ORIGINAL ARTICLE

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TO STUDY THE EFFECT OF PLAY THERAPY AND CHILD FRIENDLY CONSTRAINT INDUCED MOMEMENT THERAPY TO IMPROVE HAND FUNCTION IN SPASTIC HEMIPLEGIC CEREBRAL PALSY CHILDREN: A COMPARATIVE STUDY

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ABSTRACT

Background: Cerebral Palsy (CP) is a neurodevelopmental disorder caused by nonprogressive lesion in the developing brain. The early central nervous system (CNS) damage results in chronic physical disabilities and often includes sensory impairments. In addition CP is often associated with epilepsy and abnormalities of speech, vision, and intellect; it is the selective vulnerability of the brains motor systems that defines the disorder. Child friendly CIMT involves intensive targeted practice with the involved extremity coordination above and beyond their unilateral impairments. Ply Therapy is designed for active involvement of child in performing various tasks. The aim of the study is to evaluate the effectiveness of constraint induced movement therapy and play therapy to improve hand function in spastic hemiplegic cerebral palsy children.

Methods: A sample of 30 patients was divided in two groups, each group having 15 children. Convenient sampling was done on the basis of base line assessment and diagnosis of their condition. Duration of the study was 3 months and data collection started at day 0 and at the end of 90 days. Children in group A wore a bivalve plaster cast on the non-involved upper extremity from shoulder to finger tips for the entire time during the session lasting for 2 hours and the plaster cast was removed at the end of the session. B group consists of 15 subjects who received play therapy. The treatment program was conducted individually and adjusted to current needs and abilities of each of the patients. Outcomes: Box and Block test, QOM scale and AOU scale.

Results: It was found that there is an improvement in the hand function on application of child friendly CIMT in the patients with spastic hemiplegic cerebral palsy which was found significant using the Mann-Whitney U test ($p \leq 0.005$).

Conclusion: In this study it has been found that the use of Child friendly CIMT and PLAY THERAPY produces significant improvement in hand function for young children with spastic hemiplegic cerebral palsy. However the effectiveness of child friendly CIMT is more. Improvement was considerably more than play therapy. Therefore it is concluded that child friendly CIMT is a better treatment approach then play therapy.

Keywords: cerebral palsy, constraint induced movement therapy, play therapy.

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INTRODUCTION

Cerebral Palsy (CP) is a neurodevelopmental disorder caused by nonprogressive lesion in the developing brain. The early central nervous system (CNS) damage results in chronic physical disabilities and often includes sensory impairments. In addition CP is often associated with epilepsy and abnormalities of speech, vision, and intellect, it is the selective vulnerability of the brains motor systems that defines the disorder.[1,2,3]

CP is increased among low birth weight infants, particularly those weighing less than 1000g at birth, primarily because of intracerebral hemorrhage and periventricular leukomalacia (PVL).[4] These disorders are characterized by poor control of movement, adaptive length changes in muscles, in some cases, skeletal deformity. Disorders of movements are typically differentiated and classified clinically in terms of part of the body involved (e.g. hemiplegia, diaplegia, quadriplegia) and by clinical perceptions of tone and involuntary movement (e.g. spastic, atexic, athetoid).[5]

The prevalence of congenital CP is approximately 2 per 1000 births, with hemiplegia accounting for approximately 25% of all cases worldwide. The collaborative perinatal project in which approximately 45000 children were regularly monitored from pregnancy to the age of 7 years, found that most children with CP had been born at term with uncomplicated labours and deliveries. A substantial number of children with CP had congenital anomalies external to the CNS. Intrauterine exposure to maternal infections (e.g. inflammation of placental membranes, umbilical cord inflammations, foul smelling amniotic fluid, maternal sepsis, temperature greater than 38°C during labour, and urinary tract infection) is associated with a significant increase in the risk of CP in normal birth weight infants.[6]

Hemiplegia characterized by a clinical pattern of unilateral motor impairment is a common type of cerebral palsy. Reduced upper limb function may result from sensory abnormalities, weak grasp, loss of fine-sequenced movements of the fingers, loss of speed of movement, loss of fine motor skills, associated and mirror movements, retention of grasp reflex and spasticity.[7]

Children with hemiplegic cerebral palsy grow and develop; they learn strategies and techniques to manage daily tasks (for example play) with one hand. Performance of tasks is discovered to be more efficient and effective using the non-affected hand, even if there is only mild impairment in the affected limb.[8]

There are several areas in the brain where an injury can lead to hemiplegia. These include motor cortex of the frontal lobe, Centrum semiovale, internal capsule, cerebral peduncle and the Pons.

