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Research Article

Is there a Place for Hippotherapy in Children with Cerebral Palsy?

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Abstract

Introduction: Purpose Cerebral palsy is a disorder of movement, muscle tone and posture that is caused by damage of the developing brain. This usually led to a restriction of independence in daily living activities. One of the methods which might bring benefits for cerebral palsy children is hippotherapy. The purpose of this study was to assess the influence of hippotherapy on cerebral palsied children' posture and body function.

Material and methods: Forty-five children classified to 1 or 2 GMFCS level, with spastic diplegia or hemiplegia, aged 6-12 years were recruited. Participants were divided into three groups: study 1 (n=15), study 2 (n=15) and control (n=15). Children from study groups attended in 30 minutes hippotherapy sessions for 12 consecutive weeks, once weekly (study group l), twice weekly (study group 2). Sitting Assessment Scale (SAS) was used.

Results: Comparison of SAS shoved improvement in all children from group 1 and 2. The collected data also allowed for the distribution of changes in the assessment of body posture taking into account the type of CP, GMFCS level and age of the patient. The Fischer exact test was used to assess the significance of differences between the frequencies of various non-measurable features in groups.

Conclusion: Hippotherapy has a positive influence on body posture and individual body part function in sitting position among children with cerebral palsy. The greater improvement can be seen in the more independent, younger children with a milder type of the disease.

Keywords: Cerebral palsy; Hippotherapy; Postural control; Balance

Introduction

Cerebral palsy as a disorder of movement, muscle tone and posture cause a change in the balance of signals between the central nervous system and the muscles. This imbalance leads to increased activity in the muscles, entailing posture and change walking patterns what in consequence, causes limitation of daily activities and independence [l-4] for this reason the therapeutic process involves a number of methods and procedures that will improve the motor function of these children. In addition to traditional physiotherapy, other forms of rehabilitation are sought to complement the treatment process. One of them may by hippotherapy, where the horse becomes the main therapist. During the session child sits on animal's back and try to maintain an appropriate rider's position while the horse is walking. With every minute the horse sends to the rider many impulses which stimulate child to react and keep the position instead of falling down [5].

There is research which suggests that hippotherapy improves muscle tone, trunk control and gait patterns improvement [6-8]. The positive influence is seen in motor function and sensory processing in many diseases, including cerebral palsy. Still, there is a need to conduct studies, to better understand and evaluate the beneficial effects of hippotherapy on the various disorders that are present in many diseases.

The purpose of this study was to assess the influence of hippotherapy on children posture and individual body parts functions according to children age, GMFCS level, and type of cerebral palsy and frequency of attending hippotherapy sessions.

Material and Methods

Forty-five children (45) aged 6-12 years with spastic diplegia or hemiplegia, classified to 1 or 2 GMFCS level were included in this study. All of them were able to understand and execute simple tasks. Those, who underwent an orthopedic, neurological surgery in last 6 months, attended to other physiotherapy sessions, had contraindications for hippotherapy or were unable to understand and execute tasks, were excluded from the study.

The participants were divided into three groups: study group 1 (n=15), study group 2 (n=15) and the control group (n=15). In the study group 1 there were 6 girls and 9 boys, 3

children had diplegia, 12 hemiplegia, 10 were classified as 1 and 5 as 2 GMFCS level, mean age was 7,93 (± 2, 6). In the study group 2 there were 7 girls and 8 boys, 2 children had diplegia, 13 hemiplegia, 12 were classified as 1 and 3 as 2 GMFCS level, mean age was 7,60 (± 1, 84). In control group were 7 girls and 8 boys, 5 children had diplegia, 10 hemiplegia, 7 were classified as 1 and 8 as 2 GMFCS level, mean age was 8, 13 (± 2, 56).

The legal caregivers were informed about the study and asked for written assent before the study. Children from study groups participated in 30 minutes hippotherapy sessions once (study group 1) or twice weekly (study group 2) for 12 consecutive weeks. Sessions were individualized according to child needs and opportunities. They took place in an indoor arena (10 x 30 m) and were conducted by qualified therapeutic team. The horse was walking to the right and left for 15 minutes on each side. During first few laps in both directions child sit on horse's back and try to maintain proper rider position only, while the main therapist gave verbal instructions and manipulated child's pelvis to help rider if necessary. When the child adjusted to this situation the therapist presented exercises which the child had to perform first when the horse was standing and then during walking. Those tasks were: to lean forward and touch his left hand the right horse's ear (and vice versa), to raise straight upper limbs in front, next into the sides and rotate the trunk to the right and left, to put his hands on the back of his head, keeping the elbows wide apart. The child was supervised to perform the exercises correctly and to maintain appropriate rider position.

