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Isabela Zeringotha Almeida de Sousa

PROGRAMA DE INTERVENÇÃO PRECOCE CENTRADO NA FAMÍLIA PARA CRIANÇAS BRASILEIRAS COM PARALISIA CEREBRAL: Um estudo de coorte

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Trabalho de Conclusão do Curso de Graduação em Terapia Ocupacional da Escola de Educação Física, Fisioterapia e Terapia Ocupacional, da Universidade Federal de Minas Gerais, como requisito parcial para a obtenção do Título de Bacharel em Terapia Ocupacional.

Orientador(a): Prof. Dr. Rafael Coelho Magalhães

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RESUMO

A literatura mostra que as crianças que se submetem a um tratamento precoce e contínuo apresentam progressos em relação aos objetivos inicialmente propostos e melhoram seu desempenho ao longo das sessões. Além disso, o envolvimento e a parceria dos pais no tratamento são muito importantes, pois as interações no ambiente familiar têm implicações no desenvolvimento da criança, e é em casa que a prática terapêutica continua, fora do ambiente clínico. O objetivo deste estudo foi analisar se as crianças submetidas a tratamento precoce e intensivo, junto à programas domiciliares, apresentam melhores resultados na promoção do desenvolvimento neuropsicomotor do que as crianças submetidas a tratamento convencional. Trata-se de um estudo de coorte retrospectivo em uma instituição de Belo Horizonte – Minas Gerais. Participaram deste estudo 60 crianças com PC, com quase 18 meses de idade. Estas crianças foram divididas em dois grupos: 30 crianças com PC para o grupo de reabilitação intensiva e 30 crianças com PC para o grupo de reabilitação convencional. O grupo de reabilitação intensiva realizou cinco sessões semanais de três horas com Terapia Ocupacional, Fisioterapia e Fonoaudiologia. O grupo de reabilitação convencional continuou a fazer reabilitação de baixa frequência com sessões semanais individuais de Terapia Ocupacional, Fisioterapia e Fonoaudiologia e a prestação tradicional de cuidados da instituição. A Medida Canadense de Desempenho Ocupacional (COPM) e a Escala Bayley de Desenvolvimento Infantil-III (BSID-III) foram utilizadas para identificar objetivos funcionais e avaliar o desenvolvimento neuropsicomotor, respetivamente. A mediana dos resultados do pós-teste foi significativamente superior à mediana dos resultados do pré-teste nas escalas de desempenho e satisfação da COPM para o grupo de reabilitação intensiva ($p < 0,0001$). A frequência de atendimento foi positivamente correlacionada com as pontuações das escalas BSID-III motoras (grossa e fina), de comunicação receptiva e cognitiva. Sugere-se que o programa intensivo de reabilitação centrado na família melhorou significativamente o DNPM e alterou a percepção da família sobre sua satisfação e sobre o desempenho de seus filhos.

Palavras-chave: Paralisia cerebral. Intervenção precoce. Desenvolvimento neuropsicomotor. Prática centrada na família.

ABSTRACT

The literature shows that children who undergo early and continuous treatment make progress in relation to the objectives initially proposed and improve their performance over the course of the sessions. In addition, the involvement and partnership of parents in treatment is very important, as interactions in the family environment have implications for the child's development, and it is at home that therapeutic practice continues, outside of the clinical environment. The aim of this study was to analyze whether children undergoing early and intensive treatment, together with home-based programs, have better results in promoting neuropsychomotor development than children undergoing conventional treatment. This is a retrospective cohort study in an institution in Belo Horizonte - Minas Gerais. Sixty children with CP who were almost 18 months old took part in this study. These children were divided into two groups: 30 children with CP for the intensive rehabilitation group and 30 children with CP for the conventional rehabilitation group. The intensive rehabilitation group had five weekly three-hour sessions with Occupational Therapy, Physiotherapy and Speech Therapy. The conventional rehabilitation group continued to do low-frequency rehabilitation with weekly individual sessions of Occupational Therapy, Physiotherapy and Speech Therapy and the institution's traditional provision of care. The Canadian Occupational Performance Measure (COPM) and the Bayley Scales of Infant Development-III (BSID-III) were used to identify functional goals and assess neuropsychomotor development, respectively. The median post-test scores were significantly higher than the median pre-test scores on the performance and satisfaction scales of the COPM for the intensive rehabilitation group ($p < 0.0001$). Attendance was positively correlated with scores on the BSID-III motor (gross and fine), receptive communication and cognitive scales. It is suggested that the intensive family-centered rehabilitation program significantly improved the NPMD and altered the family's perception of their satisfaction and their child's performance.

