

OPTIMIZATION OF FUNCTIONAL ABILITIES IN CHILDREN WITH CEREBRAL PALSY THROUGH PHYSIOTHERAPY AND OCCUPATIONAL THERAPY

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Cerebral palsy leads to persistent limitations in motor function and in the child's participation in daily activities. The aim of this study was to evaluate the effectiveness of an integrated intervention combining physiotherapy and occupational therapy in optimizing the functional abilities of children with cerebral palsy. The therapeutic program was implemented over a 12-week period and focused on improving mobility, functional performance, and autonomy. Assessment was conducted using GMFM-88, PEDI-CAT, GMFCS, and MACS. The results showed significant increases in functional scores and improvements in performance in activities of daily living, while functional classifications remained stable, indicating realistic progress within the analyzed timeframe. The findings support the effectiveness of an integrated approach and highlight the importance of implementing individualized rehabilitation programs to enhance independence and participation in children with cerebral palsy.

Keywords: *physiotherapy, cerebral palsy, occupational therapy, functional assessment, activities of daily living (ADL).*

OPTIMIZAREA FUNCȚIONALITĂȚII LA COPIII CU PARALIZIE CEREBRALĂ INFANTILĂ PRIN KINETOTERAPIE ȘI TERAPIE OCUPAȚIONALĂ

Paralizia cerebrală infantilă determină limitări persistente ale funcției motorii și ale participării copilului în activitățile zilnice. Studiul a avut ca scop evaluarea eficienței unei intervenții integrate de kinetoterapie și terapie ocupațională în optimizarea funcționalității copiilor cu PCI. Programul terapeutic a fost aplicat pe o perioadă de 12 săptămâni și a vizat îmbunătățirea mobilității, a performanței funcționale și a autonomiei. Evaluarea a fost realizată prin GMFM-88, PEDI-CAT, GMFCS și MACS. Rezultatele au evidențiat creșteri semnificative ale scorurilor funcționale și îmbunătățirea performanței în activitățile vieții zilnice, în timp ce clasificările funcționale au rămas stabile, indicând un progres realist în intervalul analizat. Concluziile susțin eficiența abordării integrate și importanța implementării programelor individualizate pentru creșterea independenței și a participării copiilor cu paralizie cerebrală infantilă.

Cuvinte cheie: *kinetoterapie, paralizie cerebrală infantilă, terapie ocupațională, evaluare, ADL.*

Introduction

Cerebral palsy (CP) represents a group of permanent disorders of the development of movement and posture that cause activity limitations, with onset in the fetal period or early childhood and a non-progressive character. These disorders are the consequence of lesions or abnormalities occurring in the immature central nervous system [5, p. 1].

The motor disorders characteristic of cerebral palsy are frequently accompanied by sensory, cognitive, communication and perceptual impairments, behavioral disorders, as well as epileptic seizures [7, p. 1152]. The lesions responsible for the occurrence of CP usually develop before the age of 2 years, and the diagnosis is confirmed after this age, once the essential maturation processes of the central nervous system are completed [5, p. 3].

The defining feature of cerebral palsy is the disturbance of the child's motor development, caused by the abnormal distribution of muscle tone and impairment of the coordination of voluntary movements [8, p. 248].

Infantile cerebral palsy represents a widely распространен pathology. According to data reported by various authors, its incidence ranges between 2 and 3.1 cases per 1,000 children. Statistical data indicate an increase in the level of childhood disability caused by cerebral palsy, with values of 1.4 per 1,000 children in 1991, 1.5 per 1,000 in 1992, and 1.65 per 1,000 in 1993 [1].

In France and England, approximately 25% of patients with cerebral palsy present severe motor impairment, being unable to walk independently, while about 30% are associated with intellectual disability [7, p. 3]. Most authors consider that the actual prevalence of cerebral palsy is higher, a phenomenon explained by the decrease in mortality among premature infants and newborns with low birth weight, categories that present an increased risk of developing infantile cerebral palsy [4, p. 23].

The prevalence of moderate and severe forms of cerebral palsy is estimated between 1.5 and 2.5 per 1,000 live births, being higher in developing countries. From an epidemiological perspective, infantile cerebral palsy accounts for approximately 24% of all causes of neurological disability in children. In addition, prevalence is estimated to be about 1.3 times higher in boys, who tend to present more severe clinical forms than girls [12, p. 43].

Physiotherapy plays an essential role in the management of cerebral palsy, including a variety of therapeutic interventions aimed at improving the physiological and functional outcomes of the child [2, p. 7]. Although widely used and recommended by members of the multidisciplinary team, the effectiveness of physiotherapy interventions may vary depending on the type, intensity, and structure of the applied programs [10, p. 87].

The main objective of physiotherapy interventions is the reduction of functional impairments and the prevention of secondary complications [3, p. 145]. Physical exercise contributes to the improvement of posture, regulation of muscle tone, and enhancement of balance, playing an important role in reducing secondary conditions associated with cerebral palsy [11, p. 364].

