reallocates resources to support the areas involved in the therapy.
4. Functional Improvement: As a result of these neural changes, individuals undergoing HABIT may experience improvements in motor function, strength, coordination, and overall movement ability.

All the 42 subjects included in the study were assessed and divided into two groups A(intervention) and group B(control) and were given the treatment. The individuals showed statistically significant improve in functional independence and postural control in 4 weeks of HABIT.

According to the study results, the statistical reading of the data shows that there was improved functional independence and postural control and effect is seen in group A than B.

CONCLUSION

The study concludes that hand arm bimanual intensive therapy (HABIT) along with conventional therapy is more effective to obtain functional independence and postural control in children with spastic hemiplegic cerebral palsy.

LIMITATION

- No proper treatment protocol for HABIT is available.
- Limited number of samples.

- Less duration of training period.

FUTURE SCOPE OF THE STUDY

- The study can be done with quadriplegic population as well.
- HABIT -ILE (including lower extremities) can be done.
- The study can be done on larger population.
- The study can be done for longer duration.
- All 8 components of BOT-2 scale can be used.

Declaration by Authors

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

REFERENCE

1. Lin Y, Wang G, Wang B. Rehabilitation treatment of spastic cerebral palsy with radial extracorporeal shock wave therapy and rehabilitation therapy. Medicine (Baltimore). 2018 Dec;97(51): e13828.doi: 10.1097/MD.0000000000013828. PMID: 30572548; PMCID: PMC6320024.
2. Graham HK, Rosenbaum P, Paneth N, Dan B, Lin JP, Damiano DL, Becher JG, Gaebler-Spira D, Colver A, Reddihough DS, Crompton KE, Lieber RL. Cerebral palsy. Nat Rev Dis Primers. 2016 Jan 7; 2:15082. doi: 10.1038/nrdp.2015.82. PMID: 27188686; PMCID: PMC9619297.
3. Pediatric physical therapy – JAN S. TECKLIN (FIFTH EDITION)
4. Gordon AM, Schneider JA, Chinnan A, Charles JR. Efficacy of a hand-arm bimanual intensive therapy (HABIT) in children with hemiplegic cerebral palsy: a randomized control trial. Dev Med Child Neurol. 2007 Nov;49(11):830-8. doi: 10.1111/j.1469-8749.2007.00830. x. PMID: 17979861.
5. Charles J, Gordon AM. Development of hand-arm bimanual intensive training (HABIT) for improving bimanual coordination in children with hemiplegic cerebral palsy. Dev Med Child Neurol. 2006 Nov;48(11):931-6. doi: 10.1017/S0012162206002039. PMID: 17044964.
6. Figueiredo PRP, Mancini MC, Feitosa AM, Teixeira CMMF, Guerzoni VPD, Elvrum AG, Ferre CL, Gordon AM, BrandÃo MB. Hand-arm bimanual intensive therapy and daily functioning of children with bilateral cerebral palsy: a randomized controlled trial. Dev Med Child Neurol. 2020 Nov;62(11):1274-1282. doi: 10.1111/dmcn.14630. Epub 2020 Jul 19. PMID: 32686119.
7. Gordon AM, Hung YC, Brandao M, Ferre CL, Kuo HC, Friel K, Petra E, Chinnan A, Charles JR. Bimanual training and constraint-induced movement therapy in children with hemiplegic cerebral palsy: a randomized trial. Neurorehabil Neural Repair. 2011 Oct;25(8):692-702. doi: 10.1177/1545968311402508. Epub 2011 Jun 23. PMID: 21700924.
8. Bleyenheuft Y, Arnould C, Brandao MB, Bleyenheuft C, Gordon AM. Hand and Arm Bimanual Intensive Therapy Including Lower Extremity (HABIT-ILE) in Children With Unilateral Spastic Cerebral Palsy: A Randomized Trial. Neurorehabil Neural Repair. 2015 Aug;29(7):645-57. doi: 10.1177/1545968314562109. Epub 2014 Dec 19. PMID: 25527487.
9. Figueiredo PRP, Mancini MC, Feitosa AM, Teixeira CMMF, Guerzoni VPD, Elvrum AG, Ferre CL, Gordon AM, BrandÃo MB. Hand-arm bimanual intensive therapy and daily functioning of children with bilateral cerebral palsy: a randomized controlled trial. Dev Med Child Neurol. 2020 Nov;62(11):1274-1282. doi: 10.1111/dmcn.14630. Epub 2020 Jul 19. PMID: 32686119.
10. Bolzoni F, Bruttini C, Esposti R, Cavallari P. Hand immobilization affects arm and shoulder postural control. Exp Brain Res. 2012 Jul;220(1):63-70. doi: 10.1007/s00221-012-3115-7. Epub 2012 May 23. PMID: 22618470.
11. Hoare BJ, Wallen MA, Thorley MN, Jackman ML, Carey LM, Imms C. Constraint-induced movement therapy in children with unilateral cerebral palsy. Cochrane Database Syst Rev. 2019 Apr 1;4(4):CD004149. doi: 10.1002/14651858.CD004149.pub3. PMID: 30932166; PMCID: PMC6442500.

12. Haddad JM, Claxton LJ, Keen R, Berthier NE, Riccio GE, Hamill J, Van Emmerik RE. Development of the coordination between posture and manual control. J Exp Child Psychol. 2012 Feb;111(2):286-98. doi: 10.1016/j.jecp.2011.08.002. Epub 2011 Oct 2. PMID: 21967675; PMCID: PMC3225736.
13. Green D, Schertz M, Gordon AM, Moore A, Schejter Margalit T, Farquharson Y, Ben Bashat D, Weinstein M, Lin JP, Fattal-Valevski A. A multi-site study of functional outcomes following a themed approach to hand-arm bimanual intensive therapy for children with hemiplegia. Dev Med Child Neurol. 2013 Jun;55(6):527-33. doi: 10.1111/dmcn.12113. Epub 2013 Mar 5. Erratum in: Dev Med Child Neurol. 2016 Mar;58(3):316. doi: 10.1111/dmcn.12344. PMID: 23458353.

How to cite this article: Chaitrali Chaudhari, Abhijit Satralkar. Effectiveness of hand arm bimanual intensive therapy (HABIT) on postural control and functional independence in children with spastic hemiplegic cerebral palsy between age group 4 to 21 years. *Galore International Journal of Applied Sciences & Humanities*. 2024; 8(4): 1-7. *DOI: 10.52403/gijash.20240401*

******