Keywords: Cerebral palsy. Early intervention. Neuropsychomotor development. Family-centered practice.

LISTA DE FIGURAS/TABELAS

LISTA DE ABREVIATURAS/SIGLAS

BSD-III - Bayley Scales of Infant Development-III

COPM - Canadian Occupational Performance Measure

CP - Cerebral Palsy

CT - Computed tomography

GMFCS - Gross Motor Function Classification System

NPMD - Neuropsychomotor Development

SCP - Spastic Cerebral Palsy

SUMÁRIO

APRESENTAÇÃO

O atual trabalho segue o regulamento estabelecido pelo Curso de Graduação em Terapia Ocupacional da Escola de Educação Física, Fisioterapia e Terapia Ocupacional (EEFFTO) da Universidade Federal de Minas Gerais (UFMG), de 29 de outubro de 2012. O referente trabalho segue o formato de artigo e está redigido conforme as regras para submissão do periódico *Physical and Occupational Therapy in Pediatrics*, o artigo se encontra escrito em inglês devido às normas do periódico citado e será submetido à publicação após considerações da banca examinadora.

Family-Centered Early Intervention Program for Brazilian Infants with Cerebral Palsy: A Cohort Study[1]

INTRODUCTION

Cerebral palsy (CP) refers to a heterogeneous group of disorders, related to non-progressive conditions, that affect fetal or early infant neurodevelopment. CP is characterized by motor disorders of movement and/or posture, which are accompanied by disorders of sensation, perception, cognition, communication, behaviour and epilepsy, as well as secondary musculoskeletal problems (Nemanich *et al*., 2019; Marques *et al*., 2023). Based on the predominant neuromotor impairment, CP can be categorized into spastic, dyskinetic or ataxic (Magalhães *et al*., 2019). The spastic form is also further classified as unilateral or bilateral, according to the motor involvement. Frequently there are associated impairments of cognition, communication, perception, behavior, and/or seizures (Patel *et al*., 2020; Magalhães *et al*., 2024).

The estimated incidence of cerebral palsy (CP) ranges from 1.4 to 1.8 per 1,000 live births in high-income countries. In low- and middle-income countries, the incidence ranges from 2.95 to 3.4 per 1,000 live births (Chauhan *et al*., 2019; Galea *et al*., 2019). In Brazil, records related to incidence, prevalence and clinical characterization are precarious throughout the country (Leite *et al*., 2022). However, gestational problems, poor nutritional conditions of mothers and children and inadequate medical care before, during and after childbirth are factors that may be related to the occurrence of cases of CP (Fahey *et al*., 2017; Mancini *et al*., 2004). Although children with CP may have predictable changes in the musculoskeletal system, the impact of CP also covers the functionality of individuals. This factor influences their independence in activities of daily living, playing and social participation (Jackman *et al*., 2022).

The literature shows that children who undergo early and continuous treatment show progress in relation to the objectives initially proposed and achieve better performance throughout the sessions (Mccoy *et al*., 2019; Tebani, & Marret, 2021). In addition, the involvement and partnership of parents in treatment is very important. It is in the family context that the child's life takes place, and it is the family members who

[1] Artigo formatado de acordo com as normas de submissão do periódico *Physical and Occupational Therapy In Pediatrics* (https://www.tandfonline.com/toc/ipop20/current).

provide information about the child's environment and the difficulties encountered on a daily basis (Gafni-Lachter, & Ben-Sasson, 2022). Thus, the family and the therapist are together in the rehabilitation process, as interactions in the family environment have implications for the child's development, and it is at home that therapeutic practice continues, outside of the clinical environment (Araújo *et al*., 2018; Popova *et al*., 2022).

Regarding the treatment intensity of children with CP, the literature shows that it is important to consider the necessary dose of practice, since different interventions may require more or less practice to be successful (Law *et al*., 2012; Jackman *et al*., 2022). In many contexts, intensive or high dose interventions may not be a reality, often due to historical models and service availability, funding constraints, and family time commitment. The optimal dose of intervention will vary, depending on the individual, the goal complexity and the intervention type (Bailes *et al*., 2008; Jackman *et al*., 2022).

