

Abilitation Of A Child With Infantile Cerebral Paralysis By Means Of Diagonal Gymnastics

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ABSTRACT

The relevance of the research is due to the fact that the majority of children suffering from infantile cerebral paralysis, with untimely and non-systematic treatment, are characterized by a sharp decrease in the rehabilitation potential and opportunities for social adaptation. At the same time, not all existing methods are universal for the physical abilitation of the existing variety of cerebral paralysis forms and the accompanying multiple motor disorders. It is also necessary to consider that for a large group of children with the consequences of infantile cerebral paralysis, the individual method is often the only acceptable, since it requires the teacher to concentrate on only one person. Thus, the aim of this study was to develop individual rehabilitation trainings aimed at abilitatoin of a child with cerebral paralysis and experimental substantiation of the effectiveness of their impact on the child's motor functions. The main research methods were: theoretical analysis of literary sources; pedagogical observation; motor abilities test (modified Tardier scale, goniometry (Thomas and Duncan-Ely tests), global motor function assessment system (GMFCS)). The article presents the methodology of individual trainings with a child suffering from infantile cerebral paralysis, which includes diagonal gymnastics, stretching exercises, breathing exercises, passive-active exercises and massage. The content of the trainings was structured and included the preparatory part (massage and passive physical exercises), the main part (diagonal gymnastics, stretching exercises, exercises aimed at developing muscle strength with resistance and load, fitball gymnastics) and the final part (breathing exercises). The developed set of individual trainings showed their effectiveness, which resulted in a steady decrease in pathological symptoms, which were manifested in the normalization of muscle tone, the extinction of the labyrinth tonic reflex, which was manifested in the ability to hold the head upright and decrease the flexion tonic plants of the legs. The materials of the article are of practical value for adaptive physical training instructors specializing in rehabilitation of children with the consequences of infantile cerebral paralysis.

Keywords:

cerebral paralysis, abilitation, individual approach, diagonal gymnastics

Introduction

In recent decades, incidence of infantile cerebral paralysis (ICP), which is one of the most frequent disabling diseases of the orthopaedic neurological profile, is increasing in many countries of the world, including in Russia. ICP prevalence in the world changes with the development of medicine and society as a whole. However, statistical data show that the urgency of ICP problem has not decreased to date and does not tend to decrease [19, 25].

Most of the children suffering from infantile cerebral paralysis, with untimely and non-systematic treatment, are characterized by a sharp decrease in the rehabilitation potential and opportunities for social adaptation [5, 18]. Infantile cerebral paralysis is a consequence of underdevelopment or damage to the brain in the early stages of ontogenesis. It is manifested by disorders of muscle tone and voluntary movements. Movement disorders are often combined with changes in the psyche, speech, seizures [21, 22].

In 20-35% of patients the disability is so significant that they cannot serve themselves, move around, and it is difficult to teach them. The importance of this problem is determined by the increasing prevalence and social significance of the disease, accompanied by severe disability [2, 12, 13, 14].

The methods of medical rehabilitation used at the early stages of the rehabilitation process, as well as during the period of the formed pathological motor stereotype, allow to achieve a significant improvement in patients state [7, 24]. However, not all methods are universal for the physical abilitation of the existing variety of infantile cerebral paralysis and its accompanying multiple motor disorders. This fact necessitates further theoretical and experimental studies in this field.

This disease is accompanied by significant changes in the child's psyche requiring individual approach when working with them. For a large group of children with the consequences of

cerebral paralysis, the individual method is often the only acceptable one, since it requires the teacher to concentrate on only one person [9, 15, 16].

Interaction with one person allows to individualize the content, methods, methodological techniques, the pace of mastering educational activities according with the real abilities of the disabled person, to track the dynamics of the results when solving specific treatment and recovery, correctional and developmental and other tasks, to quickly monitor the physical and mental state, etc.

Currently, most experts agree that, first of all, a thorough early diagnosis and an individual approach to each patient are necessary, ensuring the effectiveness and individual complexity of the manipulation [8].

All the above factors determined the direction of the present study: the aim of the work was set, the tasks were formulated, the methods were selected and the results of epy research were summed up.

The aim was to study the process of abilitation of a child with spastic ICP form (tetraparesis) by means of diagonal gymnastics and stretching.

Tasks of the study:

1. To analyse the experience of using an individual approach in the process of abilitation of children with infantile cerebral paralysis.
2. To develop a set of individual trainings with a 7-year-old child suffering from spastic form of ICP, including diagonal gymnastics and stretching.
3. To determine diagnostic tools to assess the effectiveness of the developed set of trainings.
4. To reveal the influence of individual trainings on the motor abilities of a 7-year-old child with ICP.

Materials and methods:

theoretical analysis of literary sources; pedagogical observation; testing of motor abilities.

Analysis of the literary data showed that persons with the consequences of infantile cerebral paralysis have movement disorders that can be corrected and properly organized by physical activity in combination with other types of rehabilitation and vigorous activity [6, 9, 10, 11]. Abilitation is the initial formation of the ability to do something. This study deals with motor abilitation, that is, formation of vital motor skills and abilities, and also normalization of the functions of the vestibular apparatus, correction of deformities of the musculoskeletal system, mastering complex combinations of muscle work of various parts of the body during the formation of motor stereotypes [23, 25].

The object of pedagogical observations in this study was individual trainings of a child suffering from infantile cerebral paralysis. The child's attitude to trainings, reaction to the proposed tasks, his mood, activity, state of health according to subjective indicators (sleep, appetite, desire to train) were recorded.

To assess the effectiveness of the developed rehabilitation trainings, the child's motor abilities were tested, including the following control exercises [1, 17, 20]:

1. Modified Tardier scale.

This scale was described in 1954, and appeared in its modified version in 1999. During testing, a specialist evaluates the reaction to stretching of muscle groups depending on the speed of movement in two parameters:

- X- quality of the muscle reaction;
- Y - volume of movement at the moment of muscle reaction.

