Increase in Motion Range of the Cervical Spine by Means of Physical Rehabilitation in Children with Cerebral Palsy According to the Severity of Muscle Pain

Zwiększenie zakresu ruchów odcinka szyjnego kręgosłupa za pomocą fizykoterapii u dzieci z mózgowym porażeniem w zależności od nasilenia dolegliwości bólowych mięśni

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SUMMARY

Aim: The article experimentally examines the effect of rehabilitation measures on increasing the volume of movements of the cervical spine, taking into account the severity of muscle pain in children with cerebral palsy.

Materials and Methods: The study involved 168 children with spastic forms of cerebral palsy, they were divided into two observation groups: the main group, which conducted the proposed rehabilitation course (n = 98) and control, who underwent a course of conventional rehabilitation content (n = 70).

Results: During application of the proposed method, the therapeutic effect on pathologically significant areas of bilateral muscle kinematic chains was carried out taking into account their mutual antagonism, bilateral symmetry, taking into account the course of homolateral and heterolateral muscle spirals. Positive dynamics in the clinical status in the vast majority of patients during re-observation was achieved, but the effectiveness of rehabilitation and the stability of the achieved therapeutic effect in the study groups were different. Thus, in patients of the main and control groups, changes in the mobility of the cervical spine were detected, which were recorded using the proposed integrated assessment. Namely, in patients who were engaged in the proposed method, the amount of movement in the cervical spine (passive lateral tilt with an element of rotation) probably increased when compared with the indicators before rehabilitation. Also noteworthy is statistically significant reduction in pain intensity, which allows for more manipulative rehabilitation.

Conclusions: The proposed method of rehabilitation of children with spastic forms of cerebral palsy has a pronounced sanogenetic effect, meaning it stimulates their own health reserves and triggers a cascade of reactions of the body aimed at forming a healthy motor stereotype. It involves influence on organism of the patient by rehabilitation procedures with inclusion in work of all biokinematic muscular chain at the same time, taking into account spiral construction of muscles of a body, which allows to achieve a more pronounced therapeutic effect.

Key words: cerebral palsy, treatment, medical rehabilitation, methods, muscles, muscle spirals

Słowa kluczowe: porażenie mózgowe, leczenie, rehabilitacja medyczna, metody, mięśnie, spirale mięśniowe

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INTRODUCTION

Cerebral palsy is the result of damage to the cortical and subcortical structures of the central nervous system in the early stages of its development. According to the definition of the International Seminar, cerebral palsy is not an etiological diagnosis, but a clinical descriptive term, which means a group of disorders of movement and body position, causing limitations of activity caused by non-progressive brain damage of the fetus or child. Motor disorders in cerebral palsy are often accompanied by sensitivity defects, cognitive and communicative functions, perception and / or behavioral and / or convulsive disorders [1-3].

In Ukraine, there are about 20 thousand children with cerebral palsy and annually registered a number of diagnoses of cerebral palsy, established for the first time. According to medical statistics, in the structure of pediatric neurological pathology, the disease is about 24%, and the incidence rate in Ukraine is 2.59 per 1000 children.

An important point that confirms the need and relevance of this study is that cerebral palsy is in principle an incurable disease, and the possibility of socialization of patients with cerebral palsy depends on the effectiveness of treatment and rehabilitation measures, their frequency, controllability of results and timely correction of the rehabilitation program individually for each child.

Rehabilitation of children with cerebral palsy is a difficult problem due to high disability dictated by the damage to the central nervous system in the early stages of ontogenetic development of the brain. But in this period there is a defeat not only of the nervous system, but also of other organs and systems. Formation of motor disorders due to organic brain damage, the presence of muscle atrophy leads to hypodynamics, chronic muscle weakness and to osteopenia. Muscle activity, muscle tone affects the tension in bone tissue, which forms signals that control the processes of modulation and remodulation, and affects the intensity of these processes.

Cerebral palsy directly affects the daily lives of sick children. It turns out that the development of therapeutic and rehabilitation systems can involve not only the improvement of great motor skills, but also posture and mobility. Restoration of motor activity is of great importance and has a positive effect on the psycho-emotional state of a sick child, improves his socialization. Functional disorders that increase with age, pose a threat to the further development of such children, in addition, there is a risk of spinal deformity, which becomes pathological (kyphosis, lordosis, scoliosis). There may be deterioration of the hip joints, imbalance of antagonist muscles in muscle system (MS) with the simultaneous appearance of muscular dystrophy and instability of certain parts of the skeleton.