In general, when the intervention focuses on specific goals, a minimum dose of 15 to 25 hours of practice may be required, and more than half of this practice can be conducted by the family. However, if the intervention goal includes the more generalized improvement of motor ability rather than a specific functional goal, it is likely that a minimum dose of more than 40 hours of practice is required (Novak *et al*., 2020). Therefore, despite the existing research, there are still doubts about the ideal intensity of rehabilitation sessions to optimize results in each type of intervention. Studies do not consistently show the differences between intensive treatment and conventional treatment. Furthermore, it is necessary to understand exactly how and why one type of treatment can provide better and more significant results in the performance of children with CP over the other.

In order to broaden our knowledge about the ideal dose of rehabilitation sessions for children with CP, the aim of this study was to analyze whether children who undergo early and intensive treatment, with home-based programs included, show better results in promoting neuropsychomotor development than children who undergo conventional treatment.

METHODS

Study Design and Ethics.

The present, prospective, cohort study was conducted from January to July 2023 at a Brazilian philanthropic multi-professional and patient-centered institution, specialized in a wide range of areas including rehabilitation medicine, occupational, physical, psycho and speech therapies and social work, for children and teenagers diagnosed with neurological and neurodevelopmental disorders. This study adheres to the STROBE guidelines for observational research (von Elm *et al*., 2018). We have assessed the outcomes of two pre-existing early intervention rehabilitation programs within this institution, as detailed below.

This study was approved by the Ethics Committee of Federal University of Minas Gerais under the protocol CAAE 56771316.7.0000.5149. Parents or legal guardians of all children signed a written informed consent document.

Participants

This institution conducts evaluations twice a year and periodically admits children to the rehabilitation service based on their chronological registration date on the waiting list. When openings become available, children are selected from the waiting list in order. The institution's social workers manage family contacts and oversee the waiting list. The research team did not have prior access to or influence over the institution's processes. Furthermore, the study did not impact the admissions process or the management of the waiting list for any intervention services.

72 children, who were almost 18 months of age, were identified for receiving care in early intervention therapy program at baseline. These children were enrolled in one of the two existing rehabilitation programs provided by the service, namely, the intensive rehabilitation program and the conventional rehabilitation program. All children were evaluated by a pediatric neurologist that categorized the type of CP and classified the motor severity, as described by the Gross Motor Function Classification System (GMFCS) (McDowell, 2008). Computed tomography (CT) neuroimaging was used to evaluate brain topography and lesion sizes. These data were only used to characterize our participants.

Children diagnosed with any of following conditions were excluded: (i) established diagnosis of non-CP genetic syndromes or other associated diseases, such as arthrogryposis, myopathy, and metabolic anomalies; (ii) had a Botox injection previously or during the study.

A total number of 60 children with CP match with the inclusion and exclusion criteria. The sample consisted of two groups of children who were allocated by the institution itself, according to the distribution of vacancies and the order of the waiting list (the first 30 children on the list filled the vacancies in the intensive program and the rest filled the 30 vacancies in the conventional program). Thus, the first group was called the intensive rehabilitation group and the second the conventional rehabilitation group.

Based on a study by George *et al*. (2015), which investigated the association between brain function and NPMD in children at risk of abnormal development, a minimum of 30 children with CP in the intensive rehabilitation group (enrolled in the intensive program five times a week) and 30 children with CP in the conventional rehabilitation group (enrolled in the traditional program once or twice a week) were included to ensure a sampling error of 5% and 95% reliability. All recruited patients underwent assessments based on our inclusion criteria.

The intensive rehabilitation group was compared to the conventional rehabilitation group. Clinical characteristics of the subjects are showed in Table 1.

MEASURES

Therapeutic Goals of Intervention

The primary outcome measure was the Canadian Occupational Performance Measure (COPM) (Law *et al*., 1998). COPM was used to identify functional goals of the families and to measure their perception of change in infants' performance and their satisfaction with this performance (Law *et al*., 1998). We interviewed the primary caregiver, who established the functional goals for their infants and scored their child's performance and their level of satisfaction (1–10 scale) in each activity. The minimum clinically significant change for the COPM is a change of 2 (Law *et al*., 1998).