The quality of the muscle reaction is understood as the description of its resistance to passive stretching within the framework of the following parameters:

- 0 - no resistance during the entire passive movement;

- 1 - slight resistance during passive movement without a distinct "catch" phenomenon when reaching the extreme position in the joint;

- 2 - distinct "catch", interrupting passive movement with the subsequent opportunity to continue movement in the joint;

- 3 - rapidly passing clonic movements (less than 10 seconds while maintaining pressure on the joint), developing when the extreme position in the joint is reached;

- 4 - long clonic movements (significantly more than 10 seconds while maintaining pressure on the joint) when reaching the extreme position in the joint;

- 5 - passive movements in the joint are impossible.

The speed of movement in the joint is subdivided:

- V1: as slow as possible (minimizing stretch reflex);
- V2: speed of the limb segment falls under the influence of gravity;
- V3: as fast as possible.

The angle of motion in the joint was determined as follows:

- R1: angle of stopping movement of the limb at high exploration speed - V2 or V3;
- R2: volume of passive movement in the joint - V1.

Since testing at V1 is used to assess passive movement, only testing at V2 and V3 shows spasticity. R1 characterizes the volume of movement at which there is a sharp obstacle to the end of the movement due to an increased stretching reflex, and R2 characterizes the maximum possible length of muscle stretching in a quiet state (when the stretching reflex is leveled). The difference between R1 and R2 is important:

- a large difference between R1 and R2 (at least 15°) indicates the dynamics of contracture and a significant amount of possible positive dynamics on the background of correction;

- the slight difference between R1 and R2 is associated with the severity of fixed contracture.

2. Goniometry is a method of measuring the range of motion in the joints showing the degree of true spasticity. During the implementation of the developed technique, movements in the following joints were measured:

In the hip joint.

Thomas test for the iliopsoas muscle and the Duncan-Ely test for the rectus femoris (definition of the "catch" phenomenon) were used for evaluation.

Muscles testing leading to flexion position in the hip joint.

1) Hip flexion (norm $<110^\circ$). Purpose - To assess the amount of flexion in the hip joint, excluding the influence of the posterior thigh muscles.

Baby's initial position: Lying on his back with the test leg on the edge of the couch.

Testing procedure: The test leg was bent at the hip and knee joints until the sacrum began to lift off the couch. The goniometer axis was above the projection of the femoral head.

2) Thomas test. The aim is to assess the shortening of the iliopsoas muscle.

Initial position: lying on the back, both legs were unbent at the knee and hip joints, the physiological lordosis of the lumbar spine was controlled with the left hand.

Test procedure: the leg on the untested side was passively bent at the hip and knee joints and held in the lumbar lordosis compensation position, with the lumbar spine touching the couch surface. Normal flexion volume does not exceed 110° . The angle at which the hip is lifted from the surface during flexion of the contralateral hip reflects the degree of the iliopsoas muscle contraction.

3) Duncan-Ely test. The aim is to assess spasticity / shortening of the rectus muscle.

The initial position of the child: lying on the stomach, both legs were extended at the knee and hip joints.

Test procedure: the patient's knee was passively flexed with one hand causing stretching of the rectus femoris muscle. Normally, the thigh remains pressed against the couch (if there is a shortening or spasticity of the rectus femoris, the thigh will bend at the hip joint and lift the pelvis over the couch).

Testing the adductor muscles of the thigh.

1) Abduction of the hips with the legs straightened at the knee joints. The aim is to assess the severity of the adductor muscle of the thigh spasticity. The presence of spasticity of the adductor thigh muscles is indicated by a significant difference (more than 15°) between measurements of the child's slow and fast hips spreading.

2) Abduction of the hip with the legs bent at the knee joint at a right angle (norm $<45^\circ$). The aim was to assess the severity of spasticity of the adductor muscles of the thigh when the hamstring group and the gracilis muscle are excluded from the adductor function.

3) Phelps test. The aim was to assess the spasticity / shortening of the gracilis muscle. This muscle is bicuspid and can be involved in the hip adduction and knee flexion. Initial position of the child: lying on the stomach, both hips are extended at the hip joints, the untested leg is along the edge of the couch, on the tested side the thigh is maximally abducted and the leg is bent at the knee joint at 90° . Testing procedure: the child's leg was slowly unbent at the knee joint, stretching the gracilis muscle.

4) Gracilis test. The aim was to assess spasticity / shortening of the adductor muscles, and also to differentiate spasticity of the adductor longus and the gracilis muscles.

Rotational movements in the hip joint. The aim was to evaluate rotational movements in the hip joint. Rotation of the hip with the pelvis in a neutral position. Normal external rotation of the thigh is 45° , internal rotation – 50° .

Movement in the knee joint.

1) Measurement of the unilateral popliteal angle using the Tardier test (norm 1-3 years - girls - 163°, boys - 155 °;> 5 years -150 °; adults - 140 °). The aim - to assess spasticity / shortening of the medial knee flexor muscles.

The initial position of the child: lying on the back. On the tested side, the hip was bent at the hip joint by 90 ° and located strictly perpendicular to the couch, the leg was bent at the knee joint. On the untested side, the leg was fully extended at the hip and knee joints.

Movement in the ankle joint.

1) Assessment of the length of the triceps muscle of the leg during passive extension (dorsiflexion) of the foot. The aim was to assess the maximum range of motion in the ankle joint in the sagittal plane (foot extension).

Initial position of the child: lying on the back, on the tested side the leg was bent at the hip and knee joints to 90 °, the foot was in the plantar flexion position. On the untested side, the leg was fully extended at the hip and knee joints.

2) Silverskjold test. The aim - to assess the shortening of the triceps muscle of the leg or its tone increase. The test differentiates between movement disorders associated with the involvement of the soleus muscle (dorsiflexion with flexed knee) or the calf muscles (dorsiflexion with extended knee).

