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Early Diagnosis and Early Intervention on Cerebral Palsy

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ABSTRACT

Background: Cerebral palsy (CP) is described as "a group of persistent mobility and postural abnormalities caused by a non-progressive lesion that occurred during or after birth." The two halves or hemispheres of the brain are referred to as "cerebral" and "palsy" refers to loss of motor function. It is a frequent neurodevelopmental disorder that paediatricians and physiotherapists encounter. The vast majority of cerebral palsy children struggle to walk and have poor balance, which results in a bad gait. Constraint-Induced Movement Therapy (CIMT) is a method which helps improve hand function in young people with cerebral palsy (CP). CP is a widespread and prevalent condition that impacts many elements of a child's life. Hemiplegic cerebral palsy affects only one side of the child's hand and has a significant impact on the independence of children. Spastic cerebral palsy, which causes muscular rigidity and spasms, restricts mobility. It is the most prevalent kind of spastic cerebral palsy.

Aim: To determine the early diagnosis and early intervention on spastic hemiplegic cerebral palsy among children.

Method: A total of 30 subjects were selected for experimental study technique based on inclusion and exclusion criteria after which detailed study procedure was explained to the parents of the children. For four weeks, the training group got constraint induced movement therapy as well as muscular strengthening exercise from a physical therapist for 30 minutes daily

Result: Both groups showed improvement in post-test scores after the intervention. Group A's mean increased from 39.20 to 58.20, while Group B's rose from 38.27 to 53.73. The changes in both groups were statistically significant with p-values < 0.0001. Comparing the constraint induced movement therapy along with muscle strengthening training and the muscle strengthening training, constraint induced movement therapy in addition to muscle strengthening training has a significant improvement in the score is noted.

Conclusion: This experimental trial's findings assist the notion that home-based strength-training programmes are possible to enhance muscular strength in children diagnosed with spastic cerebral palsy. Strength training may benefit the upper limb extremities, according to current trends. Strengthening may be required in conjunction with more traditional methods such as spasticity reduction, surgical repair of abnormalities, and orthotic care for optimal management.

INTRODUCTION

Cerebral palsy is a rather common neurological condition which describes the disorders of movements and postures. It causes activity restrictions and disability of range of motion that are caused by the perturbation in the foetal or infant brain. It causes Motor dysfunction that may be accompanied by a seizure disease as well as sensory, cognition, communication or behavioural impairment [1]. Despite a sixfold rise in caesarean births, CP rates have remained constant

for the past 50 years. Epidemiological studies have revealed that the majority of CP occurs before to childbirth. Preterm birth, congenital deformities, Multiple pregnancy, intrauterine infection, foetal growth limitation, and placental anomalies are all connected with an increased risk [2]. A secondary systematic review published in 2008 specifically investigated the frequency of cerebral palsy in relation to gestational age and found a significant reduction in CP prevalence with increasing gestational age. The prevalence ranged from 146 (95% CI 125-170) as per 1000 children born between 22 and 27 weeks of gestation period and gradually decreased to an estimated 62 (95% CI 49-78) per 1000 children born were born between 28 and 31 weeks gestation, weeks 7 (95% CI 6-9) per 1,000 at 32 to 36 weeks and 1.13 (95. % CI 0.93-0.14) per 1000 term newborns [3]. The common risk factors of cerebral palsy are intrapartum infection, extreme prematurity, prenatal infection, low birth weight, genetic disposition [4]. These have the ability to affect the developing brain regardless of gender, however some studies show that males have greater incidence of Cerebral palsy than females [5]. The development of symptoms begins throughout early childhood, usually before the age of 18 months. In this case, an early brain damage may cause cerebral palsy which causes aberrant brain growth and reorganisation, especially during the first two years of life [6]. Prenatal or neonatal events in the at-risk infants might affect the infant's brain causing brain lesion and an indirect effect causing pain and stress. For example, the infant may be irritable, might have self-regulation issues or show evidence of transitory dystonia, implying that parent–child interaction support might be one of the key need for families with high-risk infants [7]. Cranial ultrasonography, magnetic resonance imaging (MRI) and other imaging modalities can be used to accurately predict severe CP immediately after delivery. This is not the case for people with mild to moderate CP. Early warning indicators of a child's development include delayed motor milestones, seizures, poor sucking skills, a chronically fisted hand, and a slower rate of head growth. However, the majority of patients do not exhibit clear symptoms right once and in modern practice [8]. Numerous therapy methods are available: Bobath method, sensory integration, strength training etc. Even if the kid is treated early, no approach can cure CP, because no method can reduce the instances to "minimal CP." However, if remedy starts offevolved earlier than the extraordinary styles of movement are developed, it can assist the kid in organising his potential talents in the most natural way for him [9]. Cerebral palsy is mostly diagnosed depending on motor function and postural problems which appear throughout childhood and last until death. They are non-progressive but alter with age. The main symptoms of cerebral palsy are motor function abnormalities, which are commonly accompanied by additional dysfunctions such as sensory, musculoskeletal issue, and behavioural alterations. Systematic and comprehensive motor rehabilitation plays a significant role in improvement. Rehabilitation is predicated on neuroplasticity, that is that the ability of the system to endure lasting structural and useful changes in response to internal and external stimuli; is the idea for learning and memory, similarly as for adaptation, development, and counteractive changes [10]. Individual rehabilitation is required for activity restrictions throughout life [11]. Despite the availability of several tools for analyzing cerebral palsy results, the indicate a wide range of functional problems and limits, the research concentrates on the advantages of therapies in CP. The devices and techniques that are used to describe cerebral palsy are difficult to select due to the fact that numerous alternatives with specific outcomes are not usually evident in individuals and may need specialised expertise. As a result of this, systematic information regarding the methodology and processes for assessing the effectiveness of cerebral palsy therapy is required [12].