Hemiplegia in children may occur due to many causes like stroke, infection, trauma, tumors and other congenital, neonatal and postnatal origin of the developing brain, the commonest cause being stroke. The blood vessel which is most commonly blocked or affected is the middle cerebral artery (MCA). The MCA transports blood and oxygen to the area of the brain which among other things controls the motor function.

Infants who appear normal in newborn period may show symptoms of hemiplegia only after voluntary hand use develops, at about 4 to 5 months of age. The usual concern that brings infants with hemiplegia from birth to neurological evolution is delayed crawling or walking. An associated but seldom recognized feature is that hand dominance is established during first year of life, which is not normal.[9]

The characteristics of a hemiplegic hand can be described as spastic with impaired tactile sensibility. It is held adducted, flexed and internally rotated at the shoulder, with the elbow flexed and wrist flexed and ulner deviated, the forearm pronated and thumb adducted. Sensory deficits of cortical type affecting two point discrimination, appreciation of textures, and shape and to some extent joint position sense are affected. Another important factor which may contribute to this developmental disorder in regard of the affected upper limb in a child with hemiplegic cerebral palsy is the presence of mirror movements. These occur when repetitive voluntary movements of one hand are accompanied by involuntary mirrored movements of the other hand.Considered to be normal early in motor development, mirror movements are observed to be more pronounced or are prolonged with childhood hemiplegia. The mirror activity was associated with poor bimanual coordination. This is because the two hands perform asymmetrical actions in most activities of daily living and in these situations mirror movements disturb co-ordinated performance. In children with hemiplegic cerebral palsy, mirror activity was stronger in the non-affected hand than in the affected hand.Apart from this, these children have difficulty with the timing and coordination of reaching movements, grasping, movement planning and a deficient capacity to modulate postural adjustments during reaching.[10]

The challenge to improve hand function in hemiplegic hand in cerebral palsy children has encouraged therapists to develop new forms of therapy. Amongst the various physiotherapy methods that are used to improve hand function in hemiplegic cerebral palsy are functional electrical stimulation, sensory integration, proprioceptive neuromuscular facilitation, roods techniques, neurodevelopmental therapy, constraint induced movement therapy, play therapy etc.

Traditional Physiotherapy treatment carries out to improve muscle strength, local muscular endurance and over all joint range of motion.[11] Recent evidence suggests that children with CP may improve motor performance if provided with sufficient opportunities to practice.[12, 13] One treatment approach that provides those opportunities and that is becoming increasingly popular is forced use or child friendly constraint-induced movement therapy (CIMT).

Forced use facilitates practice with the involved extremity by restraining the non-involved extremity; it can be used alone or along with conventional PT and OT.[14]

In contrast, child friendly CIMT involves intensive targeted practice with the involved extremity coordination above and beyond their unilateral impairments.[15,16]

Recent studies have defined a critical period in early life development when neuron circuits can be shaped by experience. Naylor and bower in (2005) said that a structural program of play therapy is used for treatment to ensure improvement of fine motor activities in hemiplegic children. For over 60 years play therapy has been a well established and popular mode of child treatment in clinical practice.play therapy is useful in developing hand eye coordination, fine motor skills and gross motor skill. Studies done by smith J et al (2000) and schaff R (1990) strogly support that play therapy enhances hand function in cerebral palsy children.[17]

Significantly very less work has been done to compare the effects of play therapy and child friendly CI therapy to improve hand function on hemiplegic cerebral palsy children. Based on these issues, there is a need for additional research to adequately support the use of these therapies.

METHODOLOGY

A sample of 30 patients was divided in two groups, each group having 15 children. Convenient sampling was done on the basis of base line assessment and diagnosis of their condition, as per pediatrician, orthopedician, neurologist and psychologist.age between 4-8 years were taken. Each subject was evaluated for the study that satisfied the inclusion criteria.the inclusion criteria was able to extend the wrist at least 20° and the fingers at least 10°from full flexion at the metacarpophalangeal joints, Spasticity with grade two on modified Ashworth scale, able to raise involved hand from surface of table more than 15 cm, either right or left involvement, who scored at least 70 based on Color Rivan Test of I.Q. Children with Mental retardation, Ataxic, athetoid and mixed C.P, Auditory and visual problem, Congenital deformities of upper limb, Seizures were excluded from study. Duration of the study was 3 months and data collection started at day 0 and at the end of 90 days.