Neuropsychomotor Development Assessment

Bayley Scales of Infant and Toddler Development – Third Edition (BSID-III) (Bayley, 2006) was applied by a trained professional to evaluate development. BSID-III is a standardized scale that evaluates the development of children, who range from 1 to 42 months of age (Bayley, 2006). We only applied the motor, language and cognitive scales. Scale scores, as defined in the manual according to the Index Score, were used for our statistical analysis.

This evaluation was performed at two different time-points: at enrollment (when children were around 12 months of age [baseline]) and after intensive intervention (when they were 18 months of age). We corrected for gestational age when dealing with preterm children.

Procedures

Children admitted to the institution's rehabilitation service that matched our inclusion and exclusion criteria were invited to enroll in this study. Study protocols were explained and informed consent forms were signed. Data regarding these children's birth history and clinical conditions and rehabilitation outcomes were collected. By 18 months of age, these children enrolled into a rehabilitation program, which included five three-hour sessions weekly. This intensive rehabilitation program encompasses two main elements: (i) goal-direct training and (ii) home activities to improve developmental skills based in a family-centered care (Novak & Honan, 2019) (Figure 1). Therapists analyzed and graded the complexity of the activities according to each child's abilities. Parents and caregivers attended these sessions to incorporate these activities into their daily routine. Home environment guidelines were shown, described, and delivered to each child as a booklet, weekly. All interventions were planned and discussed in a professional team (physical therapist, occupational therapist, and speech therapist) meeting every week. Devices, including wheelchairs and orthoses, were available to each child if necessary.

The conventional rehabilitation group did not engage in any intensive rehabilitation program during the study. These children were still on in low frequency rehabilitation with traditional provision of care from the center. This rehabilitation program included weekly individual physiotherapy, occupational therapy and speech therapy sessions, that lasted 45 minutes each and were conducted by a specialist.

The institution rehabilitation programs were planned by international clinical practice guideline for interventions to improve physical function for children and young people with CP (Jackman *et al*., 2021).

