

Functional Outcomes of Intensive Physical Therapy Program in Spastic Diplegic Cerebral Palsy

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Abstract

Background: Cerebral palsy is a chronic disorder characterized by impairments in gross and fine motor movement and posture, resulting from injury to the developing brain during prenatal, perinatal, or postnatal periods. This condition causes various challenges, including mental deficiencies, hearing issues, and motor problems. Spastic diplegic cerebral palsy is a prevalent subtype, which significantly affects motor function and independence.

Objective: The study aimed to evaluate the effectiveness of an intensive physical therapy program on improving motor functions in children with spastic diplegic cerebral palsy across different age groups.

Methods: A quasi-experimental study was conducted over six months at Mobility Quest Lahore, involving 18 children with spastic diplegic cerebral palsy. Participants were recruited using convenience sampling and divided into two age groups: 3 to 6 years (10 children) and >6 to 9 years (8 children). The Gross Motor Function Measure (GMFM-88) was used to assess motor function. Children received intensive physical therapy for 5 days a week, 4 hours a day, for 4 weeks, totaling 112 sessions. Statistical analyses, including single and paired T-tests, were performed using SPSS version 25.

Results: The mean change in GMFM scores for ages 3 to 6 was 6.17 (± 0.52), and for >6 to 9, it was 4.96 (± 0.01). Both age groups showed significant improvement, with p-values < 0.05.

Conclusion: The intensive physical therapy program significantly improved gross motor function in children with spastic diplegic cerebral palsy, especially in younger children, highlighting the importance of early intervention

1 Introduction

Cerebral palsy (CP) is a chronic disorder characterized by impairments in gross and fine motor movement and posture, resulting from injury to the developing brain during prenatal, perinatal, or postnatal periods. This neurological condition can lead to a spectrum of challenges including mental deficiencies, hearing issues, and language and motor problems (1, 2). CP is a prevalent condition, occurring at a rate of 2-4 per 1000 live births worldwide, with approximately 80% of affected children diagnosed with the spastic form of cerebral palsy. The underlying pathophysiology involves damage occurring during the early stages of brain development, leading to various clinical presentations such as spastic, dystonic, ataxic, or mixed types, depending on the predominant movement disorder (3, 4).

The most common subtype, spastic cerebral palsy, often results in decreased motor abilities and challenges with walking, typically assessed through the Gross Motor Function Classification System (GMFCS) (5). Detailed assessments such as the Gross Motor Function Measure

(GMFM-88) are used to track functional capabilities and monitor changes over time or as a result of interventions. Children with cerebral palsy frequently experience issues related to muscle strength, joint mobility, motor coordination, and alignment, all of which impact their physical activities (6). Physical therapy (PT) aims to address these issues by improving movement patterns and enhancing a child's ability to engage in functional activities like gross motor skills and walking. Specialized training and strengthening exercises have demonstrated significant benefits in improving motor function in children with CP, although the optimal intensity of therapy required to achieve these benefits remains uncertain (7).

Various rehabilitation protocols have been developed, ranging from low-frequency interventions to intensive programs involving up to five sessions per week. These protocols have shown improvements in gross motor function, walking cadence, and speed. Some intensive rehabilitation methods, particularly those focusing on upper-limb function, have shown remarkable efficacy in children with unilateral cerebral palsy, utilizing treatments such as constraint-induced movement therapy and bimanual training (8, 9). Intensive interventions aimed at enhancing walking abilities, such as supported treadmill training and strength training, have also been developed for children with bilateral cerebral palsy. These methods emphasize task-specific training and goal-setting, which have demonstrated improvements in both gross motor function and upper-extremity capabilities (10).