Exercise programs performed on the floor, which include muscle strengthening and stretching exercises, lead to significant increases in muscle strength and improvements in gait, the ability to transition from sitting to standing, as well as overall functional performance. Randomized controlled studies have also demonstrated that these programs may contribute to increased levels of participation and improved quality of life in children with cerebral palsy [5, pp. 5–6].

Longitudinal observational studies indicate that integrated rehabilitation programs, centered on functional goals established according to the ICF framework, can generate significant improvements in the mobility and participation of children with cerebral palsy, including in the long term [13, pp. 2421].

Pediatric occupational therapy plays a fundamental role in promoting the child's participation in everyday roles, such as the development of personal independence, involvement in productive activities, and participation in play and recreational activities [9, p. 2]. Limitations in participation caused by disability may lead to social marginalization, isolation, and decreased self-esteem, highlighting the need for therapeutic interventions that are adapted and focused on functionality [11, p. 365].

Occupational therapy interventions are selected based on the analysis of the child's performance in daily activities, the way disability influences this performance, and the role of the environment in facilitating or restricting participation [6, p. 7]. Modern practice in pediatric occupational therapy, aligned with the ICF framework and family-centered care principles, promotes interventions oriented toward activity and participation, rather than approaches focused exclusively on deficits [6, p. 11].

Although occupational therapy promotes evidence-based practice, the literature highlights a significant delay in the implementation of research findings into clinical practice, emphasizing the need for the continuous updating of therapeutic interventions and rehabilitation strategies.

Materials and methods

The study included six children diagnosed with bilateral spastic cerebral palsy (CP), aged between 4 and 6 years, including four boys and two girls, all presenting the spastic form of the condition. The research was conducted at the Kinetica Medical Rehabilitation Center during the period May–July 2025. The study was designed as a quasi-experimental, prospective pre–post study without a control group.

In this context, considering the complexity of functional limitations associated with children with special needs and the necessity of integrated therapeutic interventions, the present study aims to analyze the effectiveness of rehabilitation from a functional perspective by correlating physiotherapy and occupational therapy interventions, and further formulates the aim, objectives, and hypothesis of the study.

The physiotherapy program was individually planned for each child, aiming to achieve specific functional goals established in accordance with all components of the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY). Based on the ICF-CY framework, the assessment tools were selected and the therapeutic objectives were defined.

The psychopedagogical approach was child-centered and oriented toward functional development, aiming to facilitate active participation in activities of daily living. The intervention integrated principles of motor learning and therapeutic education by using tasks adapted to the child's developmental level and individual abilities. At the same time, the involvement of the family environment was considered essential in supporting functional progress and autonomy.

The integrated approach of physiotherapy and occupational therapy allowed the transfer of motor achievements into meaningful functional activities, contributing to the optimization of mobility, functional performance, and the level of participation of the children included in the study, in accordance with the principles of the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY).

The application of the intervention algorithm within the present study followed a structured, functional, and standardized approach, centered on the child and aligned with the framework of the International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY). Initially, all six children included in the study underwent an initial assessment, which aimed to determine the baseline functional level and the individual functional profile. The assessment was conducted using validated and internationally recognized instruments, namely GMFM-88 for the evaluation of gross motor function, GMFCS for the classification of the motor functional level, PEDI-CAT for the assessment of functional performance and participation, and MACS for the classification of manual abilities.

Based on the results obtained from the initial assessment, common functional objectives were formulated according to SMART criteria, aiming to improve functional mobility, performance in activities of daily living, and the level of participation. The objectives were defined in an individualized and family-centered manner, forming the foundation for the development of the rehabilitation program.

Subsequently, an integrated rehabilitation program was implemented, which included physiotherapy interventions conducted twice per week and occupational therapy sessions carried out once per week. The physiotherapy interventions primarily aimed at optimizing postural control, improving mobility and muscle strength, and enhancing gross motor function, while occupational therapy activities were focused on increasing functional independence, improving hand-eye coordination, and facilitating the child's participation in meaningful activities and activities of daily living. The two therapeutic components were applied in a complementary manner, aiming to transfer motor gains into real functional contexts.

At the end of the intervention period, the children underwent a final assessment using the same evaluation instruments as in the initial stage, which allowed the comparison of pre- and post-intervention results and the assessment of the effectiveness of the rehabilitation program. This algorithmic approach ensured a coherent, reproducible, and function-oriented intervention, facilitating the analysis of the impact of physiotherapy and occupational therapy on the overall functioning of the children included in the study.

Results

The results of the initial and final assessments are presented in Table 1. The comparative analysis of functional parameters, conducted at baseline and after 12 weeks of integrated physiotherapy and occupational therapy intervention, revealed relevant changes in gross motor function and overall functionality of the children included in the study.

The Gross Motor Function Classification System (GMFCS) indicated that the median level remained at Level II both at the initial and final assessments, reflecting the stability of the overall functional level of the study group during the intervention period.