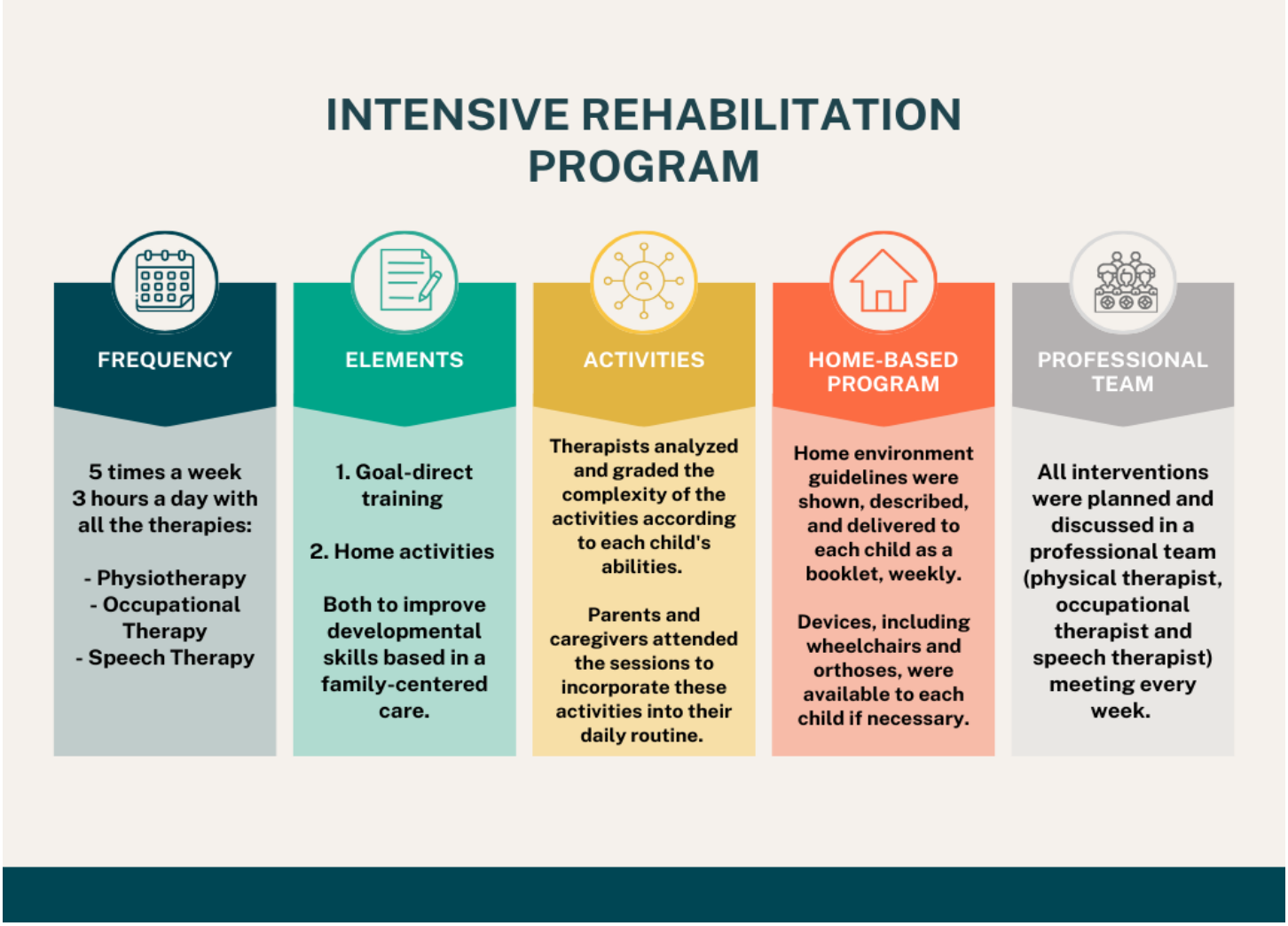

Figure 1 Intensive Early Intervention Program offered to 30 children with CP.

Data Analysis

Statistical analyses were performed using IBM SPSS Statistics® version 21.0 and Prism® version 5.0. Qualitative variables were expressed in absolute frequencies and percentages. We verified whether variables followed a gaussian distribution via the Shapiro Wilk test. Non-parametric variables were shown as median and interquartile ranges (1st quartile – 25th percentile and 3rd quartile – 75th percentile). Unpaired Student t test or Mann-Whitney tests were used to compare two independent groups, (depending on the variable distribution). Paired Student t test or Wilcoxon test compared pre- and post-treatments within the same group. Qualitative variables from

both groups were compared by either the Pearson's chi-squared test or the Pearson Exact's asymptotic chi-squared test (according to variable distribution).

RESULTS

Clinical Characteristics

Seventy-two children who enrolled in one of the early intervention programs at this institution were recruited to participate in the study. Out of these, 12 were excluded based on the exclusion criteria established for this study. From 60 children included in this study, 29 (48,3%) were girls and 31 (51,7%) were boys. 30, out of these 60 children, were part of the rehab-group and 30 children were part of conventional rehabilitation group. Both groups were matched by age and sex, as shown in Table 1. There was no difference between the groups regarding diagnosis, CP classification, and injury type. Both groups did not differ in gestational age, birth weight, baseline and final of the study weights.

Table 1 – Clinical characteristics of children with CP that received early intervention of rehabilitation program (intensive rehabilitation group and non-intensive rehabilitation group).

Characteristics n(%)	Intensive rehabilitation group (n= 30)	Non-intensive rehabilitation group (n = 30)	p value
Sex			0.5567
Female	14 (46.7)	15 (50.0)	
Male	16 (53.4)	15 (50.0)	
At birth			
Birth weight	2755 (1779;3100)*	2828 (2466;3251)*	0.1705*
Gestational age	38 (32;39)*	39 (33;40)*	0.0754*
Apgar 1'	6 (3;8)*	6 (5;8)*	0.2605*

Apgar 5'	8 (5;9)*	7 (6;9)*	0.4858*
First time point			
Age	18 (18;18)	18 (18;18)*	1.000*
Body weight	9700 (8500;11030)	9950 (8575;10250)*	0.6454*
Adequate weight	18 (60.0)	19 (63.3)	
Low weight	6 (20.0)	7 (23.3)	
Very low weight	6 (20.0)	4 (13.3)	
Rehabilitation frequency	5 (5;5)	2 (2;2)	**<0.0001**
Second time point			
Age	18 (24;24)	18 (24;24)*	1.000*
Body weight	10550 (8800;11300)	10700 (9050;10850)*	1.000*
Adequate weight	19 (63.3)	20 (66.7)	
Low weight	5 (16.7)	6 (20.0)	
Very low weight	6 (20.0)	4 (13.3)	
Rehabilitation frequency	5 (5;5)	2 (2;2)	**<0.0001**
Diagnostic			0.6975
SCP Bilateral	16 (53.4)	18 (60.0)	
SCP Unilateral	6 (20.0)	5 (16.7)	
CP Dyskinetic	4 (13.3)	5 (16.7)	
CP Ataxic	4 (13.3)	2 (6.6)	
Cause			0.3211
Hypoxia	20 (66.7)	18 (60.0)	