The final part of the ride, both right and left side, consisted of a few laps, during which the child, as at the beginning, had to sit in the correct position without exercises. All children from the study groups were present at each session. Children from the control group did not have hippotherapy; however they have a similar to the study group forms of physiotherapy.

In order to assess the children posture and function of individual body parts, a Sitting Assessment Scale (SAS) was used, in accordance with the instruction provided by Ulla Myhr [9]. Unfortunately; the assessment was not filmed because the children's caregivers did not agree for this. That is why; an assistant was included in the study. The assistant sat at the table in front of the child and determined the order of tasks, while the main investigator stood at a fixed distance from the side of the study station and carried out observations.

The child had to perform various tasks. Each of them took up to 5 minutes. During that time child could repeat task, while the investigator assessed in 4-point scale position and function of head, trunk, feet, arms and hands. Within 12 weeks, all children were subjected to the intervention described above four times. In the study group's first assessment took place prior to the first hippotherapy session, while in the control group it was performed after including child into the study. Next assessments were conducted every fourth week. Gathered information was registered in the SAS evaluation sheet and analysed with Statistical package.

Results

In order to compare changing in scores received during assessing the control of position and function of individual body parts, between the first and last examination among groups Wilcoxon's test was used. The significance level was assumed 0.05 and the statistically significant differences were found for $p<0.05$.

When comparing the assessment results with the SAS scale obtained during the first and the last examination, it was noticed that the children from study group 1 improved in almost every category (exception: foot control) (Table 1) Statistically significant differences were noted in the assessment of head and shoulder position control (in both cases, $p=0.012$) and trunk control ($p=0.005$). At the end of the study more than half of children showed correct head control, less than 50% had good control of the shoulder function, and over 70% gained 3 or 4 points for the trunk control. In the study group 2 the improvement was observed in all assessed categories (Table 1). However, statistically significant differences were noted only in the assessment of the torso control ($p=0.028$). At the end of the study, over half of examined children showed very good control of the torso setting. In the control group; the improvement of control of trunk position and hand function was noted; however, those differences were not statistically significant. At the end of the study, children who scored 3 or 4 points for trunk and hand function control accounted for nearly 87% and 67%, respectively.

Table 1: Comparison of the average values of scores in the SAS scale, for the study groups and the control group, during the 12 weeks of the study.

SAS evaluation (points)	Assessments (consecutive weeks)				
			"8"		Difference "12"-"0"
Head SG 1					
Head SG 11			3,93 ± 0,26		
Head CG	3,60 ± 0,74				
Trunk SG 1		2, 53 ± 0,74		3,00 ± 0,93	
Trunk SG 11			3,40 ± 0,74	3, 47 ± 0,64	

Trunk CG					
Foot SG 1					
Foot SG 11				2,73 ± 1,16	
Foot CG			2,53 ± 1,19		0,00 ± 0,00
Arm SG 1			2,53 ± 0,83	2,80 ± 0,86	0,53 ± 0,52
Arm SG 11		3,33 ± 1,05		3,53 ± 0,74	
Arm CG			3,00 ± 0,85		
Hand SG 1			2,40 ± 0,99		0,13 ± 0,35
Hand SG 11		3 , 53 ± 0,	3 , 53 ± 0,	3,53 ± 0,74	
Hand CG	2,80 ± 0,77	2,80 ± 0,77	2,80 ± 0,77	2,87 ± ,74	0,77 ± 0,26
TOTAL SG 1			12,40 ± 3,70		
TOTAL SG 11			16,93 ± 3,24		
TOTAL CG	14,87 ± 3,27		15,00 ± 3,30		0,27±0,46

The collected data also allowed for the distribution of changes in the assessment of body posture considering type of CP, GMFCS level and age of the patient. The Fischer exact test was used to assess the significance of differences between the frequencies of various non-measurable features in groups.