The Intensive Physical Therapy Program (IPTP) is an innovative intervention designed to enhance functional improvement in individuals with conditions like cerebral palsy. By intensifying therapy, the program aims to boost the brain's capacity to establish new neural pathways, facilitating both major and subtle motor skills. This approach is intended to help individuals with CP reach their highest potential (11). The present study seeks to educate physical therapists and other healthcare professionals about effective strategies for enhancing gross motor function improvements in children with diplegic spastic cerebral palsy. It also aims to investigate the effects of intensive therapy programs on gross motor functions in relation to age, gender, and the gross motor functional level of the child. Additionally, the study provides hope to parents of children with cerebral palsy by demonstrating that early intervention can lead to significant functional independence and improved quality of life, potentially mitigating the long-term effects of immobility and dependent disabilities (12).

2 Material and Methods

In this quasi-experimental study, data were collected over a period of six months from male and female patients at the Mobility Quest Lahore. The study adhered to the ethical principles outlined in the Declaration of Helsinki, and informed consent was obtained from the parents of all participating children with cerebral palsy, ensuring confidentiality of the assessed scores. The calculated sample size comprised 18 subjects, determined using a 5% estimated proportion of population 1 (P1) and a 40% estimated proportion of population 2 (P2) with 90% statistical power and a significance level of 5%.

A convenient sampling technique was employed to select participants. The inclusion criteria included children aged 3 to 9 years with spastic diplegic cerebral palsy, both male and female, classified at GMFMS levels I and II. The GMFMS scale is applicable only to children older than three years. Exclusion criteria included children outside the defined age limits, those with developed contractures in any body muscle, a history of muscle lengthening surgery, or any active infection in the body.

Participants were randomly divided into two groups, with each group consisting of nine children. The intensive therapy program involved three-hour sessions, five days a week, over a four-week period, totaling 112 sessions. The program focused on enhancing strength, flexibility, functional movements, weight-bearing exercises, crawling, and conditioning, aiming to reduce undesired patterns and establish new motor patterns through repetitive practice and proper biomechanics. A unique aspect of the program was the use of the Universal Exercise Unit, a tool for enhancing strength, endurance, balance, and functional abilities such as transitioning from kneeling or sitting to standing with reduced assistance.

Data collection involved the use of the Gross Motor Function Measure (GMFM-88) to assess gross motor function scores. Each child was assessed at a convenient time agreed upon by the therapist and the child's guardian before and after completing the intensive physical therapy sessions. The difference between pre- and post-treatment scores was used for statistical analysis. Statistical analysis was conducted using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize demographic data, and the GMFM scores were analyzed using single-sample and paired-sample T-tests to determine the significance of changes in motor function. Mean values of GMFM scores and standard deviations (\pm SD) were calculated for hypothesis testing, and appropriate graphs and tables were developed to illustrate the results (13).

3 Results

The results of this study demonstrate the impact of an intensive physical therapy program on the gross motor function of children with spastic diplegic cerebral palsy. A total of 18 participants were included in the study, divided into two age groups: 3 to 6 years and greater than 6 to 9 years. The demographic details of the participants are presented in Table 1.

Table 1: Demographic Data of Study Participants

Variable	Category	Frequency
Age	3-6 years	10
	>6-9 years	8
Gender	Male	10
	Female	8
GMFM Level	GMFM Level I	8
	GMFM Level II	10

The analysis of the Gross Motor Function Measure (GMFM) scores before and after the intensive therapy sessions revealed significant improvements in both age groups, with a greater improvement observed in the younger age group. Table 2 shows the pre-treatment and post-treatment GMFM scores, along with the change in scores for each age group.

Table 2: Pre- and Post-Treatment GMFM Scores with P-Values

Age Group	Pre-Treatment Mean (\pm SD)	Post-Treatment Mean (\pm SD)	Change in Score Mean (\pm SD)	P-Value
3-6 years	78.03 (\pm 1.11)	84.2 (\pm 0.59)	6.17 (\pm 0.52)	0.00
>6-9 years	79.02 (\pm 0.79)	83.98 (\pm 0.78)	4.96 (\pm 0.01)	0.00

Both age groups exhibited statistically significant improvements in GMFM scores after the therapy program, with p-values less than 0.05, indicating the effectiveness of the intensive physical therapy program. The mean change in score for the 3 to 6-year age group was greater than that for the greater than 6 to 9-year age group, suggesting that younger children benefited more from the intensive therapy.