3. Levels of motor skills formation using the Global Motor Function Assessment System (GMFCS).

In the clinical assessment of motor disorders in infantile cerebral paralysis, relied on the system for the assessing the global level of motor formation GMFCS (Global Motor Function Assessment System).

GMFCS is a descriptive system that considers the degree of motor skills development and limitation of movements in everyday life for 5 age groups of patients with ICP: up to 2 years, from 2 to 4 years, from 4 to 6 years, from 6 to 12,

from 12 to 18 years. According to GMFCS, there are 5 levels of large motor functions development:

- I - walking without restrictions;
- II - walking with restrictions;
- III-walking using hand-held mobility devices;
- IV - independent movement is limited, motorized vehicles can be used;
- V - complete dependence of the child on others (transportation in a wheelchair).

Organization of the study.

The study was performed from 2019 to 2020 in three stages. At the first stage, the general direction of the study was determined, the problem was clarified. Data of scientific and methodological literature, available domestic and foreign methods of abilitation of children with ICP were analyzed. Methods of remedial gymnastics, solving abilitation tasks for this disease were analyzed and generalized, the role of diagonal gymnastics and stretching exercises in the general abilitation process was established [3, 4].

At the second stage, a methodology for individual trainings with a child suffering from infantile cerebral paralysis was developed, which included diagonal gymnastics, stretching exercises, breathing exercises, passive-active exercises and massage. Methods of training and development were determined, a training program was developed, as well as the direct course of trainings.

At the third stage, the processing and interpretation of the results was carried out, conclusions and practical recommendations were formulated, and the text was drawn up.

The abilitation process was carried out for 7 months from September 2019 to April 2020 at home. 7 year old child, F.M., participated in the study. He had a diagnosis of infantile cerebral paralysis syndrome, form - spastic tetraparesis, as a consequence of a malformation of the brain, perinatal lesion of the central nervous system. Massage and physical training 4 times a year for 15 sessions were prescribed.

Medical physical training included the methods of O.P. Tarakanov. (as the main one), Yunusova F.A., and exercises based on the

authors' own experience (table 1). Trainings were held 3 times a week for 2 hours.

Table 1. Structure of individual trainings for a child with spastic tetraparesis

Parts of the training	Time
1. Preparatory part (massage and passive exercise)	60 min
2. Main part	50-55 min
2.1 Diagonal gymnastics	15 min
2.2 Stretching exercises	15 min
2.3 Exercises aimed at developing muscle strength with resistance and load	15 min
2.4 Fitball gymnastics	10 min
3. Final part	
3.1 Breathing exercises	10 min

Each training included preparatory, main and final parts, which determined their content and focus.

1. The preparatory part included massage, passive physical exercises, exercises aimed at increasing mobility in the joints of the upper and lower extremities

Massage movements were from the bottom up - along the links and in general: on the arms - to the armpit, on the legs - to the groin area, on the back - from the sacrum to the armpits, on the stomach - circular movements in a clockwise direction.

For all massage techniques in the initial position, lying on the stomach the child was put in the middle position, the initial position of the arms changed: arms were bent at the elbows, hands at the shoulders (cotton cushions under the forearms) or arms to the sides - the forearms hung from the support, or hands under the head, etc. For massage techniques, lying on the back the child was also put in the middle position. When massaging the abdominal muscles, a cotton roll was placed under the knees to relax the muscles.

Massage significantly increased the effectiveness of therapeutic exercises and all other health-improving measures. Massage was

combined with passive physical exercises, which gave the highest therapeutic effect.

In this case, in the process of abilitation of a patient with a spastic form of infantile cerebral paralysis, exercises were used that were called according to the way they were performed - passive and passive-active.

Passive movements were done by the instructor, while the patient memorized them visually, by ear and through the sensations he received. Passive physical exercises were used in cases where the child could not perform the required movement, but they were possible with the help. At the same time, dosed resistance to the performed movement and techniques of relaxing massage during the exercise were used.

To increase mobility in the joints of the upper extremities, the following groups of local action movements were used:

1. In the girdle of the upper limbs. Possible movements of the shoulders forward, backward, upward, downward and circular movements, produced together with the movement of the shoulder blades. Limitation of movement of the shoulder girdle is most often associated with a spasm of the pectoralis major muscles, leading the shoulders forward, and the trapezius muscles, lifting the shoulders. In this case, the shoulder

blades move from the spine forward and posture changes significantly - usually the back is round, the head is lowered.

To perform passive and passive-active movements with the shoulder girdle, the child was first in a horizontal position (lying on his back), then in an upright position (sitting and standing). In the initial position, lying on the back, it is necessary to give the middle position to the head as the overlying link.

To facilitate the abduction of the upper limb girdle back in the supine position, a narrow long cotton roll was placed between the shoulder blades.

2) In the shoulder joint, it is possible to perform the following movements - flexion (arms forward), extension (arms back), abduction (arms to the sides), adduction (arms down along the body); turns (outward and inward); circular motion.

When developing movements in the shoulder joint, the main method of gripping was the follows: standing behind the patient, shoulder girdle was fixed with one hand over the shoulder joint and the other hand grab the forearm of the patient's bent arm at the level of the elbow joint and perform the following exercises:

a) bringing the shoulder girdle to the middle position (repeatedly);

b) having fixed the shoulder girdle in the middle position (at shoulder level), with his hand all kinds of exercises in the shoulder joint - movements;

c) the same movements with stops in the main and intermediate positions;

d) stops with holding on weight and subsequent "fall" of the relaxed arm;

e) with overcoming the dosed, inferior resistance;

f) swinging movements with one or two hands - "pendulum";

g) free swimming movements;

h) hand rests while sitting, mixed rests on all fours, rests lying with hands and feet stepping over

k) hangs on straight arms - mixed (with legs supported) and "clean" with leg movement, swinging and turning of the body.

3. Possible movements in the elbow joint - flexion and extension. The initial position for the development of movements in the elbow joint was the position on the back in facilitated laying with the arm bent at the elbow joint. Cotton rolls were placed under the knees.