During the 12 weeks of the study, in the study group 1 we observed a lack of improvement in posture in children with diplegia. In the study group 2, also the lack of improvement of body posture in children with diplegia was more often observed (Table 2). In the control group, the lack of improvement was much more frequent in patients with hemiplegia.

Table 2: Changes in the SAS scale 2 rating fòr the type of CP.

Type of CP	**Study group 1**				**Study group 2**				**Control group**			
	no improvement		**improvement**		**No improvement**		**improvement**		**no improvement**		**improvement**	
	(N)	(0/0)	(N)		(N)		(N)		(N)		(N)	
diplegia		33,33	2	66,67		50		50	3	60	2	40
hemiplegia	1	8,33	11	91,67	5	38,46	8	61,54	8	80	2	20

Comparing the assessment of postural attitude of children with diplegia between the study group 1 and 2 there were no statistically significant differences (p=0.600). Similarly, when comparing the body posture of children with hemiplegia between these groups (p=0.087). While comparing the posture of children with diplegia between the study group 1 and the control group, no statistically significant differences were observed (p=0.429). However, a comparison of the body posture of children with hemiplegia between those groups showed that there were statistically significant differences (p=0.001). The improvement of the SAS score was significantly more frequent in the study group 1.

There were no primarily statistically significant differences between the SAS ratings for different GMFCS levels (p=0.287) (Table 3). At the end of the study, comparing the assessment of the body posture of children from the first level of GMFCS between the study group 1 and the control group statistically significant differences were observed (p=0.001). The comparison of the body posture assessment of children from the second level of GMFCS between study group 1 and control group showed no statistically significant differences (p=0.326). Comparing the assessment of the body posture of children from the first I and second level of GMFCS between the study group 2 and the control group, no statistically significant differences were found (p=0.073) and (p=0.509), although the improvement was more frequent in the control group 2 than the control group.

Table 3: Changes in the SAS scale Assessment for the GMFCS level

GMFCS level	Study group 1				Study group 2				Control group			
	no improvement		improvement		No improvement		improvement		no improvement		improvement	
	(N)		(N)		(N)		(N)	(0/0)	(N)		(N)	
1	o	o	10	100	5	41,67	7	58,33	6	85,71		14,29
11	2	40	3	60	2	66,67		33,33	5	62,5	3	37,5

Comparing the changing in the posture of children related to the age between the I study group and the control group; statistically significant differences were observed (p-0.000) among children between 6 and 7 years. However, a comparison of the body posture assessment of children aged 8-12 years between these groups showed that there were no statistically significant differences (p=0.379) (Table 4). Comparing the assessment of the body posture of children aged 6-7 years between the study group 2 and the control group, statistically significant differences were noticed (p=0.022). In children aged 8-12 years between these groups, there were no statistically significant differences (p=0.442).

Table 4: Changes in the SAS scale assessment in terms of age (for two age groups: 6-7 and 8-12 years).

Age ranges (years)	Study group 1				Study group 2				Control group			
	no im provement		improvement		No improvement		improvement		No improvement		improvement	
	(N)		(N)		(N)		(N)		(N)		(N)	
06-Jul		o	10	100	3	30,00	7	70,00	7	87,5		12,5
08-Dec	2	40	3	60	3	60,00	2	40,00	4	57,14	3	42,86

There was no statistically significant difference in changes in the control of body posture in terms of age between two study groups (p=0.095), (p=0.240) (Table 4).

Discussion

Hippoteraphy therapeutic horseback riding are used to describe treatment strategies that use the movement of the horse for improving postural control, balance and general function or mobility [6,10]. The main finding from our study was that hippo teraphy helps to improve body posture. As a result of observations and analyzes, it turned out that in both study groups, position and function of almost every assessed body part improved. The most pronounced changes were seen in study group 1 that had hippotherapy twice a week, where head and arm control increased significantly. While among children from study group 2 the most important changes concerned trunk control. In Shurtleffet al. studies, among children who underwent hippotherapy, anterior—posterior translation of the head and spine decreased, which may suggest better head and trunk stability. Researchers also observed improvement in upper extremities function [11,12]. Reduction of involuntary movements of head, trunk or extremities and the decrease in the muscle tone, which improved motor functions among cerebral palsied children, were presented in study by Ionatamishvili et al., who used therapeutic riding as an intervention [13]. The increase in strength, balance, and muscle tone, leading to better coordination of the movement of the upper and lower trunk, were also presented in older publications carried out with smaller number of participants or applying therapeutic horseback riding instead of hippotherapy [14].

