

Effectiveness of therapeutic physical exercises in cases of spastic cerebral palsy

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Abstract:

Selection of appropriate physical exercises and the use of right methods is vital for directing the process of Adaptive Physical Education (APE). Adaptive Physical Education Specialist should understand goals of exercises, their nature, structure and the way they influence the human body. In cases of Spastic Cerebral Palsy the aim of regular physical exercises is the improvement of functional independence.

Our research objective was to define the effectiveness of regular therapeutic exercises (physical therapy) in Spastic Cerebral Palsy cases.

The research was carried out in the Medical and Educational Center of Children Neurology and Neurorehabilitation of Tbilisi; the target of the research were 11 children with Spastic Cerebral Palsy who underwent Graded Exercise Therapy (GET). We used GMFM scale for gross motor function assessment. The observation was going on during 2 years. Results of treatment with physical exercises were improved by 26.4 percent after one year, and by 38.4 percent, after two years, in comparison with the initial results (12.1 percent). As a result of the research it was concluded that appropriately selected therapeutic exercises improve motor skills and functional independence of children with spastic cerebral palsy.

Key words: supination, pronation, physical therapy, cerebral palsy

Introduction:

According to the data of the World Health Organization 10 percent of our planet population has limited abilities. 100 million children are among them. According to the data of the same organization there are 600 million persons with limited abilities in the world [7]. The majority of them are poor that makes their involvement in public activities impossible. Parents of children with Cerebral Palsy face many problems connected with solving of health issues. They particularly need specialist's assistance at an early stage of child development. One of the most frequent problems causing disability is problem connected with motor development. Difficulties in moving independently cause serious problems to the individual and greatly decreases the quality of his or her life and functional independence [6].

Cerebral Palsy is a complex concept encompassing a number of disturbances that result in limits of child movement, posture and balance skills. Besides motor disorders Cerebral Palsy is always accompanied with disorders of brain function including sight-based perceptual problems, disorders connected with cognition, skills of hearing, speaking, attention and behavior. Because of number of problems caused by cerebral palsy, its treatment requires multi-disciplinary team approach [4]. For the purpose of improving motor skills treatment may include physical therapy that is used in various modes and may have different effects. It is considered that an adequate physical exercises *do* significantly improve child's functional independence [1, 2, 3, 5]. In Georgia various methods and approaches for Cerebral Palsy management are applied; though the data on effectiveness of treatment of children with Cerebral Palsy are scarce. The articles published show that authors are more frequently interested in effective assistance programs and not in problems concerning movement development. Physical exercise is a target-oriented movement/action that is selected for solving this or that issue of physical education. This means that the physical exercise is concerned only with those movements and actions that best respond to tasks of physical education. In other words, this is human's movement action that best fits regularities of physical education [8] during physical exercises. During physical therapy we should consider the following:

1. Appropriately selected medical physical exercises
2. Physical exercises should differ according to the forms of cerebral palsy
3. It is important that the exercises are encouraging, interesting and challenging for the child
4. The group of medical physical exercises should be changed (replaced) with other medical physical exercises during the whole period of treatment.

Adaptive physical education specialists should understand the goal of the physical exercises, its nature, structure, the way it affects the human body etc. Besides, in case of supporting and movement and nerve and muscle apparatus problems, particular attention is given to methods of physical exercises application during rehabilitation or correction processes. Children with Cerebral Palsy particularly require development of special

individual programs for psycho-social development and the assistance of physical therapist at the very early stage of development, who knows methods of rehabilitation. It is particularly important that physical exercises are selected appropriately and individually for every child. Medical physical exercises are very effective at early ages of development [9]. The main objective of physical exercises in cases of cerebral palsy is the reduction of anomalous movements and activation of normal movements [10].