The main method of gripping: the shoulder was fixed with one hand over the elbow joint, pressing it to the support in the prone position or to the child's body in the sitting position. With the other hand, the forearm was taken by the lower third, closer to the hand:

a) the elbow joint was extended. Before extension, first the forearm was bent to the limit, then unbend as much as possible, pulled forward and unbent, shaken, relaxing the muscles of the forearm, "roll" the shoulder and unbend it again, then hold the arm in the extension position for some time and bend it to the possible limit. This was repeated several times until the movement became freer. Before the exercise, the hand was brought to the middle position and held it so for the entire duration of the exercise (or fixed with a splint);

b) changing position from a supine to a prone, hands resting on the forearms. From the position of support on the forearms, face down - to support on straight arms;

d) throwing and catching the ball from different starting initial positions with the help of an instructor;

e) taught to turn the forearm (palm up - supination and palm down - pronation). The supination and pronation movements were performed passively, with stops and relaxation.

4. Wrist joint. Possible movements in the joint: flexion (movement of the hand towards the palmar surface of the forearm), extension (movement of the hand towards the dorsum of the forearm), abduction (movement of the hand towards the little finger), adduction (movement of the hand towards the thumb), circular movements -

performed in isolation by the hand and in combination with pronation and supination of the forearm.

Initial positions for hand work – lying on the back, the arm was flexed at the elbow, the forearm was in the middle position, the hand was with thumbs up, the fingers were clenched into a fist or free. The palm-to-palm method of gripping the hand was used - the palm of the instructor was put on the child's palm, fingers intertwined and bent.

Movements typical of the joint in combination with relaxation were used - "shaking the hands".

5. The joints of the fingers. Possible movements - flexion - extension, abduction - adduction.

Exercises for the wrist and finger joints:

a) Learning to relax the muscles of the forearm, hand and fingers. The main method of massage was "shaking" the hand and fingers separately.

b) Doing all movements common to the joints of the hand and fingers in combination with resistance, stretching and muscle relaxation;

c) Doing thumb oppositions to each finger.

To increase mobility in the joints of the lower extremities, the following groups of movements of local influence were used:

1. Movement in the hip joint. Movement in the joint: flexion-extension, abduction-adduction, rotation - i.e. turns outward and inward. Exercises in the initial positions:

- lying on your back. Approached the child from the side, with one hand held the child's leg by the upper third of the lower leg (from above), with the other fixed the pelvis (the overlying link) and performed the abduction-adduction movement;

- put the hands on the upper surface of the thighs of the child's straight legs - performed alternate and simultaneous "rolling" of the legs (turns out and in);

- lying on the stomach - one leg of the child was bent at the knee joint at a right angle, the knee was held under the knee with the same

hand (from the front surface at the level of the lower third of the child's thigh) or the knee was grasped with the hand, the patient's lower leg on his forearm, fixed the child's pelvis and made extension in the hip joint, abduction and turns.

Each exercise must be finished by relaxing the leg muscles.

2. Knee joint. Movement - flexion and extension. Performed in the initial positions lying on the back, on the stomach.

Exercises:

- * In the initial position, lying on the back (the legs hang from the support), alternate and simultaneous extension of the legs at the knee joints was performed;

- * In the initial prone position, alternate flexion and extension of the legs at the knee joints were performed.

3. Ankle joint. Possible movements are flexion (movement of the foot downward), extension (movement of the foot toward itself), abduction (movement to the side), adduction (movement inward), turns (supination - turn with the thumb up, pronation - with the little toe up).

Exercises:

- Initial position lying on the back: the child's legs were bent; all possible passive movements were performed;

- The initial position was lying on the stomach: the leg was bent at the knee joint at a right angle, one hand grasped the foot from the sole (top), the other held the lower leg from the front surface and performed passive extension.

2. The main part.

The main part included diagonal gymnastics exercises, stretching exercises, weight exercises and exercises on fitballs.

Diagonal gymnastics is an active and passive influence on the species-specific receptors of the musculoskeletal system (muscles) in order to normalize the structures of the brain and spinal cord through impulses in the central nervous system. The diagonal gymnastics complex was performed in the supine position (on the back, on

the stomach). This complex was done in two modes: passive (with the help of parents), passive-active.

Diagonal gymnastics means:

1. Exercises in the initial position - lying on the stomach:

a) alternate flexion-extension in the joints of the left and right legs alternately in the ankle, knee, hip joints

b) simultaneous flexion-extension in the joints of the legs also: in the ankle, knee, hip joints

c) simultaneous flexion-extension in the joints of the hands: wrist, elbow, shoulder.

2. Joint (synchronous-asynchronous) flexion-extension:

d) in the ankle joint by one and the wrist joint by the other hand;

e) in the knee joint by one hand and the elbow joint by the other hand;

f) in the hip joint of one leg and the shoulder joint of the other arm;

g) in the ankle joints of the legs and wrist joints of the hands;

h) in the knee joints of the legs and elbow joints of the arms;

i) in the hip joints of the legs and shoulder joints of the arms;

j) in the ankle joints of the legs and then in the left, then in the right wrist joints of the arms;

l) in the knee joints of the legs and, at the same time, in the left, then in the right wrist joints of the hands;

m) in the hip joints of the legs and, at the same time, in the left, then in the right shoulder joints of the hands;

m) in the elbow joints of the hands and then in the left, then in the right knee joints of the legs;

o) in the shoulder joints of the arms and then in the left, then in the right hip joints of the legs.

One of the effective methods for the prevention and development of contractures is a special set of stretching exercises - stretching.

When carrying out these procedures, the following rules must be followed: there should be no tension in the muscle, the direction of stretching is strictly along the axis of the muscle fiber, stretching should be slow, when stretching, the force of influence increases gradually, stretching is performed while inhaling.

All stretches are based on natural joint movements.

The indications for the use of stretching exercises are limited motion in the joints, contractures, motor disorders, and gait disturbances.

Pronounced hyperkinesia, pain syndromes, persistent contractures can be contraindications for stretching.