Preterm birth	10 (33.3)	12 (40.0)	
GMFCS			0.9600
I	2 (6.7)	2 (6.7)	
II	2 (6.7)	3 (10.0)	
III	5 (16.6)	4 (13.3)	
IV	9 (30.0)	11 (36.7)	
V	12 (40.0)	10 (33.3)	
Medication			0.2871
None	4 (13.3)	2 (6.7)	
Anti-spastic	10 (33.3)	10 (40.0)	
Antiepileptic	4 (25.0)	3 (10.0)	
Antiepileptic polypharmacy	8 (26.7)	10 (33.3)	
Anti-spastic + Antiepileptic polypharmacy	4 (13.3)	5 (16.7)	
Computed Tomography			0.1232
Occipital encephalomalacia	2 (6.7)	2 (6.7)	
Parietal encephalomalacia	3 (10.0)	3 (10.0)	
Frontal encephalomalacia	0 (0.0)	4 (13.3)	
Bilateral encephalomalacia	7 (23.3)	3 (10.0)	
Cortical hypotrophy	7 (23.3)	7 (23.3)	
Ventricular system dilatation	5 (16.7)	6 (20.0)	
Leukomalacia	5 (16.7)	3 (10.0)	

Cerebellar atrophy	1 (3.3)	2 (6.7)

CP = Cerebral Palsy; **SCP** = Spastic Cerebral Palsy; **GMFCS** = Gross Motor Function Classification System. Values are expressed in numbers of individuals and percentage for categorical variables. Chi-square test of Pearson or asymptotic chi-square test of Pearson Exact was used for comparisons. *****Numerical variables are expressed as medians followed by (percentile 25 – percentile 75). Values for classification of body weight are expressed in numbers and percentages. Mann-Whitney test was used for median comparisons.

Therapeutic Goals of Intervention

The functional goals were reported by families at COPM. The median posttest scores were significantly higher than the median pretest scores on COPM performance and satisfaction scales for intensive rehabilitation group ($p < 0.0001$). On the other hand, there were no significant differences in pretest and posttest COPM median scores for performance and satisfaction in the conventional rehabilitation group ($p > 0.05$) (Table 2).

Table 2 – Comparison between median scores and measure of variance (interquartile range) in the COPM test used in the assessment of performance and satisfaction of the therapeutic goals of intervention at time-point 1 (baseline) and time-point 2 (after six months of intervention) in children with cerebral palsy that received early intervention of rehabilitation (intensive rehabilitation group) and that did not receive (non-intensive rehabilitation group) early intervention on rehabilitation program

	Intensive Rehabilitation Group			Conventional Rehabilitation Group		
COPM	Time-point 1	Time-point 2	p value	Time-point 1	Time-point 2	p value

Performance	5.0 (3.25 ; 6.0)	7.0 (5 ; 8)	**P<0.0001**	5.0 (3.0 ; 6.0)	5.0 (3.0 ; 6.0)	0.9937
Satisfaction	5.0 (4.0 ; 6.0)	8.0 (6.0 ; 9.0)	**P<0.0001**	5.0 (4 ; 6.25)	5.0 (4.0 ; 6.25)	0.9938

Values are expressed as medians and (percentile 25; percentile 75). Wilcoxon test was used for comparisons between values of the same individual at both time-points.

Neuropsychomotor Development (NPMD)

At the first Time-point, there was no significant difference between both groups according to Bayley III scores. After six months of intensive rehabilitation, CP patients significantly improved their NPMD, as evidenced by higher scores at the second time point (as compared to the baseline, first, time-point). The non-intensive rehabilitation group BSID-III scores did not vary. Frequency of attendance was positively correlated to motor (gross and fine), receptive communication, and cognitive BSID-III scale scores (Table 3).