Regarding gross motor function, assessed using the GMFM-88, the mean score increased from 66.7 ± 2.9 to 71.1 ± 3.1 , the difference being statistically significant ($P < 0.05$). This increase indicates an improvement in gross motor abilities following the applied intervention.

The analysis of PEDI-CAT scores revealed statistically significant improvements across all evaluated domains. In the Activities of Daily Living (ADL) domain, the mean score increased from 38.8 ± 2.7 to 45.2 ± 3.0 ($P < 0.05$). The Mobility domain showed an increase from 33.2 ± 2.2 to 39.0 ± 2.6 ($P < 0.05$), while the Social/Cognitive domain increased from 43.3 ± 2.9 to 49.5 ± 3.1 ($P < 0.05$).

Regarding manual ability, assessed using the Manual Ability Classification System (MACS), the distribution of levels revealed a favorable change in the functional profile of the study group. At the initial assessment, 33.3% of the children were classified at Level II and 66.7% at Level III, whereas at the final assessment, the proportion of children classified at Level II increased to 50%, while those classified at Level III decreased to 50%.

Table 1. Interpretation and comparison of the results obtained

Instrument		Initial assessment	Final assessment	P
GMFCS		II	II	-
GMFM-88		66,7 $\pm$ 2,9	71,1 $\pm$ 3,1	<0,05
PEDI-CAT	ADL	38,8 $\pm$ 2,7	45,2 $\pm$ 3,0	<0,05
	Mobility	33,2 $\pm$ 2,2	39,0 $\pm$ 2,6	<0,05
	Social/Cognitivex	43,3 $\pm$ 2,9	49,5 $\pm$ 3,1	<0,05
MACS	2 children	Level II – 33,3%	Level II – 50%	-
	4 children	Level III – 66,7%	Level III – 50%	-

Overall, the data presented in Table 1 indicate that the intervention applied over 12 weeks was associated with statistically significant improvements in gross motor function and overall functionality, as demonstrated by change-sensitive instruments such as GMFM-88 and PEDI-CAT, while the functional classification instruments reflected stability in the functional level or a favorable trend in the redistribution of classification levels.

Discussion

The results presented in Table 1 indicate that the integrated physiotherapy and occupational therapy intervention, applied over a period of 12 weeks, was associated with statistically significant improvements in gross motor function and overall functionality in the children included in the study. These improvements were evidenced by significant increases in GMFM-88 and PEDI-CAT scores, while the functional classification instruments, GMFCS and MACS, reflected functional stability or a favorable trend in the redistribution of functional levels.

The significant increase in the GMFM-88 score suggests progress in gross motor abilities, particularly with regard to postural control, transitions, and functional mobility. This result is consistent with findings reported in the literature, which indicate that structured physiotherapy programs implemented with appropriate frequency can lead to measurable short-term improvements in gross motor function, especially in children with mild to moderate functional levels.

The significant improvements observed across all PEDI-CAT domains indicate that motor progress was accompanied by relevant functional gains in daily activities, mobility, and social–cognitive engagement. The increases in scores in the Activities of Daily Living (ADL) domain suggest improved autonomy in self-care activities, while progress in the Mobility domain reflects an increased ability to perform movement and functional transfers. Furthermore, the improvements observed in the Social/Cognitive domain may be associated with more active participation in structured activities and better adaptation to the functional demands of the environment.

The stability of GMFCS throughout the intervention period was expected, given that this instrument describes the overall functional level and is less sensitive to short-term changes. In contrast, the changes observed in the distribution of MACS levels, although not subjected to statistical testing, indicate a favorable trend toward improved functional use of the hand, reflected by the increased proportion of children classified at Level II at the final assessment.

It is important to emphasize that the results of this study should be interpreted in the context of the small sample size and the absence of a control group, which limits the generalization of the conclusions. Nevertheless, the consistency of the improvements observed in change-sensitive instruments supports the clinical relevance of the applied intervention.

Overall, the obtained data suggest that an integrated physiotherapy and occupational therapy program, conducted over a 12-week period, may contribute to improvements in gross motor function and overall functionality in children with special needs, particularly in domains that can be quantified through instruments sensitive to functional changes.

Conclusions

Infantile cerebral palsy represents a complex neurological condition frequently associated with significant functional limitations that affect motor development, autonomy, and the child's participation in daily activities. Considering the non-progressive but permanent nature of the condition, early, structured, and continuous therapeutic intervention plays an essential role in reducing functional impairments and preventing secondary complications, thereby contributing to the optimization of the child's functional potential.

The results of the study confirm the effectiveness of an integrated physiotherapy and occupational therapy approach in improving gross motor function and overall functionality in children with cerebral palsy. The significant increases in GMFM-88 and PEDI-CAT scores demonstrate the positive impact of the intervention on mobility and performance in activities of daily living, while the stability of the functional classifications (GMFCS and MACS) reflects the realistic nature of the progress achieved within a 12-week intervention period. These findings support the need for the implementation of integrated rehabilitation programs tailored to the individual needs of children with cerebral palsy.

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