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Efficacy of Physiotherapy and Conductive Education in Improving Motor Skills and Mental Function in Children with Cerebral Palsy

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Abstract

Background: Children with Cerebral Palsy (CP) often receive physiotherapy to achieve maximum motor potential and prevent secondary conditions. Conductive Education (CE) is an education programme that combines special education and rehabilitation. **Purpose:** Study the effect of physiotherapy and conductive education in development of fine, gross motor skills and mental function in the children with CP. **Subjects and Methods:** This is a prospective case study that was carried out on 105 children with CP less than 4 years old selected from outpatient clinic in National Institute for Neuro Motor System. Cases were taken consecutively from February 2019 to September 2019. A written informed consent was taken from all participants after proper explanation of the study. They were classified into three groups (group I, group II and group III) according to their age. All children are subjected to complete history taking, clinical examination, use of developmental quotient (DQ) sheet before and after 6 months of regular physiotherapy and conductive education program. **Results:** There was statistically significant improvement in fine motor, cognation and gross motor in 3 groups after 6 months of regular physiotherapy and conductive education program. The maximum improvement was in group I, so children with cerebral palsy were achieved maximum improvement when physiotherapy and conductive education started as early as possible. **Conclusion:** Significant improvement has in fine motor, cognation and gross motor in 3 groups after 6 months of regular physiotherapy and conductive education program. Early start physiotherapy and conductive education program gave us better outcome.

Keywords

Cerebral Palsy, Conductive Education, Rehabilitation

1. Introduction

Cerebral palsy (CP) is a neurological condition which can affect people in different ways, resulting in different types and levels of impairment(s). Cerebral Palsy may occur at birth where specific parts of the brain have been damaged as a result of a medical complication(s) [1].

It is not possible to diagnose CP in infants less than 6 months except in very severe cases. The patterns of various forms of CP emerge gradually with the earliest clues being a delay in developmental milestones and abnormal muscle tone [2].

Physiotherapy has long been central to the clinical management of children with these disorders. Children are often referred to physiotherapy as soon as the diagnosis is confirmed or suspected [3].

2. Aim of Work

Study the effect of physiotherapy and conductive education in development of fine, gross motor skills and mental function in the children with cerebral palsy.

3. Subjects and Methods

Subjects: The protocol was approved by the local research ethics committee of the pediatric department at Al-Azhar University for girls and a written informed consent was taken from all participants after proper explanation of the study.

This is a prospective case study that was carried out on 105 children with cerebral palsy less than 4 year selected from outpatient clinic of pediatric neurology department in National Institute for Neuro Motor System; cases were taken consecutively from February 2019 to September 2019; the inclusion criteria were conducted in the study.

Inclusion criteria:

1) Spastic cerebral palsy children (paraplegic, diplegic, hemiplegic) and atonic cerebral palsy which diagnosed by pediatric neurologist.

2) Patient should have educable and cooperative function allowing for physiotherapy.

3) Both sexes.

Exclusion criteria:

1) Both newly diagnosed and old cases. Dyskinatic and ataxic cerebral palsy children.

2) Severe behavioral disorder that could interfere with physiotherapy.

3) Other concomitant neurologic disorder or neurodegenerative disorder or muscle-skeletal disorder.

4) Profound mental retardation

Method:

During the period of the study any child come to outpatient clinic less than 4 years old his\her parent complained of delayed this child motor, mental or the child has history of any problem happened prenatal, natal and postnatal were subjected to the following: complete history taking with special emphasis on: **1)** Personal history (Full Name, birth date, age by months, sex and residence), complain, medical history (History: prenatal, perinatal, postnatal, history of maternal illness or infection during pregnancy, History of admission in NICU, The presence of co-morbid conditions like visual, hearing impairment, epilepsy, speech and behaviour abnormalities), family history, drug history and physiotherapy history. **2)** Clinical examinations, complete neurological examination and assessment as motor power and tone of the muscle in upper limp and lower limp, reflexes (superficial, deep, and pathological reflex), examination of the sensory system, ask about sphincteric control to the urine and stool.