Recently, there have also appeared studies confirming the beneficial effect of hippotherapy in children with cerebral palsy. Moraes et al. indicate that the rider influenced of stimuli coming from a moving horse and performing exercises while staying on the animal's back activates muscles, joints, vestibular system, which together lead to increase strength and range of motion of different body parts and contribute to improve postural control and review and meta-analysis conducted by Tseng et al. confirmed that short-term hippotherapy significantly reduced asymmetrical activity of the hip adductor muscles and could improve postural control in children with spastic CP, classified to I-IV level of GMFCS. However, they did not obtain sufficient evidence that long-term equine assisted therapy provide a significant benefit to those children [7]. These last statements are in contradiction with numerous studies, confirming the beneficial influence of hippotherapy on the balance, gross motor functions and functional performance, which are cited in work of Koca and Ataseven [8], or meta-analysis of the literature performed by Zadnikar et al [6]. At this point, it is worth to mention the huge study carried out by

Kwon et al. among 91 children, 4-10 years old, qualified to different GMFCS levels. They observed that hippotherapy positively affected balance and gross motor functions [15]. In our study, we assessed the effects of hippotherapy on postural control between children with diplegia and hemiplegia. We observed significant improvement among those with hemiplegia, when compared study group 1 or study group 2 with control. The benefits were also noticed during the analysis of hippotherapy influence on patients with diplegia, but they were not statistically significant.

In the, study of Ionatamishvili et al., which included patients not only with a spastic type of cerebral palsy, authors observed that effective motor activity improved after hippotherapy mostly in children with hyperkinetic than spastic CP type [13]. The reports presented above may suggest that the better benefits of hyippotherapy receive children with milder types of the disease.

The analysis of the data performed in our study showed that the improvement of body posture as a result of hippotherapy occurred both among children classified as 1 and 2 GMFCS level. However, statistically significant changes were observed only in children with I GMFCS level if compare with the results of children in the study group 1 with the control group. Hamill et al. also pointed to the lack of improvement in postural control among children with cerebral palsy, in the sitting position after hippotherapy in the standardized outcome measures. Positive results related to gross motor function and balance, not only for children with 1-111 but also for those classify as IV GMFCS level, were presented in Kwon et al. publication [15].

In our study we considered the distribution of postural changes as consequences of hippotherapy due to the age of the children. To be able to perform a statistical analysis, we divided children into younger (6-7) years old and older (8-12) years old. When comparing study group 1 or 2 with the control group, the significant improvement was observed always in the younger patients. To support our result, we can mention that Bertoti also observed better benefits of therapeutic horseback riding among younger children [14]. Despite the increased interest in the topic of the influence of hippotherapy on children with cerebral palsy, the optimal frequency of riding, which would bring the greatest benefits, still hasn't been determined. Nevertheless, it still hasn't been determined how often individual sessions should take place. That is why; we decided to verify this problem in our study. We had two study groups in which children received hippotherapy for 12 or 14 sessions. When comparing changes in body posture during 12 weeks of hippotherapy we noticed the improvement in both groups. However, considering the type of CP, there were no statistically significant differences between study group 1 and 2. Similar observations were made by analyzing the distribution of changes in terms of age ranges. In turn, the comparison of GMFCS levels showed that the improvement occurred both for the 1 and 2 levels in study group 1, but statistically significant differences were recorded only for level I. According to our knowledge there are no publications dealing with problem. Some similarity to the results we obtained can be found in the study of Moraes et al. They applied hippotherapy twice a week for 12 weeks and compared its effects on postural balance after 12 and 24 sessions. They concluded that 24 sessions were more effective than 12 sessions to improve balance [16]. We highlight that comparison and simplification of results of hippotherapy in relation to the CP type, GMFCS level or age ranges is difficult. That is why, further research should be conducted among homogeneous group of participants with using objective and standardized tools.

Conclusion

Hippotherapy could have positive influence on sitting body posture in children with cerebral palsy. The improvement, we observed in our study, included position and function of head, trunk and upper extremities. Referring to the children age, GMFCS level or type of cerebral palsy, more benefits from hippotherapy may receive younger, independently mobile and less severe involved child with CP.

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