For children with spastic diplegia, the following conditions for stretching are recommended: duration of exercises for no more than 20 minutes and the duration of one stretching is from 3-5 to 7-9 seconds.

Before stretching, the child should be as relaxed as possible. This was achieved by prior massage and passive gymnastics.

The most favorable positions for relaxation are the initial supine position or the initial prone position.

Load exercises were used in accordance with the direction of exposure to specific muscle groups.

• For the muscles of the neck:

1. Initial position - lying on the back, the head hanging from the support. The shoulders were pressed against the support by the hands of the assistant. All possible head movements (flexion-extension, turns, bends) were done passively. Then lifting of the head from the position of extreme extension was stimulated. The patient was asked to keep the head horizontal for a count of 10;

2. Initial position - sitting, knees hanging from the support. Having put the palm on the child's head, he was asked to press on the palm (count to 5; movements left, right, backward, forward).

• For the muscles of the trunk:

1. Initial position - sitting on the knees. Pressure was on the shoulders with both hands. The child responded by extending the spine, by pulling back the shoulder girdle;

2. Initial position - lying on the stomach, chest and stomach on the edge of the table. Legs and buttocks were held. Holding the child by the hands, he was asked to rise up from the extreme bend, straighten his back and neck, and stay in the upper position (up to 10 times);

3. Initial position - lying on the stomach, legs hanging from the couch. The child was helped to raise his legs and asked to slowly lower them (up to 10 times). The legs were kept in a horizontal position for up to 10 counts;

4. Initial position - kneeling. Holding the child by the shins. Holding the child by the arms and giving him a horizontal position, he was asked to return to the initial position (10-15 times);

5. Initial position - on all fours, supporting the child, he was asked to lower the pelvis, first from right, then to left and return to the initial position;

6. Initial position - on all fours, 250 g weights were on the legs and arms. The opposite legs and arms were lifted with an assistant, holding the weight for 30 seconds in each direction.

• For the abdominal muscles:

1. Initial position - lying down, legs hanging from the edge of the couch. The child was taken by the hand, helped to sit down, with the other hand helped to put his hand on the support from behind (up to 10 times in each direction);

2. Initial position - lying on the side, head and shoulder girdle out of support. The pelvis was fixed. The child was helped to get up and turn his head away from the support, arms were clasped and straightened (up to 10 times in each direction);

3. Initial position - sitting on the assistant's knees, facing him, the legs are straightened and on the sides of the assistant's torso, the arms were

folded on the chest. Holding the child's body with the hands, he was asked to lean back so that the body took a horizontal position. The arms were extended at all joints. He was helped to return the initial position (up to 10 times).

• For arms:

1. Initial position - sitting, legs in Turkish style. The child was asked to bend or straighten his arm at the elbow joint, while the pressure was exerted on the forearm in the opposite to the movement direction (5 times in each direction);

2. Initial position - lying on the stomach, support on straightened arms. The child's body was supported in a horizontal position, push-ups (up to 10 times) were made.

• Standing:

1. Initial position - standing. The instructor was behind the child, clasping his hips above the knees, pressing his soles to the support. Then he was pushed forward and down. The child independently straightened the torso (up to 15 times);

2. Initial position - standing. Squatting was in two positions: legs together and legs wider than shoulders, feet were turned by 45°. The child was held so that the feet were firmly pressed to the floor. The child was helped to sit up and get up;

3. Initial position on the knees, body upright. The child was held by the arms. He was helped to stand on his feet in turn (feet pressed to the floor) from this position and return to the initial position.

The main part was supplemented by exercises with fitballs.

1. Initial position - lying on the stomach. Swinging the child forward, he was asked to put his arms forward and make several forward movements forward and with his hands on the floor, depending on the movement of the ball. When the ball was moving backward, the legs were put on the support and made small forward movements so that the legs were completely on the support (up to 10 times);

2. Initial position - lying on the back. Rocking the child forward, he was asked to touch

the body with his palms and push off (up to 10 times);

3. Initial position - lying on the back. The child was put to a sitting position and asked to maintain this position; by swinging the ball, the attempts were made to disturb the balance (up to 10 times).

In the process of abilitation trainings, the methodological recommendations for teaching voluntary movements described in a practical guide edited by F.A. Yunusov, A.P. Efimov [25] were followed:

1) movements in oblique directions (diagonals) for each limb separately and simultaneous counter movements of the upper and lower limbs obligatory with resistance. Diagonal work is essential for mastering new coordination in muscle work;

2) stretching exercises;

3) alternation of muscles tension and relaxation while performing active movements (for example, keeping the arm on weight and then dropping it), the same with respect to the head, legs, etc.;

4) exercises with objects (toys, balls, sticks, hoops and others);

5) exercises with weights (sandbags or shot bags, dumbbells, stuffed balls, parts of a weighted suit, and others);

6) teaching correct breathing.

3. Breathing exercises were included in the final part.

For a child with infantile cerebral paralysis, the most suitable method of breathing exercises is contact breathing.

The hand was placed on a certain area of the chest. The hand was close enough to the surface of the chest. At the same time, the degree of pressure on the surface was maintained during all phases of breathing (inhalation and exhalation). The instructor's hand should be warm, because the child unconsciously begins to breathe deeper just in that part of the lung where he feels the instructor's hand. The procedure lasted 7-10 minutes.

In the international classification, among the methods of controlled breathing, there are the so-called "therapeutic positions of the body" - these are postures that have an effect on the breathing process by themselves.

Each exercise was done 2-3 times in a row in both directions.