If diagnosed cerebral palsy by pediatric neurologist and fulfill all inclusion criteria, we Used of Developmental quotient (DQ) sheet: The DQ has been performed twice to the patient 1st before starting in physiotherapy and conductive education and the 2nd one after 6 months of regular of physiotherapy and rehabilitation program then we compared between two. Scores on these developmental scales were used to calculate a developmental quotient (DQ) according to the formula: **DQ = (months corresponding to test performance) × 100/(the child's chronological age in months)**

The scores is take from text book called *Developmental Programming for Infants and Young Children* Designed by (University of Michigan Press ELT, 1981) for children functioning in the 0-to-36-month developmental age range, this score sheet is designed to permit small increments in a child's skills to be frequently noted and a child's development to be graphically displayed.

4. Results

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Table 1 and Figure 1, Figure 2: demonstrate the demographic data (age, sex and consanguinity) of cerebral palsy children. The age was classified as following (group I any child diagnosed as CP his\her age less than 12 months, group II ranged between 13 months to 23 months and group III ranged between 24 months to 48 months.

The male was predominant represented 58.03% while the female represented 41.9%.

The negative consanguinity was predominant represented 68%, 1% and 58% respectively in the 3 groups.

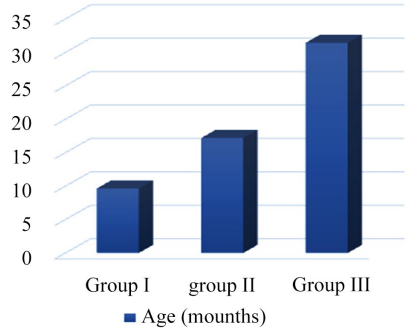

Figure 1. Age in 3 groups.

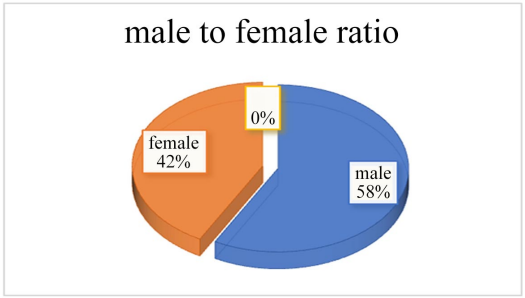

Figure 2. Male to female ratio.

Table 1. Comparison between group I, group II and group III regards demographic data.

		Group I (≤12 months)		Group II (13 months - 23 month)		Group III (≥24 month)		Chi square test/ ANOVA test**	
								X^2/f**	P value
Sex	Female	13	37.1%	16	47.1%	15	41.7%	0.698	0.705
	Male	22	62.9%	18	52.9%	21	58.3%		
Cons	Negative	24	68.6%	21	61.8%	21	58.3%	0.822	0.663
	Positive	11	31.4%	13	38.2%	15	41.7%		
Age (months)	Mean ± SD	9.63 ± 1.97		17.18 ± 2.93		31.42 ± 6.47		235.945**	<0.001**

Table 2 and **Figure 3**: demonstrate according to the natal and post-natal history, the largest percentage in risk factor in the 3 groups was a history of incubated by respiratory distress that shown 51% in a group I, 35% in a group II and 33% in a group III. 6% in a group I, 15% in a group II and 6% in group III.

Table 3 and **Figure 4**: illustrate the clinical picture and fits in the 3 group. Showing 77% of group I, 85% … of … group II and 75% … of group III presented by spastic cerebral palsy. In comparison of 3 groups according to associated fits it was positive or present in 37% in a group I, 12% in a group II and 14% in a group III

Table 4 and **Figure 5** show there was statistically significant improvement in fine motor, cognation and gross motor in group I, II and III after 6 months of

regular physiotherapy and conductive education program. There was statistically significant increase in improvement in group I in comparison to group II and group III by use developmental quotient before and after 6 months of physiotherapy and conductive education session.