Materials and Methods:

The research was carried out in the Medical and Educational Center of Children Neurology and Neurorehabilitation of Tbilisi; all children under observation had a diagnosis of spastic cerebral palsy. Their conditions were assessed by neurologist who made a diagnosis for the children and determined the severity level of cerebral palsy among them. These children underwent specific graded exercise therapy developed by us in accordance to the severity of illness. And parents were advised on recommended exercises that could be applied at home conditions. We carried observations during 2 years. At every stage of observation we made motor assessment, by using GMFM scale and evaluated children’s following skills:

- self-control
- turning around
- sitting/sitting up
- standing in crawling position and moving around
- standing on knees and moving around
- standing up/standing
- walking

The treatment included six courses of medical treatment and every course included 20 procedures.

Results and conclusions:

The group we selected involved eleven children who started medical treatment from the first 6 months to 1 year of their lives. For having group homogeneity we selected children with mild spastic cerebral palsy (spastic diplegia). Table # 1 shows eleven patients’ gross motor skills: head control - holding up the head, turning around (from supination to pronation), physical exercises according to sitting and sitting up positions on initial (I) stage, after one year (II) and two years (III). “+” means “is able to do”, “-” means “not able to do”.

Table I: Research Target Group Motor Skills (head control, turning around, sitting and sitting up)

Skills		1	2	3	4	5	6	7	8	9	10	11	
Holding up the head	I	+	+	+	+	+	+	+	+	+	+	+	
	II	+	+	+	+	+	+	+	+	+	+	+	
	III	+	+	+	+	+	+	+	+	+	+	+	
Turning around	S-P	I	+	+	+	+	+	---	---	---	---	---	
		II	+	+	+	+	+	+	+	+	+	+	
		III	+	+	+	+	+	+	+	+	+	+	
	P-S	I	+	+	+	+	+	+	+	+	+	+	+
		II	+	+	+	+	+	+	+	+	+	+	+
		III	+	+	+	+	+	+	+	+	+	+	+
Sitting	on floor	I	---	---	---	---	---	---	---	---	---	---	
		II		+	+	+	+	+	+	+	+	+	
		III	+	+	+	+	+	+	+	+	+	+	
	on chair	I	+	+	+	+	+	+	---	---	---	---	---
		II	+	+	+	+	+	+	---	---	---	---	+
		III	+	+	+	+	+	+	---	---	---	+	+
	side-sitting	I	---	---	---	---	---	---	---	---	---	---	---
		II	---	---	---	---	---	---	---	---	---	---	---
		III	---	---	---	---	---	---	---	---	---	---	---
	with support	I	---	+	+	+	+	+	---	---	---	+	+
		II	+	+	+	+	+	+	+	+	+	+	+
		III	+	+	+	+	+	+	+	+	+	+	+
Sitting up	with support	I	---	---	---	---	---	---	---	---	---	---	
		II	---	---	---	---	---	---	---	---	---	---	
		III	---	---	---	---	---	---	---	---	---	---	
	by proning	I	---	---	---	---	---	---	---	---	---	---	---
		II	---	+	---	---	---	---	---	---	---	---	---
		III	+	+	+	---	---	---	+	---	---	---	---

As is it seen from the Table, all the eleven patients **had a skill of holding up head** at the very initial stage of exercises and during two years, as for the **turning around movements** from supination to pronation only 54.5 percent of patients were able to make at the initial stage of exercises. After one year of exercising all children were able to make turning around movements. According to the data about the skill of **sitting on floor**, neither of the target group members was able to do this on the initial stage of exercises. After one and two years of physical therapy an absolute improvement was obvious that is well seen in the Table. As for the skill of **sitting on chair**, only 54.5 percent of patients had this skill at the initial stage; the results were improved by 9.1 percent in a period of one-year physical therapy, and by 17.5 percent in 2 years period, in comparison with the results of the initial stage. Neither of patients developed the skill of **side-sitting** during the whole period of therapy. **Sitting with support** had a positive effect. As it can be seen from the Table, 36.4 percent of patients were not able to sit with support at the initial stage. And in the end of the first and second year all members of group could accomplish sitting with support. **Sitting-up** motion seemed to be the hardest one. This was reflected in the following facts: neither of group members could develop the skill of sitting-up **with support**, only 0.9 percent of the group members became able to sit-up **with proning** in one-year period of physical therapy and 36.3 percent of members could accomplish it in two-year's period. In the Table # 2 we present the results of patients on the following skills: standing in crawling position and moving around, standing on knees and moving around. The markers are the same as in the Table # 1. At the initial stage 0.9 percent of group members was able to stand in crawling position; in one-year period this result was improved to 18.1 percent and in two-year period 81.4 percent of group members could stand in crawling position. Neither of the group members was able to develop the skill of moving around in crawling position **in reciprocal manner** during the therapy. 0.9 percent of patients could move around in crawling position **in unreciprocal manner**; at the second stage this result was the same and on the third stage the result was improved to 63.3 percent. Children were not able to develop the skill of **standing on knees** and moving around in this position, during first and second stages and in the end of the third stage 27.2 percent of patients developed these skills.