AIM

The article experimentally examines the effect of rehabilitation measures on increasing the volume of movements of the cervical spine, taking into account the severity of muscle pain in children with cerebral palsy.

MATERIALS AND METHODS

In order to solve the tasks, the effectiveness of a set of rehabilitation measures was assessed in 168 children aged 3 to 7 years, with spastic forms of cerebral palsy (spastic diplegia - 68 children, spastic hemiplegia - 63, tetraparesis (spastic form) - 37 patients). All children were divided into two groups of observation: the main group, which conducted the proposed course of rehabilitation (n = 98) and control, who underwent a course of generally accepted rehabilitation content (n = 70).

The rehabilitation course developed by us was carried out on the basis of the Center for Rehabilitation of Children with Organic Nervous System Lesions of Poltava Regional Children's Clinical Hospital. The course of the generally accepted rehabilitation took place in neurological department of the Poltava regional children's clinical hospital.

Rehabilitation measures were aimed at solving the following tasks: normalization of voluntary movements in the joints of the upper and lower extremities, the formation of posture skills close to optimal and correction of foot position, correction of sensory disorders, correction of coordination disorders (fine motor skills of the hand, static and dynamic balance, rhythmic movements, spatial orientation), training of musculoskeletal sensation, prevention and correction of contractures, learning new postures and movements and normalization of the respiratory system.

The examination was conducted three times: before the course of treatment when the child applied to the medical institution, after the course of rehabilitation and three months to study the long-term results of treatment and the effectiveness of independent homework to perform individually selected exercises and knowledge obtained by parents at the school for parents the "Spiral".

Methods of the study: somatoscopy, anthropometry, clinical and neurological examination, measurement of the volume of movements of the cervical spine (evaluated according to the scheme Menya-Lesage in the author's modification); large motor functions were measured on the scale Gross Motor Function Measure (GMFM) [4, 5], used a modified Ashworth's muscle spasticity scale to assess muscle tone [4] muscle pain in contracted muscles was examined using the Visual Analog Scale (VAS); violation of the statics of the child's posture in the gravitational field was assessed by goniometric method of studying conditionally skeletal plots in the frontal and sagittal planes; methods of mathematical statistics were used to analyze the obtained data.

The Ethics Commission of the Poltava State Medical University has no comments on the methods used in this study.

RESULTS AND DISCUSSION

Changes in the volume of movements of the cervical spine are quite informative before treatment to assess the initial state, and in the dynamics and at the end of the course as an integral indicator of the state of the muscular kinematic spiral, because the cervical spine is biokinematically connected to other parts of the spine, pelvic joints and tender limbs, and the neck muscles (flexors and extensors) are an integral part

Table 1. Explanations for Figure 1

Pain assesment	No pain	Minimal pain	Average pain	Strong pain	Very strong pain	Strongest pain
Points	0	2	4	6	8	10

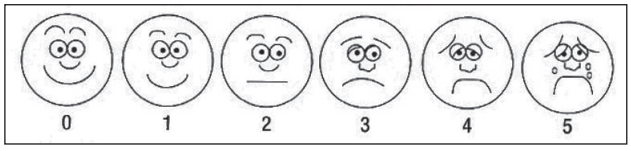


Figure 1. Wong-Baker facial grimace scale for pain intensity assessment

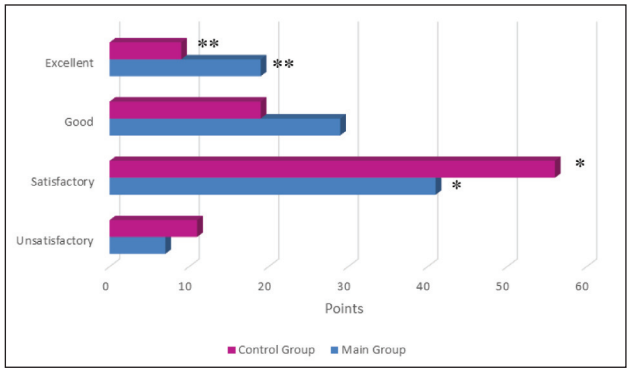
of the main muscle spirals, which entangle the human body from the delicate limbs to the head. Therefore, restrictions on movements in the cervical spine arise as independent pathologically significant functional blocks, and as compensatory sanogenetic in order to maintain body balance, this, as a consequence, is one of the links in the formation of pathological motor stereotype [6] (Figure 1, table 1).