Table 5 and Figure 6 show there is a significant improvement in fine motor, cognation and gross motor in children with cerebral palsy when start physiotherapy a conductive education early as possible.

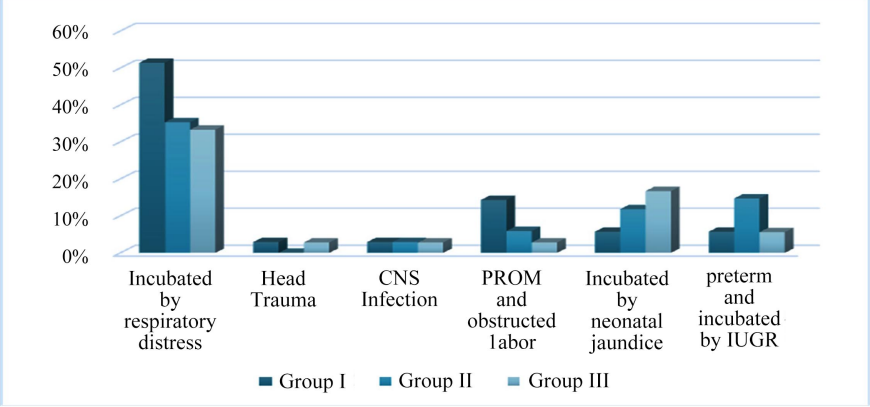

Figure 3. Risk factors of cerebral palsy children.

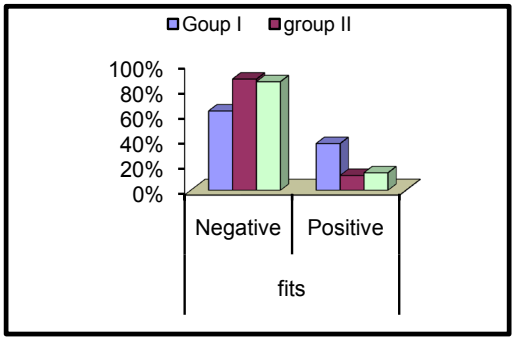

Figure 4. Fits in cerebral palsy children.

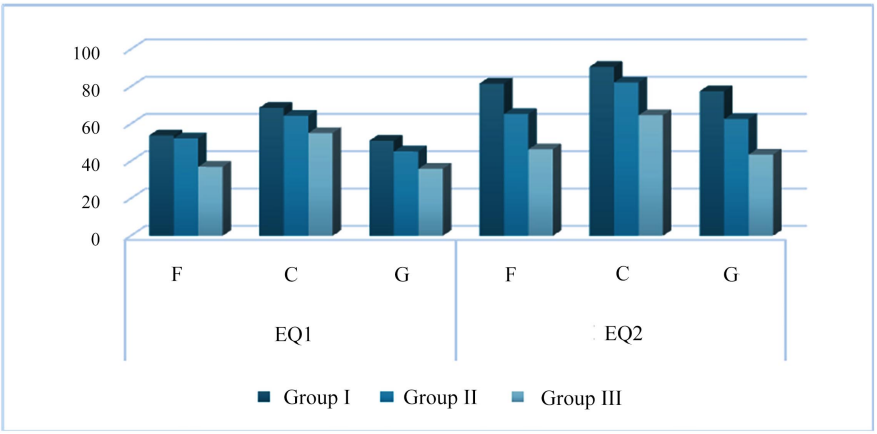

Figure 5. Developmental quotient results before starting physiotherapy and conductive education session and 6 months after this session in **group I**, **II** and **III**.