METHODS

Study design: This experimental study was conducted with a sample of 30 children, aged between 2 and 5 years, who were selected based on specific inclusion and exclusion criteria. The participants were recruited from the Pediatric Intensive Care Unit (PICU) of Saveetha Institute of Medical and Technical Sciences, located in Thandalam, Chennai – 602105. Careful screening was done to ensure that only eligible candidates fitting the study parameters were included. The study aimed to investigate targeted outcomes within this age group, providing a controlled environment for accurate observation and data collection. By selecting participants from a single, reputable medical institution, consistency in clinical assessment and monitoring was maintained throughout the research process.

Subjects: Inclusion and Exclusion criteria: Children of both genders were included in this study with the age group between 2 to 5 and with minimal function of hand. Subjects with visual or hearing problems and prior upper limb surgery were excluded. Also the subjects who suffer from other neurological conditions or cognitive problems were excluded

STUDY PROCEDURE:

A total of 30 children were chosen based on the inclusion and exclusion criteria, and their parents' informed consent were obtained after they have been informed about the procedure's safety and simplicity.

Infants who were likely to participate were briefed on this study and its intervention before their parent's informed agreement was obtained.

Materials required: sling, mitts with velcro or resting hand splints.

Experimental group: The training group received constraint induced movement therapy along with muscle strengthening training by the physical therapist for 20 minutes daily for 4 weeks.

Training protocol includes

Activity 1: Constraint induced movement therapy

Stage 1: On the affected hand, 10 degrees active wrist extension was recommended.

Stage 2: On the affected hand, 10 degrees active thumb abduction was recommended.

Stage 3: Any additional two digits on the afflicted hand were extended 10 degrees.

Activity 2: Conventional therapy _ Muscle strengthening exercises

Stage 1: Isotonic exercises - Isotonic contractions occurred when muscles contracted or lengthened against resistance and tension remained the same. Isometric contractions occurred when tension increased but the muscle maintained a constant length.

Stage 2: Isometric exercises - Isometric exercises work specific muscles without moving the surrounding joints. By constantly contracting the muscles, isometric exercises were helpful in improving physical endurance and posture by strengthening and stabilizing the muscles.

Stage 3: Isokinetic exercises - Isokinetic exercise Trusted Source was a form of resistance training. It allowed the targeted muscle to work at a full strength while maintaining a constant speed.

Control group: Control group received only the conventional therapy of muscle strengthening exercises for 20 minutes daily for 4 weeks.