Figure1: Staging rings

Figure 2: Playing dough

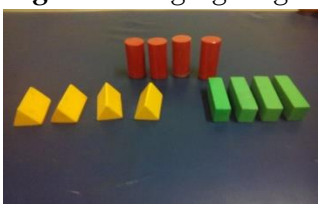


Figure 4: cylindrical, rectangular

Figure 3: building blocks and triangular blocks

Figure 5: box and block tool kit

Figure 6: plaster cast used during CIMT

Figure7: Pegboard

Figure 8: Stop watch

PROCEDURE

Subjects meeting the inclusion criteria were selected and parents were asked to sign in the written consent form stating the voluntary acceptance to participate in the study. The subjects were than assigned into two groups. The patient

was seated on CP chair and was strapped to it. A Large table was used up to chest height.

Children in group A wore a bivalve plaster cast on the non-involved upper extremity from shoulder to finger tips for the entire time during the session lasting for 2 hours and the plaster cast was removed at the end of the session. This was done every day for 3 months.[32] Behavioral techniques for shaping, included like Practicing target movements, when movement performed successfully, than task was made difficult and increased progressively. Repetitive task practice was achieved by making them to perform continuously for 10 minutes.

B group consists of 15 subjects who received play therapy. The treatment program was conducted individually and adjusted to current needs and abilities of each of the patients. The therapeutic regime was same for all participants. The session lasted for 2 hours every day for 3 months.

The following activities were used in both groups during the study

1. Make hand impression on play dough
2. Make shapes with play dough
3. Play with wooden puzzles
4. Pegboard games
5. Building block game
6. Turning cards
7. Staging rings

Instruction on how to perform the activities

- Play with dough – If the child is unable to open out their hand, physiotherapist should facilitate hand opening and place the dough into the Childs hand.
- Wooden puzzles – After the child grasps the puzzle the physiotherapist should facilitate the direction where to place the puzzle in the board.
- Building block – The child is asked to sort the blocks by picking up from table and putting one above the other.
- Turning cards –The child is asked to turn the cards upside down that is kept in the table.
- Staging rings – rings of different colour and shape are used which need to b placed in a stand. The child is asked to put the rings in the stand. Data collection was done on the 0 day and 90 day.


Figure 9: PLAY THERAPY ACTIVITIES


Figure10: CHILD FRIENDLY CIMT ACTIVITIES


Figure 11: PLAY THERAPY ASSISTED ACTIVITIES

DATA REPRESENTATION AND RESULTS

In this study 30 subjects were randomly selected, and then were allocated in group A and group B. There were 17 males and 13 females with a mean age of 6.55 ± 0.41 ranging from 5.6-7.5 in group A and a mean age of 6.63 ± 0.64 with a minimum age of 5.6-8.0 in group B. Baseline reading was taken using BBT, MAL scale for improving hand function.

Age	Group A		Age	Group B	
	No. of patients			No. of patients	
	Males	females		males	females
4.0-5.5	0	0	4.0-5.5	0	0
5.6-6.6	5	3	5.6-6.6	5	4
6.7-7.5	3	4	6.7-7.5	3	0
7.6-8.0	0	0	7.6-8.0	1	2
Total	8	7	Total	9	6

Table 1: Demographic data of Group A and Group B

Analysis and interpretation:

All analysis was obtained using PASW version 21.An alpha-level of 0.05 was used to determine statistical signicance. Statistical techniques used for analysis were wilcoxon signed ranks test and mann-whitney test, which is applicable, to compare each point of time in the two groups. Both within group and between group analyses was done to analyze the dependent variables. The data obtained using BBT, QOM and AOU scale of this study are ordinal and not interval or ratio. Since this does not adequately fulfill the conditions for parametric tests, non parametric test is applied here. The wilcoxon Signed Ranks test is used to compare the results of two different groups of subjects to see they differ significantly. The result shows a significant improvement in the group

getting both children friendly CIMT and play therapy.

Within group analysis

OUTCOME MEASURE	GROUP	DAYS	MEAN ± SD	WILCOXON SIGNED RANKS TEST (P)	COMMENT
QOM	A	0	1.80 ± 0.414	0.000	Null hypothesis rejected
		90	3.2 ± 0.616		
	B	0	1.33 ± 0.488	0.000	Null hypothesis rejected
		90	2.40 ± 0.507		
AOU	A	0	1.93 ± 0.258	0.000	Null hypothesis rejected
		90	3.27 ± 0.458		
	B	0	1.73 ± O.458	0.000	Null hypothesis rejected
		90	2.87 ± 0.352		
BBT	A	0	14.60 ± 0.828	0.001	Null hypothesis rejected
		90	19.47 ± 0.743		
	B	0	14.67 ± 1.175	0.001	Null hypothesis rejected
		90	17.87 ± 1.302		

Table 2: within group analyses Group A and Group B of BBT, QOM and AOU scale.