Contact breathing exercises consisted of the following exercises:

a) Initial position - lying on your the, head above the pelvis. Ventilation was increased in the anterior sections of the upper lobe of the child's lung. The hand was under the collarbone along the ribs of the child, good contact of the hand with the chest was maintained and accompanied its movements during inhalation and exhalation (Figure 1);



Fig. 1. Increasing ventilation in the anterior sections of the upper lobe of the lung in a child

b) Initial position - lying on the stomach, head above the pelvis. Ventilation was increased in the posterior parts of the upper lobe of the child's lung. The hand was between the shoulder

and the shoulder blade of the corresponding side. The little finger or pad of the little finger was between the spine and the shoulder blade (Figure 2);

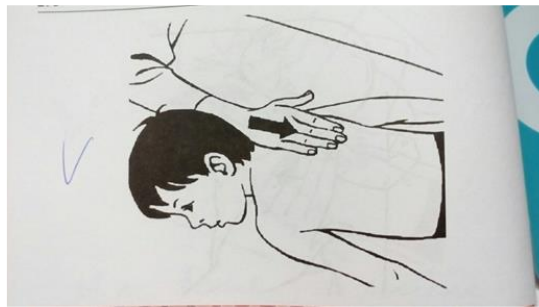


Fig.2. Increasing ventilation in the posterior parts of the upper lobe of the lung in a child

c) Initial position - lying on the back, head above the pelvis. Ventilation was increased in the anterior segments of the right or lingual segments of the left lung in a child (Figure 3);

d) Initial position - lying on the stomach, head above the pelvis. Increase ventilation in the posterior segments of the middle lobe of the right lung in a child (Figure 4);



Fig.4. Exercise for increasing ventilation in the posterior segments of the middle lobe of the right lung in a child

e) Initial position - lying on the back, head above the pelvis. Ventilation was increased in the anterior parts of the lower lobe of the child's lung.

The hand rests on the lower chest along the lower edge of the rib (Figure 5);



Fig.5. Strengthening ventilation in the anterior parts of the lower lobe of the lung

f) Initial position - lying on the side. Ventilation was increased in the lateral parts of the lower lobe of the child's lung. The hand was

on the inferior-lateral part of the chest along the lower edge of the rib (Figure 6)



Fig.6. Increasing ventilation in the lateral parts of the lower lobe of the lung in a child

g) Initial position - lying on the stomach, head down. Ventilation was increased in the posterior parts of the lower lobe of the child's

lung. The hand was on the back of the ribcage along the lower edge of the rib (Figure 7).



Figure 7 - Increasing ventilation in the posterior parts of the lower lobe of the lung

Results.

A detailed assessment of motor skills using the Global Motor Function Scales (GMFM 66/88)

was carried out before the start of the exercise cycle and immediately after it (Table 2).

Table 2 Scale of measurement of large motor functions (GMFM 66/88)

	A. Position of the child lying on the couch	0	1	2	3	HO
1.	Lying on the back, head in the midline: turned the head with a symmetrical arrangement of the limbs				•	
2.	Lying on the back: brings the arms to the midline, touches one arm by another with the finger				•	
3.	Lying on back: raised his head 450				•	
4.	Lying on the back: fully bent the right hip and knee				•	
5.	Lying on the back: fully bent the left hip and knee				•	
6.	Lying on the back: reached with the right hand towards the toy, the arm crossed the midline of the body				•	
7.	Lying on the back: reached with the left arm towards the toy, the arm crossed the midline of the body				•	
8.	Lying on the back: turned onto the stomach through the right side				•	
9.	Lying on the back: turned onto your stomach through the right side					

					•	
10.	Lying on the back: raised the head to an upright position				•	
11.	Lying on the stomach with support on the forearms: held the head upright, arms were extended at the elbows, the chest was raised				•	
12.	Lying on the stomach with support on the forearms: when transferring weight to the right arm, the left arm was fully unbent, stretched forward				•	
13.	Lying on the stomach with support on the forearms: when transferring weight to the left arm the left arm was fully unbend, stretched forward				•	
14.	Lying on the stomach: turned onto the back through the right side				•	
15.	Lying on the stomach: turned onto the back through the left side				•	
16.	Lying on the stomach: turned to the right side (by 90 ⁰)				•	
17.	Lying on the stomach: turned to the left side (by 90 ⁰)				•	
The total of points in the section "Lying on the couch"					51	
% of maximum (N / 51x100%)					100%	
18.	B. Sitting	0	1	2	3	HO
a.	Lay on the back, the doctor held the child by the hands: the child sat down, holding his head			•	•	
19.	Lay on the back: turned over right side, sat down			•	•	
20.	Lay on the back: turned over left side, sits down			•	•	
21.	Sat on the rug, supported by the doctor by the chest: held the head upright for 3 seconds			•	•	
22.	Sat on the rug, supported by the doctor by chest: held the head upright for 10 seconds			•	•	
23.	Sat on the rug with support on his hand, maintained balance for 5 seconds			•	•	
24.	Sat on the rug with free hands, maintained balance for 3 seconds			•	•	
25.	Sat on the rug with a small toy in front of him: bent over to the toy, touched it and returned to his initial position without resting on his arms			•	•	
26.	Sat on the rug: hand touched a toy located at an angle of 45° behind the back on the right, returned to his initial position			•	•	
27.	Sat on the rug: hand touched the toy, located at an angle of 45° behind the back to the left, returned to his initial position		•		•	
28.	Sitting with the right side (both legs were bent to the left, and both feet were near the left thigh or in line with the left thigh), arms were free: maintained balance for 5 seconds		•		•	
29.	Sitting with the left side (both legs were bent to the right side, and both feet were near the right thigh or in line with the right thigh), arm were free: maintained balance for 5 seconds		•		•	
30.	Sat on the rug: lay on the stomach, controlling movements		•		•	
31.	Sat on the rug with legs extended forward: got on all fours through	•		•		

