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The Ability to Reduce the Severity of Motor Disorders in Children With Cerebral Palsy.

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ABSTRACT

Children's cerebral palsy remains a frequent pathology in children. The effectiveness of the schemes used for the rehabilitation of these children remains low. Purpose: to evaluate the effectiveness of the author's technique, including therapeutic gymnastics and technical means, in children 7-9 years old with infantile cerebral palsy. The study was performed on 35 children aged 7-9 years with infantile cerebral palsy: 17 of them made up a control group, 18 - experimental. In the children studied, spastic diplegia or spastic tetra paresis was noted. The children of the experimental group used the author's complex correction, which includes curative gymnastics, the use of strength training, orthoses and verticalizers. Children of the control group are prescribed a traditional correction of infantile cerebral palsy. All children are assessed dynamics of motor skills on the scale of Cheylie, goniometry of knee joints, spasticity of muscles, and strength of the quadriceps muscle of the thigh. The results are processed by Student's test. As a result of the lessons, all children have achieved a positive dynamics of the indicators taken into account. A more pronounced positive dynamics of the strength of the quadriceps muscle (by 19.2%), the level of the motor skill (from 9.3 to 27.8%) and spasticity of the limb (by 26.5%) was achieved in the children of the experimental group. The dynamics of the amplitude of knee extension in both groups of observations was comparable. The use of the author's method in the practice of improving children is able to increase the effectiveness of their rehabilitation in children's cerebral palsy.

Keywords: children, cerebral palsy, motor disorders, physical rehabilitation.

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INTRODUCTION

Despite the serious progress of modern medicine, the rehabilitation of children with infantile cerebral palsy (cerebral palsy) remains one of the unresolved problems. According to modern statistics, in recent years the incidence of cerebral palsy in children has increased in some regions of the world to 400 cases per thousand of births [1], with a significant proportion of them being children with genetic disorders [2].

Many factors are known that predispose to the development of cerebral palsy [3, 4, 5]. Various cytogenetic aspects of disorders [5], capable of leading to negative somatic manifestations inherent in cerebral palsy [6, 7], are becoming clear.

Modern science is actively seeking ways to restore impaired functions with medication [8, 9] and is particularly active in the search for non-drug rehabilitation [10, 11]. Therefore, approaches to the rehabilitation of such children continue to improve, but still remain far from ideal [12, 13], despite its complex nature. A very complex and poorly developed issue is the development of tools and methods for correcting motor disorders for children with cerebral palsy [14]. It was noted that the great correctional potential of these children has therapeutic physical training with the use of special simulators [15]. In this case, the recommended complexes of exercise therapy for children with cerebral palsy are performed mainly in the initial positions lying or sitting, which carries a high risk of developing secondary complications [16]. It becomes clear that exercise in a standing posture can have a serious positive effect [17]. However, their wide use is hampered by the insufficiently developed methodical aspects of the use of specialized training devices, which allow keeping the child with cerebral palsy in an upright position.

The purpose of the study: to evaluate the effectiveness of the author's method, including therapeutic gymnastics and technical means, in children aged 7-9 years with cerebral palsy.

MATERIALS AND METHODS

The study was approved by the local ethics committee of the Russian State Social University on September 15, 2016 (protocol No. 9). The research was conducted on the basis of the Russian State Social University. 35 children 7-9 years old with cerebral palsy were examined. All children have spastic diplegia or spastic tetra paresis. Their mean age was 8.0 ± 1.1 years. By random sampling, the subjects were divided into a control group (17 people) and an experimental group (18 people) to correct their condition.

The control group worked for 107 days according to the plan of motor rehabilitation approved in this institution (therapeutic gymnastics in the form of passive exercises and the use of orthoses). In the experimental group, the author's method of complex correction of motor disorders in children with cerebral palsy was used for 107 days. At the first stage (1-14 days) the patients of the experimental group were engaged in therapeutic gymnastics, used the orthosis for daytime sleep and additionally used force training (active-passive motor actions) and passive stretching of the muscles, which created the conditions for preparing the child for virtualization. 10 lessons (19 hours) were conducted. They passed in the gym. Their duration was: passive exercises - 20 minutes; passive stretching of the muscles - 10 minutes; active-passive motor actions - 15 minutes; orthosis for daytime sleep - from 20-40 minutes. At the second stage (15-107th day) the children of the experimental group were engaged in therapeutic gymnastics, which was supplemented by strength training (active-passive motor actions with weighting agents), applied passive muscle stretching and used orthosis with virtualization. At the second stage, 84 sessions (157 hours) were conducted. Their duration was: passive exercises - 20 minutes; passive stretching of the muscles - 10 minutes; active-passive motor actions with a weighting agent - 15 minutes; the use of orthosis and verticalizer - up to 60 minutes.

Assessment of the state of children in both groups was carried out at the end and at the conclusion of classes using the same methods. Assessment of motor skills was conducted on the scale of Chaili. Evaluation of the child's motor skills was carried out by positioning in various positions on a 6-point scale. Based on the results of positioning, the degree of development of the child's gross motor skills in each position was estimated: lying on his back, lying on his stomach, sitting on the floor, sitting on the cube and standing [18].

To measure the level of spasticity, the Ashworth scale was used, with its help, the severity and frequency of resistance to passive movements were measured by a five-point rating (from 0 to 4 points). During the test, the limbs of the patient were moved in the full range of their movement, assessing the muscle tone [18].

Evaluation of the strength of the quadriceps femoris was carried out during the extension of the leg in the knee joint. The subject was put on a chair and asked to unbend his leg in the knee joint. In this case, one arm resisted this movement, and the other - palpated the contracting muscle. Muscular strength was evaluated by a 6-point system [18].