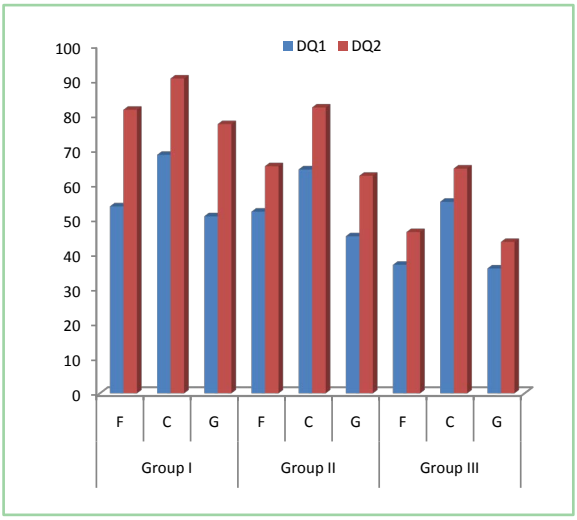

Figure 6. Improvement in fine motor, cognation and gross motor in children with cerebral palsy.

Table 2. Comparison between group I, group II and group III as regarding the risk factors.

	Group I (≤12 ms)		group II (13 ms - 23 ms)		Group III (≥24 ms)		Chi square test	
	No	%	No	%	No	%	X^2	P value
History of Incubation by respiratory distress	18	51.4%	12	35.3%	12	33.3%	2.885	0.236
Head Trauma	1	2.9%	0	0.0%	1	2.8%	0.977	0.614
CNS Infection	1	2.9%	1	2.9%	1	2.8%	0.002	0.999
PROM and obstructed labor	5	14.3%	2	5.9%	1	2.8%	3.555	0.169
Incubated by neonatal jaundice	2	5.7%	4	11.8%	6	16.7%	2.109	0.348
Prematurity incubated by IUGR	2	5.7%	5	14.7%	2	5.6%	2.415	0.299

Table 3. Comparison between group I, group II and group III as regards clinical picture and fits. and fits.

		Group I (≤12 ms)		group II (13 ms - 23 ms)		Group III (≥24 ms)		chi square test	
		No	%	No	%	No	%	x^2	p value
CL/p	**Atonic**	8	22.9%	5	14.7%	9	25.0%	1.234	0.540
	Spastic	**27**	**77.1%**	**29**	**85.3%**	**27**	**75.0%**		
	• Diplegic	18	66.7%	21	72.4%	22	81.5%		
	• Hemiplegic	6	22.2%	7	24.1%	5	18.5%	0.893	0.925
	• Quadriplegic	3	11.1%	2	6.9%	2	7.4%		
Fits	Negative	22	62.9%	30	88.2%	31	86.1%	8.357	0.015
	Positive	13	37.1%	4	11.8%	5	13.9%		

Table 4. Comparison in developmental quotient results before starting physiotherapy and conductive education session and 6 months after this session in **group I**, **II** and **III**.

		Group I (≤12 ms)		Group II (13 ms - 23 ms)		Group III (≥24 ms)		One way ANOVA	
		Mean	SD	Mean	SD	Mean	SD	F	p value
Developmental quotient result before starting physiotherapy and conductive education session	Fine motor	53.74%	18.53%	52.21%	19.78%	36.94%	18.29%	8.452	<0.001
	Cognition	68.54%	21.59%	64.35%	20.55%	55.06%	22.11%	3.686	0.028
	Gross motor	50.89%	21.66%	45.15%	20.76%	35.88%	17.86%	4.846	0.001
Developmental quotient result 6 months after physiotherapy and conductive education session	Fine motor	81.51%	23%	65.29%	24.67%	46.36%	20.96%	20.987	<0.001
	Cognition	90.51%	17.12%	82.18%	23.44%	64.61%	23.79%	13.236	<0.001
	Gross motor	77.4%	17.65%	62.53%	19.35%	43.5%	24.28%	24.011	<0.001

fine motor before and after program in group I; fine motor group II; Fine motor group III; cognation before and after program in group I; cognation group II; cognation group III; gross motor before and after program in group I; gross motor group II; gross motor group III.

Table 5. Percentage of improvement in fine motor, cognation and gross motor between group I, group II and group III regards developmental quotient before and after 6 months of physiotherapy and conductive education session.