Table II: Research Target Group Motor Skills (standing in crawling position, standing on knees and moving around)

Skills			1	2	3	4	5	6	7	8	9	10	11		
Standing in crawling position and moving around	Standing	I	---	+	---	---	---	---	---	---	---	---	---		
		II	---	+	+	---	---	---	---	---	---	---	---		
		III	+	+	+	+	+	+	+	+	+	+	---		
	In reciprocal manner	I	---	---	---	---	---	---	---	---	---	---	---	---	
		II	---	---	---	---	---	---	---	---	---	---	---	---	
		III	---	---	---	---	---	---	---	---	---	---	---	---	
		Unreciprocal manner	I	---	+	---	---	---	---	---	---	---	---	---	---
			II	---	+	---	---	---	---	---	---	---	---	---	---
			III	+	+	---	+	+	+	---	+	---	+	---	---
Standing on knees and moving around	I	---	---	---	---	---	---	---	---	---	---	---	---		
	II	---	---	---	---	---	---	---	---	---	---	---	---		
	III	---	+	---	---	+	---	---	---	---	---	+	---		

In Table # 3 we present results regarding the skills of standing up, standing and walking positions. The markers are the same as in the Table # 1.

Table III: Research Target Group Motor Skills (standing in crawling position, standing on knees and moving around)

Skills			1	2	3	4	5	6	7	8	9	10	11	
Standing up	By putting one leg forward	I	---	---	---	---	---	---	---	---	---	---	---	
		II	---	---	---	---	---	---	---	---	---	---	---	
		III	---	---	---	---	---	---	---	---	---	---	---	
	From bear position	I	---	---	---	---	---	---	---	---	---	---	---	---
		II	---	---	---	---	---	---	---	---	---	---	---	---
		III	---	---	---	---	---	---	---	---	---	---	---	---
	With support	I	---	---	---	---	---	---	---	---	---	---	---	---
		II	---	+	+	---	---	---	---	---	---	---	---	---
		III	+	+	+	+	---	+	+	+	+	+	+	---
Standing	With support	I	---	+	+	+	---	---	---	---	---	---	---	
		II	---	+	+	+	---	---	---	---	---	---	---	
		III	+	+	+	+	---	+	+	+	+	+	---	
	Independently	I	---	---	---	---	---	---	---	---	---	---	---	---
		II	---	---	---	---	---	---	---	---	---	---	---	---
		III	---	---	---	---	---	---	---	---	---	---	---	---

Walking	With support	I	---	---	---	---	---	---	---	---	---	---	
		II	---	---	---	---	---	---	---	---	---	---	
		III	+	+	---	+	---	+	---	+	+	+	---
	Independently	I	---	---	---	---	---	---	---	---	---	---	---
		II	---	---	---	---	---	---	---	---	---	---	---
		III	---	---	---	---	---	---	---	---	---	---	---
	With supporting means	I	---	---	---	---	---	---	---	---	---	---	---
		II	---	---	---	---	---	---	---	---	---	---	---
		III	---	---	---	---	---	---	---	---	---	---	---

As it has become obvious **standing up by putting one leg forward** and **standing up from bear position** had no effect. As for the skill of standing up **with support**, the results in developing this skill were improved to 18.1 percent in the end of the second stage, and to 81.1 percent in the end of the third stage. Results in the development of skill of **standing with support** at the first stage were improved in 27.2 percent of group members, on the second stage nothing was changed and at the third stage these results were improved to 81.1 percent. The most negative results we received were related to the skill of walking. For example, 63.6 percent of group members were able to walk with support and neither of patients was able to develop the skill of moving independently and by using some kind of supporting means.