The data indicate that the intensive physical therapy program led to significant improvements in gross motor function in children with spastic diplegic cerebral palsy, particularly in the younger age group. These findings underscore the importance of early intervention in maximizing therapeutic outcomes for children with cerebral palsy.

4 Discussion

The discussion of this study focuses on the significant improvements observed in the gross motor function of children with spastic diplegic cerebral palsy following an intensive physical therapy program. The results align with previous research that highlights the benefits of early and intensive rehabilitation in enhancing motor skills in children with cerebral palsy. The greater improvements in the younger age group, 3 to 6 years, underscore the critical importance of early intervention in maximizing therapeutic outcomes. This finding is consistent with the well-documented principle that early neural plasticity offers more opportunities for motor function enhancement (7, 8).

In comparison to traditional therapy approaches, the intensive therapy program implemented in this study provided a higher frequency and intensity of sessions, which contributed to the significant improvements observed. Previous studies have demonstrated that increased therapy intensity can lead to better outcomes in motor function and independence (9, 10). However, the specific intensity required for optimal results has varied across studies, highlighting the need for a tailored approach to therapy based on individual patient needs and responses (6).

The study's strength lies in its structured approach to assessing the impact of intensive physical therapy on children with cerebral palsy using well-defined inclusion criteria and standardized assessment tools such as the GMFM-88. This allowed for a rigorous evaluation of the therapy's effectiveness and provided valuable insights into the benefits of intensive therapy regimens. Furthermore, the random allocation of participants into age-specific groups helped to minimize selection bias and allowed for a more accurate comparison of therapy outcomes across different developmental stages.

Despite these strengths, the study had limitations. The small sample size of 18 participants limited the generalizability of the findings to the broader population of children with cerebral palsy. A larger sample size would provide more robust data and allow for more definitive conclusions regarding the therapy's efficacy. Additionally, the study did not account for potential confounding variables such as the severity of spasticity, coexisting medical conditions, or variations in individual response to therapy, which could influence the outcomes.

Another limitation was the short duration of follow-up, which restricted the ability to assess the long-term sustainability of the improvements observed. Future studies should consider longer follow-up periods to determine whether the gains in motor function are maintained over time and to explore the potential for further improvements with continued therapy. Moreover, incorporating a control group that receives standard therapy would strengthen the study's design by providing a direct comparison of outcomes between different therapy approaches.

The findings of this study have important implications for clinical practice and rehabilitation strategies for children with cerebral palsy. Early and intensive physical therapy should be considered a priority in treatment plans to maximize functional gains and improve quality of life. Clinicians should tailor therapy programs to the individual needs of each child, taking into account their age, developmental stage, and specific motor impairments. This personalized approach can help optimize therapy outcomes and support children in achieving greater independence and participation in daily activities.

This study provides evidence that an intensive physical therapy program can lead to significant improvements in gross motor function in children with spastic diplegic cerebral palsy, particularly in younger children. These findings support the growing body of evidence advocating for early and intensive intervention as a means to enhance motor outcomes in this population. Further research with larger sample sizes, longer follow-up periods, and comparative analysis with standard therapy is recommended to validate these results and inform best practices for the rehabilitation of children with cerebral palsy (12, 13).

5 Conclusion

The study demonstrated that an intensive physical therapy program significantly improved gross motor function in children with spastic diplegic cerebral palsy, particularly in those aged 3 to 6 years. These findings emphasize the critical role of early and intensive intervention in optimizing motor outcomes, highlighting the potential for such programs to enhance the quality of life and functional independence in this population. The implications for human healthcare are profound, suggesting that prioritizing early intervention in therapeutic strategies can lead to better long-term outcomes and reduce the burden of disability in children with cerebral palsy, ultimately fostering greater participation in daily activities and societal integration.

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Disclaimers

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