	the right side					
32.	Sat on the rug with legs extended forward: got on all fours through the left side	•		•		
33.	Sat on the rug: turned 900 without using hands	•	•			
34.	Sat on the bench without support on arms and legs: maintained balance for 10 seconds	•				
35.	Stood: sat on the low bench	•				
36.	Sat on the floor: sat on a low bench	•				
37.	Sat on the floor: sat on a high bench	•				
The total of points in the section "Sitting"					22	44
% of maximum (N / 60x100%)					37%	73%
	B. Crawling and walking on the knees	0	1	2	3	HO
38.	On the stomach: Crawled forward 1.8m (6ft)			•	•	
39.	On all fours: Kept weight on hands and knees for 10 seconds			•	•	
40.	On all fours: sat down, sits, not leaning on hands			•	•	
41.	On the stomach: kneeled on all fours, keeping the weight on the hands and knees			•	•	
42.	On all fours: stretched forward with the right hand, raising the hand above the shoulder			•	•	
43.	On all fours: stretched forward with the left hand, raising the hand above the shoulder			•	•	
44.	On all fours: crawled or moved in jerks forward 1.8 m (6 ft)			•	•	
45.	On all fours: Reciprocally crawled forward 1.8m (6ft)			•	•	
46.	On all fours: climbed up the stairs 4 steps on hands and knees / feet	•				
47.	On all fours: descended backwards down the stairs 4 steps on hands and knees / feet	•				
48.	Sat on the rug: kneeled, pushing off with the hands, held the straightened body without resting on his hands for 10 seconds	•				
49.	Kneeling with a straightened body: took a standing position on one right knee with a straightened body using hands, maintained balance, hands were free for 10 seconds	•				
50.	Kneeling with a straightened body: took a standing position on one left knee with a straightened body using hands, maintained balance, hands were free for 10 seconds	•				
51.	Kneeling with a straightened body: moved on his knees 10 steps forward without support on the hands	•				
The total of points in the section "Crawling and walking on the knees"					16	24
% of maximum (N/42x100%)					38%	57%

The child does not stand; therefore, the standing position was excluded from consideration, i.e. the assessment was made

according to the 51-st motor function (function D, D = 0).

Calculation of the coefficient for the first examination

$$\text{Total coefficient} = (\% A + \% B + \% C + \% D + \% E) / 5 = (100 + 37 + 38 + 0 + 0) / 5 = 35\%$$

Based on the results of the initial examination according to GMFCS, a coefficient of 35% was calculated, which corresponds to the IV level of the child's motor development.

young children), but we could correctly prioritize abilitation, which were shifted towards correcting posture and contracture prevention.

After habilitation, the coefficient increased to 46%.

Calculation of the coefficient for the second examination:

$$\text{Total coefficient} = (\% A + \% B + \% c + \% D + \% e) / 5 = (100 + 73 + 57 + 0 + 0) / 5 = 46\%$$

This is slightly above the IV level, which indicates a positive dynamic. Functionally, many of the tested movements reached the third (highest level), for example, sitting, crawling, and correct holding of the head in different initial positions.

Goniometric studies were carried out twice, before the beginning of the training cycle and after its completion (Table 3)

Table 3.

Joint	Movement	1 examination		2 examination	
		D	S	D	S
Shoulder joint Sitting position	Abduction (N = 180 °)	180°±2	180°±2	180°±2	180°±2
	"catch" test	0°	0	0°	0
	Flexion (N=180°)	170°±2	170°±2	170°±2	170°±2
Elbow joint Lying on your back	Flexion (N=30°)	30°±1	30°±1	30°±1	30°±1
	Extension (N=180°)	180°±2	180°±2	180°±2	180°±2
	"catch" test	165°	2	160°	2
Combined radioulnar joint	Hand pronation (N=90°)	90°±1	90°±1	90°±1	90°±1

		1 examination		2 examination	
	Hand supination (N = 70 °)	30°±1	35°±1	40°±1	45°±1
	"catch" test	25°±1 3	27°±1 2	28°±1 3	30°±1 2
Wrist joint	Flexion (N=105°)	100°±2	100°±2	100°±2	100°±2
	Extension (N=115°)	105°±2	105°±2	108°±2	108°±2
Hip joint (h / j) Supine position	Flexion (<110°)	100°±2	100°±2	100°±2	100°±2
	Thomas test	17°±1	15°±1	18°±1	15°±1
	Abduction - the leg is extended in the hip and knee joints (N = 50 °)	20°±1	20°±1	30°±1	30°±1
	"catch" test	10°±1 3	10°±1 3	15°±1 2	15°±1 2
	Abduction - the leg is extended in the hip and knee joints by 90°(N=45°)	40°±1	40°±1	45°±1	45°±1
	"catch" test	25°±1 2	25°±1 2	30°±1 1	30°±1 1
Position on the stomach	Phelps adduction	++	++	++	++
	Internal rotation (N=60°)	70°±1	70°±1	60°±1	60°±1
	External rotation (N=40°)	30°±1	30°±1	33°±1	33°±1
	Duncan-Ellie test (+, ++, +++)	+	+	+	+
Knee-joint	Extension (N=5°)	0°	0°	0°	0°
	Unilateral popliteal angle (N 1-3 years: girls -163 °, boys - 155 °;> 5 years - 150 °, adults - 140 °)	140°±2	138°±2	151°±2	148°±2
	Tect "catch"	125°±2 1	125°±2 1	135°±2 1	135°±2 1
Ankle joint	Dorsiflexion with flexion at the knee joint (N = 60 °)	85°±1	83°±1	80°±1	78°±1
	"catch" test	97° 2	100° 2	90° 2	95° 2
	Dorsiflexion with extension at the knee joint (N = 70 °)	90°±1	93°±1	85°±1	87°±1
	"catch" test	100° 3	105° 3	95° 2	97° 2
	Plantar flexion with flexion at the knee joint (N = 45 °)	45°±1	45°±1	45°±1	45°±1

Discussion.

During the study, it was found that abduction and flexion of the right and left shoulder joints were within the normal range (180°), flexion (30°), extension (180°) in the

elbow joint were normal, the spasticity in the biceps muscles R2 - R1 = 20° (S); R2 - R1 = 15° (D), normal pronation, significant limitation of supination 50° (D), 55° (S); the presence of spasticity in the muscles R2 - R1 = 15° (D), R2 -

R1 = 15° (S); dorsiflexion (100°) and extension (105°) were normal, showing a significant increase in muscle tone, difficulty in active movements, the presence of flexor-pronator synkinesis, which occurs when the muscles of the pronators of the forearm are activated, which manifests in voluntary flexion of the arm in the elbow joint by additional movement - pronation of the forearm.