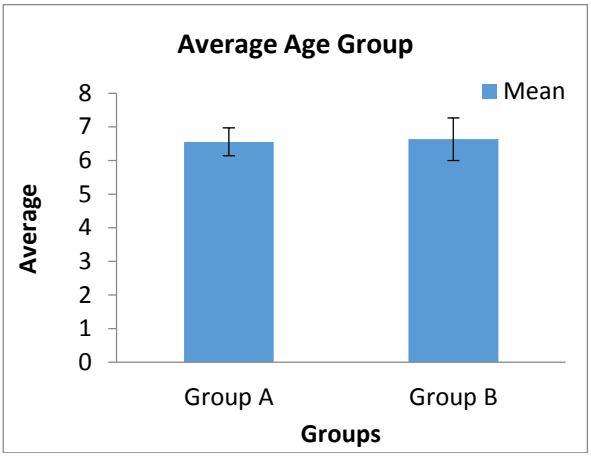
The mean values of 0 days and 90 days in group A and group B of BBT, AOU and QOM scale shows that there is significant improvement in hand function of the patients after 90 days of treatment with both child friendly CIMT(group A) and PLAY THERAPY (Group B). Wilcoxon Signed Ranks Test was used to find out the significance of the analysis between 0 days and 90 days of group A and group B. As significance level was found to be less than 0.05, null hypothesis was rejected.

BETWEEN GROUP ANALYSIS

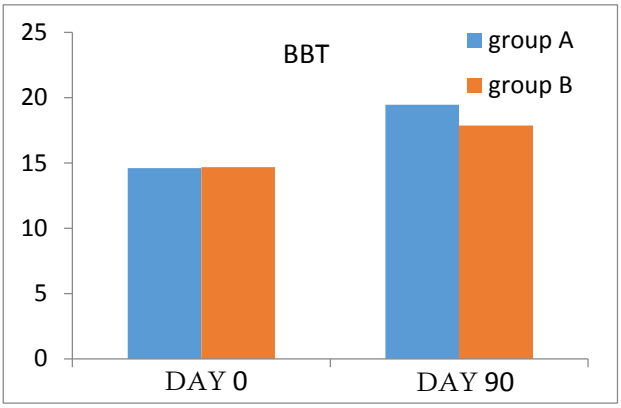
OUTCOME MEASURES	GROUP A	GROUP B	MANN-WHITNEY U TEST	COMMENT
	MEAN ± SD	MEAN ± SD	P	
QOM	3.20 ± 0.67	2.40 ± 0.507	0.001	Null hypothesis rejected
AOU	3.07 ± 0.450	1.50 ± 0.509	0.015	Null hypothesis rejected
BBT	19.47 ± 0.743	17.87 ± 1.302	0.000	Null hypothesis rejected

Table 3: Between group analysis of group A and group B of BBT, AOU and QOM scale.

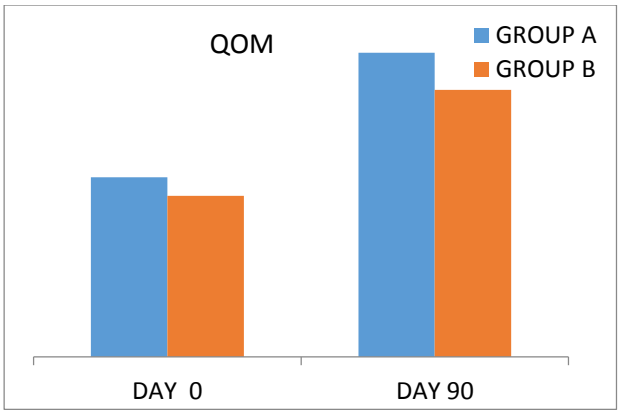
The mean values of BBT, AOU and QOM show that there is significant difference in pre and post physiotherapy treatment in group A compared to Group B. As the P value is less than 0.05 null hypothesis is rejected and alternative hypothesis is accepted. Thus the intervention used in group A has better effects than the intervention used in group B.