OUTCOME MEASURE:

This study employed a specific outcome measure to evaluate spastic hemiplegic cerebral palsy in children, a condition that typically results in muscle tightness and weakness on one side of the body, impacting voluntary movement and coordination. To assess motor impairment and monitor progress, the Fugl-Meyer Assessment (FMA) was applied with a focus on upper limb function. Although originally intended for adults recovering from stroke, the Fugl-Meyer Scale is increasingly being adapted for use in pediatric populations, especially in children with cerebral palsy. The scale comprises

30 tasks, each rated on a three-point scale: 0 for no ability, 1 for partial ability, and 2 for full performance. These tasks examine reflexes, voluntary movements in and out of synergy patterns, as well as coordination and movement speed. This structured scoring system allows for consistent evaluation of motor deficits, enabling healthcare providers to objectively track changes and gauge the effectiveness of therapeutic interventions. Its adaptation for children with spastic hemiplegia offers a consistent approach to measuring upper limb function over time. The FMA's clear format and ease of use make it particularly suitable for clinical and rehabilitation settings. In addition, it supports early intervention, individualized treatment planning, and the setting of realistic goals, all of which contribute to enhancing motor outcomes and overall well-being in affected children

RESULT

The outcome measures of 30 subjects were assessed using Fugl-meyer scale and has shown that the sample data was gathered from the PICU of saveetha Institute of medical and technical sciences. The significance between the pre-test and post-test is determined using paired t test. The level of confidence for both the measurements are 95%.

The outcome showed significant change (table 1) with the mean differences of 14. With a 95% confidence interval of mean between -21.15 to -16.25, expressing the symptom score has been increased drastically before and after the treatment. The p value obtained (p value <0.0001) by analysing pretest and post-test values showed that there is significantly different.