Table # 4 shows the dynamics of results received during two-year’s period of medical exercises.

Table IV: Effectiveness of Treatment

Patients	Results at the Initial Stage	Results received after one-year therapy	Results received after two-year’s therapy
1	12,5percent	22,4percent	39,8percent
2	10,9percent	20,5percent	35,8percent
3	9,7percent	25,6percent	36,4percent
4	15,9percent	32,7percent	40,6percent
5	16,4percent	24,8percent	31,9percent
6	11,7percent	33,6percent	49,6percent
7	8,9percent	24,9percent	39,9percent
8	12,6percent	23,8percent	40,3percent
9	16,7percent	25,3percent	36,5percent
10	10,3percent	30,4percent	42,5percent
11	9,3percent	22,4percent	33,9percent

As it is seen from the Table (Table # 4), results of physical exercises were improved by 26.4 percent in one year and by 38.4 percent in two-year period, in comparison with the results of the initial stage (12.1 percent).

Results of the research show significant increase of GMFM-scale points for every child that makes the effectiveness of physical exercises evident; individual data of patients are also clear and it makes it possible to correct the amount of load.

The first Chart below shows dynamics of physical exercises results. The vertical axis presents percentages and horizontal axis indicates the cases of research. There are the following markers: I – the initial stage, II – results after one year, III – results after two years.

As the chart indicates physical exercises each individual underwent have results that are easily distinguishable from another. And this difference is in direct correlation with the severity of disease and graded physical exercises the individuals underwent during the therapeutic treatment.

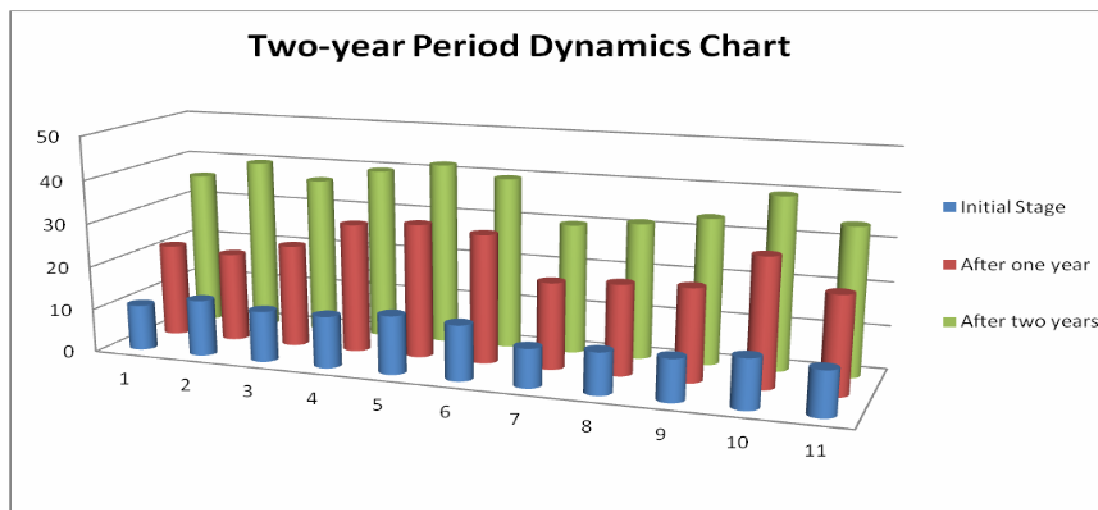


Chart 1: Treatment Results

The results of the research made it evident that regular physical therapy improves patients' motor skills significantly. And consequently, this results in decreasing disability. On the other hand, by decreasing the level of disability we can improve patient's quality of life, psychological and emotional climate of his or her family and reduce waste of economic resources.

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