		Developmental quotient results before starting physiotherapy and conductive education session		Developmental quotient result 6 months after physiotherapy and conductive education session		Percentage of improvement
		Mean	SD	Mean	SD	
Group I (≤12 ms)	Fine motor	53.74	18.53	81.51	23	27.77%
	Cognation	68.54	21.59	90.51	17.12	21.97%
	Gross motor	50.89	21.66	77.4	17.65	26.51%
Group II (13 ms - 23 ms)	Fine motor	52.21	19.78	65.29	24.67	13.08%
	Cognation	64.35	20.55	82.18	23.44	17.83%
	Gross motor	45.15	20.76	62.53	19.35	17.38%
Group III (≥24 ms)	Fine motor	36.94	18.29	46.36	20.96	9.42%
	Cognation	55.06	22.11	64.61	23.79	9.55%
	Gross motor	35.88	17.86	43.5	24.28	7.62%

Percentage of improvement in fine motor in 3 groups; Percentage of improvement in cognation in 3 groups; Percentage of improvement in gross motor in 3 groups.

5. Discussion

Cerebral palsy has always been known as a disorder of movement and posture

resulting from a non-progressive injury to the developing brain [4]. The aim of work of the current study was to study the effect of physiotherapy and conductive education in development of fine, gross motor skills and mental function in the children with cerebral palsy. For this study, 105 children with cerebral palsy less than 4 year selected from outpatient clinic of pediatric neurology department in National Institute for Neuro Motor System.

In the present study (58.03%) of the children with CP were males suggesting a male predominance. This result was compatible with the result published in Australian Cerebral Palsy Register (ACPR) where data demonstrated that male s are at higher risk of developing cerebral palsy as 56.4% of cohort study were males [5]. Males born very preterm also appear to be more vulnerable to white matter injury and intraventricular hemorrhage than females. Experimental studies in adult animals and data from adult patients with stroke indicate that sex hormones such as estrogens provide protection against hypoxic-ischemic injury, and the neonatal brain is also influenced by these hormones, this is why male more liable to cerebral palsy than female [6].

As regards 37% of our studies case have positive history of consanguinity. Which agreed with [7] who studied that consanguinity and birth deficits in other family members were positively associated with cerebral palsy (OR = 4.62; 95% CI: 2.07 - 10.3 and OR = 12.7; 95% CI: 3.13 - 51.7 respectively), suggesting a possible genetic link.

In our study we classified the patients into 3 group the first group age was less than 1 years old and second group age ranged from 1 years to 2 years old while the third group was more than 2 year. [8] and [9] suggested that CP could be confirmed at the age of 2 years with sufficient reliability. But another study by [10] supports the choice of 5 years as an appropriate age to ensure that the condition is non-progressive. However, many recent studies confirmed that Cerebral palsy is a clinical diagnosis based on a combination of clinical and neurological signs, diagnosis typically occurs between age 12 and 24 months and early detection of CP should be considered for early management (early intervention programs) and so for a good prognosis [10] and [11].

Regarding the natal and post natal history the most common risk factors were the history of incubation by respiratory distress which was 51.4% in group I, 35.3% in group II, 33.3% in group III. this is in agreement with [12] who reported the cerebral palsy was diagnosed in six of 257 unventilated newborns (2.3%), 30 of 320 ventilated newborns without hypocapnia (9.4%), and 22 of 80 ventilated newborns with hypocapnia (27.5%), Two additional ventilatory risk factors for disabling cerebral palsy were found hyperoxia and prolonged duration of ventilation, In a multivariate analysis, each of the three ventilator variables independently contributed a 2-to 3-fold increase in risk of disabling cerebral palsy, These risks were additive. Although duration of mechanical ventilation in very low birth weight newborns likely represents severity of illness, both hypocapnia and hyperoxia are largely controlled by ventilatory practice.