On this scale, pain was assessed by facial expression, motor reactions from the extremities and torso, verbal reactions, or a combination of behavioral and autonomic changes during palpation of shortened muscles. The intensity of pain during the manipulations statistically significantly decreased under the influence of treatment in patients of the main group from 4.4 ± 0.2 to 1.7 ± 0.1 points, and in the control it lowered from 4.2 ± 0.3 to 2, 8 ± 0.3 points. This indicates a positive shift not only in the physical condition of patients when using the proposed method, but also to improve the perception of procedures and the overall quality of life of children [7-11].

Thus, when applying the proposed method, the therapeutic effect on pathogenic areas of bilateral muscle kinematic chains was carried out taking into account their mutual antagonism, bilateral symmetry, taking into account the course of both homolateral muscle spirals and heterolateral muscle spirals directly on the affected areas and on the entire muscle spiral, while activating the antagonist of muscle spiral [6, 12, 13].

Under the influence of the proposed course of treatment in patients of the main and control groups, the following changes in the mobility of the cervical spine were detected, which were recorded using the author's proposed integrated assessment (Table 2) [12].

Positive dynamics in the clinical status in the vast majority of patients during re-observation was achieved, but the effectiveness of rehabilitation and the stability of the achieved therapeutic effect in the study groups were different. Thus, in patients of the main and control groups, changes in the mobility of the cervical spine were detected, which were recorded using the proposed integrated assessment. Namely, in patients who were engaged in the proposed method, the amount of movement in the cervical spine (passive lateral tilt with an element of rotation) probably increased when compared with the indicators before rehabilitation. Also noteworthy is the probable reduction in the intensity of pain, which allows for rehabilitation manipulations in a larger volume (Table 3).



Note: * - p<0.05, ** - p<0.01

Figure 2. The results of an integrated assessment of the effectiveness of the rehabilitation effect on the area of the muscular spiral in the cervical spine in patients of the studied groups

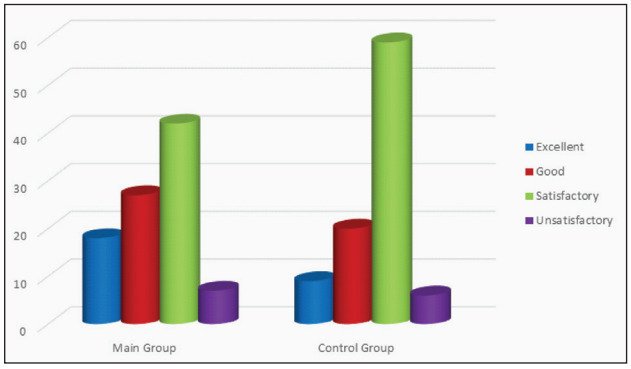


Figure 3. The results of an integrated assessment of the effectiveness of the rehabilitation effect in patients of the studied groups (%)

Table 2. Integral assessment of changes in the mobility of the cervical spine

Result	Parameter
Excellent	the increase in the volume of movements is ≥ 15º
Good	the increase in the volume of movements is 10º – 14,99º
Satisfactory	the increase in the volume of movements is є 5º – 9,99º
Unsatisfactory	the increase in the volume of movements is ≤ 5º

Table 3. The results of the rehabilitation effect on the volume of movements in the cervical spine in patients of the studied groups

Study groups	Main group		Control group	
	Initial parameters	After treatment	Initial parameters	After treatment
Volume of movements in the cervical spine (passive lateral tilt with an element of rotation), (in degrees)	22.4 ± 2.17°	33.2 ± 3.05° *	23.6 ± 2.21°	28.1 ± 4.11°
Pain intensity, points	4.4 ± 0.2	1.7 ± 0.1*	4.2 ± 0.3	2.8 ± 0.3*