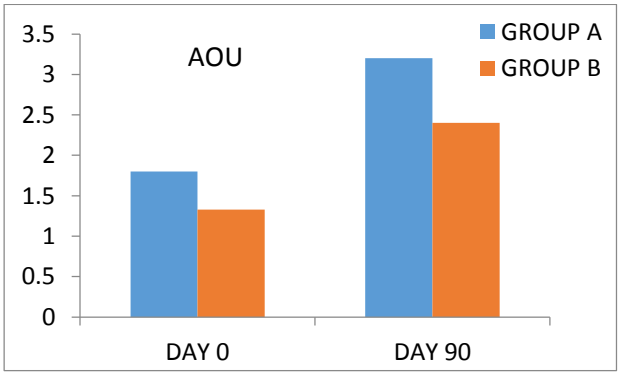
Graph 1: Average age group of childrens in Group A and Group B



Graph 2: Mean difference in BBT scale in group A and B



Graph 3: Mean difference in QOM scale in group A and B



Graph 4: Mean difference in AOU scale in group A and B

RESULTS

To look for the difference between the baseline readings taken on the 1st day of the study with the post test readings to improve hand function by applying child friendly CIMT and play therapy on the 90th day, Wilcoxon Signed Ranks Test was performed which showed a significant difference in both groups A and B (Table 2).

It was found that there is an improvement in the hand function on application of child friendly CIMT in the patients with spastic hemiplegic cerebral palsy which was found significant using the Mann-Whitney U test ($p \leq 0.005$). It has been found from the study that use of child friendly CIMT and Play therapy produces significant improvement in hand function for young children with spastic hemiplegic cerebral palsy. However child friendly CIMT shows better result in improving hand function in spastic hemiplegic cerebral palsy children than play therapy. Hence alternate hypothesis is accepted at $P = 0.000$ and null hypothesis is rejected.

DISCUSSION

The present study was undertaken to determine the comparative effect of child friendly CIMT and play therapy on spastic hemiplegic cerebral palsy children to improve hand function.

Data collected through the study showed more improvement in the hand function in patients with hemiplegic CP in group A. Thus it can be said that child friendly CIMT is more beneficial in improving hand function for young children with spastic hemiplegic cp.

When we analyze the mean values of pre and post test, it is found that the mean values of

1. Box and Block test are 14.60 and 14.67 for group A and B respectively in day 0 and the values found to be increased at day 90 i.e. 19.47 and 17.87 respectively.
2. QOM scale are 1.80 and 1.33 for group A and B respectively in day 0 and the values found to be increased at day 90 i.e. 3.20 and 2.40 respectively.
3. AOU scale are 1.93 and 1.73 for group A and B respectively in day 0 and the values found to be increased at day 90 i.e. 3.87 and 2.87 respectively.

These results showed that patients treated with child friendly CIMT had their hand functions more significantly improved.

In Group B subjects, it is found that the mean difference is,

1. In box and Block Test are 19.47 and 17.47 in group A and B respectively and is found that statistically group A is more significant (0.000)
2. In QOM are 3.20 and 2.40 in group A and B respectively and is found that statistically group A is more significant (0.001)
3. In AOU scale are 3.07 and 1.50 in group A and B respectively and is found that statistically group A is more significant (0.015)

From the results it is evident that patients who received treatment of child friendly CIMT (Group A) showed more improvement in hand functions for young children with spastic hemiplegic cerebral palsy when compared to patients who received treatment of play therapy (Group B).

The calculated statistical value obtained through focus on Wilcoxon Signed Ranks Test, and Mann Whitney test.

Graphical presentations, which point to overall sense of the study depicts the same. All graphs show the significant difference for improvement in hand functions, in group A and group B respectively.

LIMITATIONS

1. The study is done on an immediate basis i.e. the BBT and MAL scale was used immediately on the use of child friendly CIMT and play therapy.
2. No follow up was done. The lack of follow up has the drawback that sustained improvement and further progression value is not revealed.
3. The spastic hemiplegic CP was both of right and left side.
4. It is known that right sided spastic hemiplegic CP have some perceptual disorder which is not considered in this study, but this nevertheless can affect the outcome.

CONCLUSION

In this study it has been found that the use of Child friendly CIMT and PLAY THERAPY produces significant improvement in hand function for young children with spastic hemiplegic cerebral palsy. However the effectiveness of child friendly CIMT is more. Improvement was considerably more than play therapy. Therefore it is concluded that child friendly CIMT is a better treatment approach then play therapy.

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