In our study the present of concomitant fits was represented 37.1% in group I, 11.8% in group II and 13.9 in group III, this indicated the fits disappear with increase of age. In the study of [13] Forty-one children (25%) had seizures beyond the neonatal period. Four children had West syndrome, which resolved with treatment. Thirteen children had febrile seizures that they outgrew. Thirty children had focal epilepsy with seizure manifestations and EEG discharges typical of early-onset childhood occipital epilepsy or childhood epilepsy centrotem spikes; 23 have outgrown these seizures. Two children had idiopathic generalized epilepsy; it was ongoing in 1 child. Fourteen children had evolution from 1 epileptic syndrome to another. At last follow-up (median age, 12.7 years; minimum age, 9.7 years), 80% had not had a seizure for >2 years, The electro clinical features of seizure disorders associated with CP and WMI are those of the age-limited, epileptic syndromes of childhood, with favorable outcome in the majority, The findings have important implications for counseling and drug treatment.

Our study showed that improvement in fine motor was 27.77% in group I, 13.08% in group II, 9.42% in group III and the improvement in cognation was 21.97% in group I, 17.83% in group II, 9.55% in group III after 6 month of 3 session weekly of conductive education, This was a significant improvement in fine motor and cognation in the three group of children with cerebral palsy and the group I was highest percentage in improvement than group II and III this were evident a significant improvement in fine motor and cognation when conductive education program started as early as possible. in the study done by [14] of early developmental intervention programmes that began within the first 12 months of life for infants born before 37 weeks' gestational age follow up by DQ sheet, cognitive outcomes at infancy and at school age was significant, showed a significant effect in favour of early developmental interventions at infancy only.

In the present study the improvement in gross motor was 26.51% in group I, 17.38% in group II, 7.62% in group III after 6 month of 3 session weekly of physiotherapy, this was showed a significant improvement gross motor in the three studied groups of children with cerebral palsy and the group I was highest percentage in improvement than group II and III this concluded a significant improvement in gross motor when start physiotherapy as early as possible.

This agreement with [15] who reported Early Physical Therapy Treatment shows better results on Improvement of GMFCS Score in Different Types of Cerebral Palsy Patients, in his study that conducted on 30 preterm infant after discharge from hospitals, briefed the parents on the objective and contents of physiotherapy treatment, infants will assess in GMFCS, Assessment of the initial performance is follow by the infants receive Early Physiotherapy Intervention for 1 hour daily for 4 year, Regular neurological follow up after 1 year, Second assessment will be done after 1 year and third assessment will be done after 1 year. [16] reported in his study which done in Children with CP in 2015 at Kenyatta National Hospital (KNH) in Kenya, there is a relatively high incidence of children under 6 years with CP, which highlights the need for the provision of

early intervention and rehabilitation. There was a lack of a multidisciplinary team (MDT) approach to the rehabilitation process for young children with cerebral palsy, and limited techniques were used during therapy.

Furthermore a study done by [17] conducted that early diagnosis begins with a medical history and involves using neuroimaging, standardized neurological, and standardized motor assessments that indicate congruent abnormal findings indicative of cerebral palsy, Clinicians should understand the importance of prompt referral to diagnostic-specific early intervention to optimize infant motor and cognitive plasticity, prevent secondary complications, and enhance caregiver well-being.

On the other hand, a study done by [18] showed lasting benefits of early intervention, this evidence is not sufficient to exclude the value of early intervention. The main reasons for this are the lack of precision in identifying infants for intervention studies and insufficient difference between the interventions offered to the intervention and control group. Although we realize that early identification of all infants with CP in the general population will not be possible, we propose a research agenda directed at large-scale identification of infants with early signs of CP and testing of high-intensity, early interventions in which the infant actively participates.

6. Conclusion

Significant improvement has in fine motor, cognation and gross motor in group I, II and III after 6 months of regular physiotherapy and conductive education program. Early start physiotherapy and conductive education program gave us better outcome.

7. Recommendation

1) Infants who have any risk factor for development of cerebral palsy should be monitored by pediatric neurologist to follow up this infant every 2 months by developmental quotient.

2) If the child diagnosed as cerebral palsy must be started physiotherapy and conductive education program early as possible and regular in this session to reach to the maximum level of improvement.

3) Further studies on large number are needed to determine which early developmental interventions are the most effective in improving cognitive and motor outcomes.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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