* - difference is statistically significant (p<0.05)

Table 4. Indicators for assessing the level of motor disorders and the amount of muscle tone in children of the examined groups at the beginning and after the rehabilitation course

Study groups	The degree of spasticity according to the Ashworth's scale, points GMFM scale (%)			
	Initial parameters	After treatment	Initial parameters	After treatment
Main (n=98)	2.52 ± 0.02	1.75 ± 0.03*	59.71 ± 4.25	67.31 ± 3.92 *
Control (n=70)	2.71 ± 0.01	2.20 ± 0.02*	60.22 ± 3.78	65.33 ± 4.1

* - difference is statistically significant (p<0.05)

Changes that occurred in the area of muscle spirals in the cervical spine in patients of the studied groups during the integrated evaluation of the effectiveness of the rehabilitation effect, taking into account the spiral structure of the muscles and with the inclusion in the work of the entire biokinematic muscle chain simultaneously, shown in Figure 2, which clearly demonstrates the vast majority of excellent results of rehabilitation among patients of the main group and the number of satisfactory among the control.

Thus, the increase in the volume of painless movements in the cervical spine is quite informative both before treatment to assess the initial state, and in the dynamics and at the end of the course as an integral indicator of the state of the muscular kinematic spiral. Increasing the volume of movements of the cervical spine, taking into account the intensity of pain, it is advisable to use as a criterion for the effectiveness of the rehabilitation effect on muscle spirals in patients with spastic forms of cerebral palsy.

Given this fact, that a significant reduction in spasticity is not always accompanied by a marked improvement in locomotor functions, we conducted an integrated assessment according to the method of Dekopov A.V. [14] as follows:

1. Excellent result - reduction of tone to 1.5-2 points; improvement of motor functions on one category according to GMFM.
2. Good result - reduction of tone to 1-1.5 points; positive dynamics of motor functions, the patient remains in the same group according to GMFM.
3. Satisfactory result - reduction of tone to 2 points without clear dynamics of motor functions
4. Unsatisfactory result - lack of clear dynamics of spasticity and locomotor functions or negative dynamics.

Evaluation of motor functions on the GMFM scale proved the probability of the difference in the growth of total motility from 59.71 ± 4.25% to 67.31 ± 3.92% in patients of the main group, and in patients who were engaged in the conventional method, the increase was only 5.1 ± 0.3% in total for the group (Table 3). The most significant changes in indicators were observed in patients of both subgroups by subtests in group B (sitting) and group D (standing) [15].

During the integrated assessment of the effectiveness of the rehabilitation effect according to the method of Dekopov A.V. we got the results, which testified in favor of the proposed technique with the inclusion in the work of the entire biokinematic muscle chain simultaneously taking into account the spiral structure of the muscles of the body and the course of muscle spiral, namely: the number of patients in the main group, who according to the total assessment of spasticity and the level of motor disorders received an excellent and good result was significantly higher, and those who had a satisfactory and unsatisfactory result at the end of the course, respectively, lower (Figure 3).

Thus, the proposed method of rehabilitation of children with spastic forms of cerebral palsy has a pronounced sanogenetic effect, meaning it stimulates their own health reserves and triggers a cascade of reactions of the body aimed at forming a healthy motor stereotype. It involves influence on organism of the patient by rehabilitation procedures with inclusion in work of all biokinematic muscular chain at the same time, taking into account spiral construction of muscles of a body, which allows to achieve a more pronounced therapeutic effect, to improve the results of rehabilitation not only in children who walk independently, sit, but also in those who are bedridden [13].

CONCLUSIONS

Painless increase in the volume of movements in the cervical spine should be used as a new integrated marker for assessing the effectiveness of rehabilitation treatment. The proposed

method of rehabilitation of children with spastic forms of cerebral palsy has a therapeutic sanogenetic effect, that is, stimulates its own health reserves and triggers a cascade of reactions of the body, aimed at bringing the motor stereotype to the optimal. It involves influence on the patient's body by rehabilitation procedures with the inclusion of the entire biokinematic muscle chain simultaneously, taking into account the spiral structure of the muscles of the body, which allows to achieve a more pronounced rehabilitation effect, improve the quality of life, improve the results of rehabilitation not only in those children who walk independently.

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