Flexion of the hip joint was normal, the presence of slight contraction in the iliopsoas muscle (Thomas test (D 30°), (S 25°)), moderately limited abduction of the joint (D 20°), (S 20°) with straightened legs. There was a grade 3 catch symptom (clonic movements for less than 10 seconds while maintaining pressure on the joint); R2-R1 = 10° (D), R2 - R1 = 15° (S). With the legs bent in the hip and knee joints, the "catch" symptom was much less pronounced - 2 degree. This shows the presence of spasticity in the posterior thigh muscle group (biceps, semi-membranous and semi-tendinous).

Phelps Adduction test showed that there was a shortening of the gracilis muscle; according to the Duncan-Ellie test, the rectus muscle was normal.

Rotational movements in the hip joint showed an average degree of contraction of the adductor muscles of the thigh, weakening and overstretching of the gluteus muscles.

Studies have shown the presence of moderate contracture in the hip joint.

The measurement of the popliteal angle showed an average degree of contraction in the knee joints (135°) and the presence of spasticity of the posterior thigh muscle group, manifested by the catch phenomenon (R2 - R1 = 10°), leading to a significant decrease in the range of motion in the knee joints.

In the sitting position with an attempt to straighten the legs, passive internal rotation and flexion in the knee joints were observed. At the same time, the impossibility of complete hip flexion in the hip joints, pelvic tilt and unstable

position, sitting - the presence of a compensatory forward bend of the trunk were noted.

Indicators of goniometry in the ankle joint were - with the knee bent 5 °, with the unbent knee -7 °.

Tardier's test (R2 - R1 = 5°) showed the presence of spasticity in the triceps muscle of the lower leg and its shortening and the presence of contracture in the ankle joint. A grade 4 catch symptom indicated the presence of clonic ankle cramps. During the study, the presence of tibial synkinesia was noted, which was manifested by additional activation of the lower leg muscles during voluntary flexion of the leg at the knee joint, which led to dorsiflexion of the foot and its supination.

These studies show a complex mechanism of impaired neuromuscular interaction. Parameters of Tardier scale reveal the presence of pronounced muscle tone of the upper and lower extremities, difficulty in passive movements, synkinesis and contractures in the hip and ankle joints.

When assessing the goniometric parameters of the arm joints after the end of the trainings, the supination of the arm slightly improved by 10°, the passive movements were freer, and the manipulative function of the hand improved.

According to the results of the study, there was a positive dynamic of goniometric parameters in the joints of the legs:

Abduction of the hip joint increased by 10° with straight legs. The degree of "catch" symptom decreased from the 3rd to the 2nd. The adduction angles with the legs bent at the hip and knee joints were 45 °, the "catch" test decreased from the 2nd to the 1st degree. The parameters of internal rotation of the hip joint improved by 10°. Analysis of these parameters of the hip joint showed that the tone was leveled and the restoration of the gluteal muscles begins, the amplitude in the hip joint increased.

In the knee joint, the unilateral knee angle increased by 10°, the "catch" test of unexpressed grade 1. This suggests that the spasticity of the

posterior thigh muscles has significantly decreased.

Dorsiflexion in the ankle joint with bent and unbent knees increased by 5°, clonic contractions stopped, the catch symptom decreased from grade 3 to grade 2, respectively. The placement of the feet on the surface has improved significantly.

After abilitation by means of diagonal gymnastics and stretching, they changed in a positive direction, showing a significant increase in joint mobility. According to the Tardier scale, muscle tone decreased, movements became freer. It should be noted that muscles, ligaments and other tissues have their own receptors that respond to stretching during child's work. Removal of spasticity made it possible to develop shortened tendons, increase the volume of passive movements, increase the elasticity of muscle fibers and, as a result, there was a decrease in contractures in the upper shoulder girdle and lower extremities.

The analysis of the goniometric parameters shows that the prolonged complex of physical rehabilitation, consisting of massage, diagonal, passive, breathing exercises, performed according to Tarakanov O.P., Semenova K.A., Shapkova L.V., Kokolina V.F. methods 2 hours a day 3 times a week in two courses of 15 sessions showed the effective influence on a child with a spastic form of infantile cerebral paralysis. The general state, the condition of the musculoskeletal system significantly improved, the muscle imbalance was reduced, which contributed to the formation of basic motor skills, increased motor activity, increased range of motion in the joints, and relaxation of spastic muscles.

Conclusion.

Analysis of the scientific and methodological literature shows an increase in the number of patients with infantile cerebral paralysis, the main cause for the development of which is damage or anomalies in the development of the brain of the fetus and newborn. Such

children, with untimely and unsystematic treatment, are distinguished by a sharp decrease in the abilitation potential and social adaptation. We summarize the fact that in correct physical training and health-improving work with children suffering this pathology, an individual approach is often the only acceptable, since it requires the teacher to concentrate on only one person.

In the course of the study, a set of individual trainings with a child with spastic tetraplegia was developed, the main principles of which were: regularity, systematic and continuous use of exercises, strict individualization of exercises in accordance with the stage of the disease, its severity, the child's age, his mental development, gradual, strictly dosed increased physical activity. The complex was based on the means of diagonal gymnastics and stretching, and it was also supplemented with passive exercises, massage, exercises on fitball and with weights.

The developed complex of individual trainings showed its effectiveness, which was expressed in a steady decrease in pathological symptoms, which manifested in normalization of muscle tone, the extinction of the labyrinth tonic reflex, which was manifested in the vertical holding of the head and a decrease in flexion tonic settings of the legs. This allows to believe that the developed set of exercises used in the process of abilitation will help expand the motor and functional capabilities of a child with infantile cerebral paralysis.

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