Goniometry was carried out with the help of a protractor. The amount of movement in the knee joint was measured by placing the hinge of the protractor in the region of the projection of the joint space on the outer surface of the limb. One device was placed along the axis of the tibia, the other along the thigh axis [18]. Statistical processing of the data obtained during the study consisted in calculating the arithmetic mean (M), the error of the mean value (m), and determining the reliability of the differences in the mean values (t-test of the Student's).

RESULTS OF INVESTIGATION AND DISCUSSION

When assessing the initial motor skills in the control and experimental groups, a similarly low level of their development was noted. Before the correction was applied in both groups of children with cerebral palsy, a high degree of spasticity was found. This was accompanied by a similar decrease in the angle of extension of the knee joint, as well as a comparable weakening of the strength of the quadriceps femoris muscle (Table).

Table: Dynamics of motor abilities of children with cerebral palsy during observation

Initial position	Control group, M±m, n=17		Experimental group, M±m, n=18	
	initial values	at the end of observation	initial values	at the end of observation
Motor skill with the initial position lying on the back, points	3.12±0.48	3.35±0.54 p<0.05	3.10±0.56	3.77±0.59 p<0.01 p ₁ <0.05
Motor skills in the initial position, lying on the abdomen, points	3.06±0.67	3.42±0.50 p<0.05	3.08±0.63	3.74±0.45 p<0.01 p ₁ <0.05
Motor skill with the starting position sitting on the floor, points	2.70±0.76	3.10±0.68 p<0.05	2.68±0.70	3.51±0.57 p<0.01 p ₁ <0.05
Motor skill at the starting position sitting on the cube, points	2.54±0.62	3.16±0.38 p<0.05	2.48±0.70	3.92±0.39 p<0.01 p ₁ <0.05
Motor skill with the initial standing position, points	1.72± 0.49	2.12±0.37 p<0.05	1.68±0.58	2.71±0.42 p<0.01 p ₁ <0.05
Spasticity of the limb, points	3.05±0.33	2.72±0.44 p<0.05	3.02±0.47	2.15±0.52 p<0.01 p ₁ <0.05
Strength of quadriceps femoris, points	1.36±0.56	1.61±0.61 p<0.05	1.29±0.49	1.92±0.38 p<0.01 p ₁ <0.05
Angulation of knee extension, degrees	147.1±0.24	166.4±0.20 p<0.05	146.9±0.19	170.3±0.27 p<0.05

Legend: p - reliability of indicator dynamics against the background of the impact; p_1 - reliability of differences between the groups at the end of the observation.

As a result of the correction in both groups, there were significant positive changes in all the parameters recorded compared with the baseline (Table). At the same time, for all the indicators of the motor skill taken into account, a more pronounced increase in the experimental group was noted. Its values in children in this group, achieved as a result of applying the author's correction program, exceeded those in the control group when assessing the motor skill from the starting positions: lying on the back by 12.5%, lying on the abdomen by 9.3%, sitting on the floor 13.2%, sitting on the cube at 24.0%, standing at 27.8%.

Overcoming the lag in the physical development of children with cerebral palsy on the background of adaptation to physical exertion is associated not only with compensation for their defeat of the central nervous system, but also is a consequence of a decrease in the characteristic hypokinesia. The expansion of motor activity within the author's methodology stimulates the child's natural development, causing a chain of adaptive reactions of his body: resistance to colds and infectious diseases increases, and the prerequisites for strengthening the heart muscle are created [19, 20]. Overcoming hypokinesia leads to the elimination of excess weight, which leads to an even greater additional increase in their motor activity [21].

As a result of the corrective actions carried out in the experimental group, a more pronounced decrease in the spasticity of the quadriceps femoris was noted. The degree of reduction of this indicator in the experimental group exceeded that in the control group by 26.5%. The results obtained are obviously related in the experimental group with a more physiological redistribution of muscle tone in the form of attenuation of the overvoltage and excess shortening in the muscles [22]. Apparently, against the background of correction by the author's program, the muscles begin to be included in the work more synchronously and rhythmically, which makes the movements more dexterous, dimensional and complete in volume. Optimization of the muscle tone can also be associated in this case with increased maturation of the remaining preserved brain structures [23].

As a result of the assessment of the dynamics of the strength of the quadriceps femoris, a more pronounced increase in the experimental group was observed during the health improvement measures. Her level in children, who received correction for the author's program, exceeded the control by 19.2%. Apparently, the technique applied in the experimental group was able to cause more active muscle contractions and to excite a greater number of motor units with more pronounced involvement in volitional activity. All this contributed to a more pronounced restoration of the functions of the muscular system in the children of the experimental group than in the control group. Apparently, a long-repeated excitation along the nerve pathways led to a gradual alleviation of neuromuscular conduction by decreasing synaptic resistance [24, 25].

In both observation groups, the angle of extension of the knee joint increased by the end of the correction: in the control group by 13.1%, in the experimental group by 15.9%. Apparently, the use of a set of health effects in the experimental group more actively stimulated the activity of brain structures controlling locomotion acts and manipulation of objects [26].

CONCLUSION

Manifestations of cerebral palsy are characterized by severe disturbances in motor and static kinetic functions, which are difficult to compensate for. In the course of the performed study, the effectiveness of the method developed by the authors for correcting motor disorders in children aged 7-8 years with cerebral palsy was assessed, which included therapeutic gymnastics, orthosis and virtualization. In the course of the study it was proved that the use of this technique has advantages over the traditional correction in the dynamics of goniometry, the strength of the quadriceps muscle of the thigh and spasticity of the muscles. Its application also provided a significant improvement in motor skills, a degree that surpassed the results of the traditional treatment. Application of the developed methodology in the practice of recovery can increase the efficiency of rehabilitation of children with cerebral palsy, increasing the degree of their social integration.

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