Table 3 – Comparison between scaled score in the five sub-scales of the BSID-III test used in the assessment of the neuropsychomotor development at time-point 1 (baseline) and time-point 2 (after six months of intervention) in the children with cerebral palsy that received early intervention of rehabilitation (intensive rehabilitation group) and that did not receive (non-intensive rehabilitation group) early intervention on rehabilitation program.

	Intensive Rehabilitation Group			Conventional Rehabilitation Group		
Sub-scale	Time-point 1	Time-point 2	p value	Time-point 1	Time-point 2	p value

Gross Motor	1 (1 ; 2)	2 (2 ; 3)	**P<0.0001**	1 (1 ; 3)	1 (1 ; 3)	0.9937
Fine Motor	1 (1 ; 2)	2 (2 ; 3)	**P<0.0001**	1 (1 ; 2)	1 (1 ; 2)	0.9932
Expressive Communication	1 (1 ; 3)	2 (2 ; 4)	**P<0.0001**	1 (1 ; 3)	1 (1 ; 4)	0.9937
Receptive Communication	2 (1 ; 5)	2 (2 ; 7)	**0.0001**	2 (1 ; 4)	2 (1 ; 5)	0.9938
Cognitive	1 (1 ; 3)	3 (2 ; 5)	**0.0003**	1 (1 ; 2)	1 (1 ; 3)	0.9938

Values are expressed as medians and (percentile 25; percentile 75). Wilcoxon test was used for comparisons between values of the same individual at both time-points.

DISCUSSION

Neuropsychomotor development differed significantly between our intensive rehabilitation group (children with CP who had been enrolled in the intensive rehabilitation program for 6 months) compared to our conventional rehabilitation group (children with CP enrolled in the regular rehabilitation program). The intensive rehabilitation group scored higher on the BSID-III, thus suggesting an improvement in NPMD, a fact which corroborates the study's hypothesis that children who undergo early and intensive treatment, based on family-centered practice and including home-based programs, show better results in promoting neuropsychomotor development.

In addition, the family reported a significant change in COPM in the intensive rehabilitation group and not in the conventional rehabilitation group. In this sense, there is strong evidence based on the literature on the effectiveness of intensive goal-oriented and family-focused interventions in improving the child's performance (Novak *et al*., 2013; Novak *et al*., 2020; Willis *et al*., 2018).

The patients submitted to the high-intensity intervention obtained significant improvement compared to the conventional rehabilitation group measured by the BDSI-III. This fact converges with the literature, which shows that high-dose practice in early intervention with children with CP, this practice being family-centered, is positively related to the promotion of neuropsychomotor development. (Tinderholt *et al*., 2014; Novak *et al*., 2020).

Furthermore, interventions developed in partnership with parents, using targeted home-based programs, functional training, and parental education, even in a non-home environment, have positive results in promoting the neuropsychomotor development of children with CP compared to other types of interventions (Novak, & Berry, 2014; Novak, & Honan, 2019; Popova *et al*., 2022). This corroborates our findings, since the rehabilitation group that underwent family-centered intervention and home-based programs showed relevant improvement in all assessments comparing pre- and post-treatment.

Limitations and Strengths

Our study is unique since it evaluated, high intensity and frequency rehabilitation program in children with CP at 12 months of age. We used diagnosis, image of brain lesions, and GMFCS to asses' similarities between groups, which made our comparison even stronger in regard to NPMD assessment.

This study also has limitations. Firstly, our study design did not enable us to control for all confounding factors that can influence NPMD. However, we controlled for the main confounding factors reported have an influence on NPMD (such as diagnosis, age, and sex) and all children included in this study have similar socioeconomic backgrounds. This should minimize the risk for confounding factors, considering that, they all have access to similar education, diet, and living conditions. Secondly, six months of rehabilitation may be a short time compared to the early intervention and child neurological rehabilitation program. However other studies point to the possibility of increasing skills after intervention in this period of time (Matusz *et al*., 2018; Novak *et al*., 2020).

Additionally, several studies evidence the benefits of early intervention on CP functionality improvement (Damiano & Longo., 2021; Karim *et al*., 2021).

CONCLUSION

In our study, an intensive rehabilitation program based on family-centered practice, with home programs included, suggested significant improvements in the children's NPMD and also changes in the family's perception of their child's performance and satisfaction. Thus, it is important to propose that high intensity practice, together with work focused on family goals, is beneficially associated with skill gains in children with CP.

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