TABLE 1: PRETEST AND POSTTEST VALUES OF GROUP A

S. NO	GROUP A	MEAN	STANDARD DEVIATION	t VALUE	p VALUE
1	Pre-test	39.20	2.78	18.9102	<0.0001
2	Post-test	58.20	2.57		

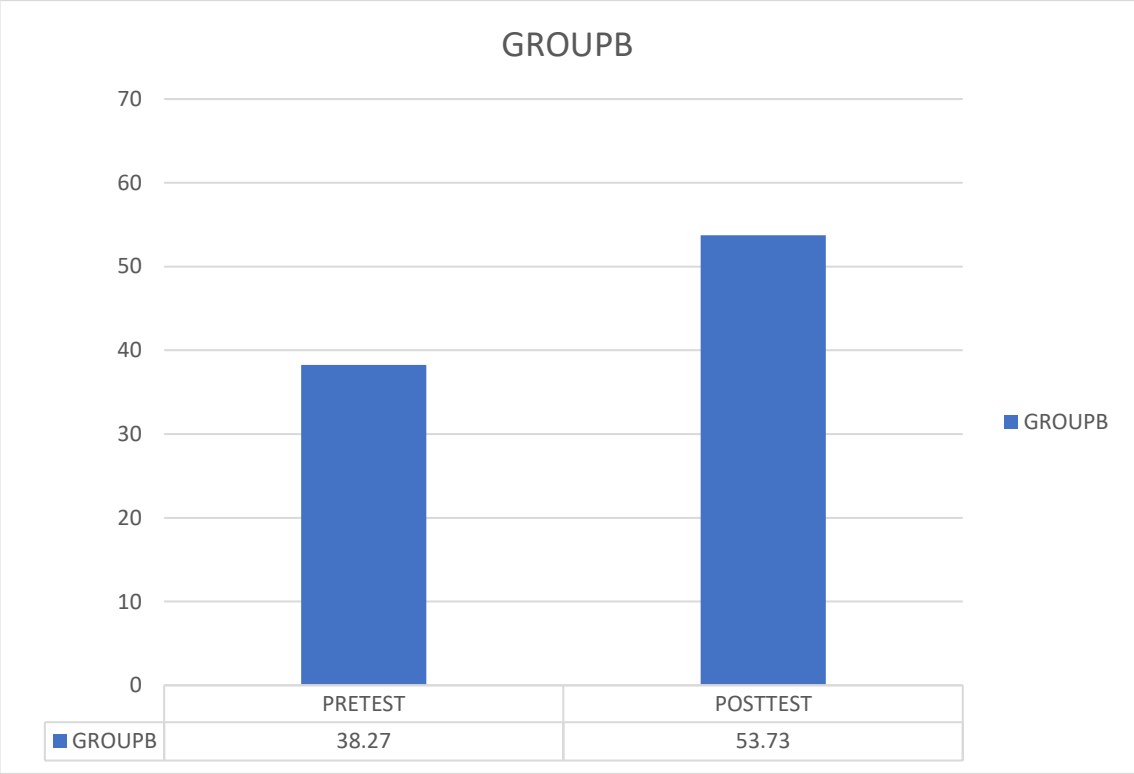
GRAPH 1: MEAN OF PRE-TEST AND POST-TEST VALUES OF GROUP

The outcome showed significant change (table 2) with the mean differences of 3.97. With a 95% confidence interval of mean between 17.45 to 13.48, expressing the symptom score has been increased drastically before and after the treatment. The p value obtained (p value <0.0001) by analysing pre-test and post-test values showed that there is significantly different.

TABLE 2: PRE-TEST AND POST-TEST VALUES OF GROUP B

S. NO	GROUP B	MEAN	STANDARD DEVIATION	t VALUE	p VALUE
1	Pre-test	38,27	2.22	16.7183	<0.0001
2	Post-test	53.73	2.60		

GRAPH 2: MEAN OF PRE-TEST AND POST-TEST VALUES OF GROUP B



Hence, constraint induced movement therapy along with muscle strengthening training has shown statistically significant improvement in the spastic hemiplegic cerebral palsy among children. Null hypothesis has been rejected due to the beneficial effects obtained from constraint induced movement therapy along with muscle strengthening training is alternative hypothesis is proved.

DISCUSSION

This study adds to the body of data suggesting Strength training programmes at home may be both effective and convenient technique for developing muscular strength in young people with spastic cerebral palsy. Cerebral palsy (CP)

can disrupt sensory and cognitive development as well as create movement abnormalities. Problems in these areas of functioning can have an impact on the development of children's speech, language, and communication [13]. In most situations, early therapy yields faster and better improvements since the kid does not yet exhibit significant abnormalities and so has less experience with aberrant movements [9].

McCubbin and Shasby's study (1985) found that in a six week isokinetic strengthening program improved Triceps muscle strength in a group of ten young persons. To keep parents and children engaged, the intervention must promote active engagement from the kid and so be both entertaining and easy to handle. A therapist should ideally be present to provide assistance and check the quality of the instruction. However, due to expenses, this will not be feasible on a wide scale [8].

Despite the difficulties of making an early diagnosis, the many at-risk newborns are "treated and cured proactively." Statistical analysis confirms the difficulties in early diagnosis and evaluation of early therapeutic results [9]. All of the young persons in this research had been actively maintained and had no substantial corrected musculoskeletal abnormalities at the time of the investigation, leaving vulnerability as the predominant residual functional impairment predictor. Functional restrictions in persons with cerebral palsy might be caused by a variety of reasons, including persistent musculoskeletal deformities and spasticity. Strength training can be seen as part of complete management strategy instead of an independent intervention in this setting [14]. Our approach was especially created considering clinical feasibility. This software made use of basic, low-cost equipment.

The results from both groups indicate a clear improvement in post-test scores following the intervention. Group A showed an increase in the mean score from 39.20 before the intervention to 58.20 afterward, with standard deviations of 2.78 and 2.57, respectively. Group B also demonstrated progress, with the average score rising from 38.27 in the pre-test to 53.73 in the post-test, and standard deviations of 2.22 and 2.60. While both groups benefited from their respective interventions, the improvement was more pronounced in Group A, suggesting a stronger effect. The statistical significance of these findings is supported by p-values less than 0.0001. These outcomes highlight the overall effectiveness of the treatments, with Group A showing comparatively better results.

CONCLUSION

This experimental trial's findings assist the notion that both interventions demonstrated promising results in improving motor function in children with spastic hemiplegic cerebral palsy, with statistically significant improvements ($p < 0.0001$) observed in both groups. These findings highlight the effectiveness of the interventions in enhancing motor abilities. Looking ahead, this research provides a foundation for further studies to refine and adapt these approaches for broader use in pediatric rehabilitation. By exploring different therapeutic techniques and tailoring interventions to individual needs, future research could lead to even more targeted and effective treatments. Ultimately, this can help improve the quality of life for children with cerebral palsy, offering them greater independence and mobility.

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