

Hand function improving in patients with cerebral palsy

Usprawnianie funkcji ręki u pacjentów z mózgowym porażeniem dziecięcym

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Streszczenie

Ręka jest narządem naszego ciała spełniającym bardzo wiele różnych funkcji. Poprzez sprawnie funkcjonujące kończyn górnych doświadczamy i uczymy się, komunikujemy się ze światem, zdobywamy samodzielność. W mózgowym porażeniu dziecięcym rolą terapeuty jest prawidłowe zaplanowanie procesu terapii ręki, wymaga to od niego posiadania dużej wiedzy o tym, czym jest MPD, jakie niesie ze sobą objawy ruchowe oraz zaburzenia współistniejące, które wpływają na nieprawidłowy rozwój dziecka. Fizjoterapeuta musi we właściwy sposób ocenić poziom funkcjonalny dziecka, przewidzieć i zaplanować terapię tak by dziecko osiągnęło maksimum swoich możliwości rozwojowych. Nie jest to łatwe zadanie bo praktycznie każde dziecko z mózgowym porażeniem dziecięcym jest inne, inne są jego ograniczenia ruchowe, objawy towarzyszące i środowisko w którym się wychowuje.

Słowa kluczowe: mózgowie porażenie dziecięce, MPD, funkcja ręki, terapia ręki, rehabilitacja

Abstract

The hand is an organ of our body that fulfills a lot of different functions. Through efficiently functioning upper limbs, we experience and learn, communicate with the world, and gain

independence. In the cerebral palsy, the role of the therapist is to properly plan the hand therapy process, it requires him to have a good knowledge of what MPD is, which is associated with movement symptoms and coexisting disorders that affect the child's abnormal development. The physiotherapist must properly assess the child's functional level, anticipate and plan therapy so that the child reaches its maximum development potential. This is not an easy task because virtually every child with cerebral palsy is different, other are its movement limitations, accompanying symptoms and the environment in which he is brought up.

Key words: cerebral palsy, MPD, hand function, hand therapy, rehabilitation

Introduction

Hand dysfunction in cerebral palsy depends on the location, extent and severity of damage to the central nervous system. It may be small in light forms of cerebral palsy or limit many functions in severe forms of quadriplegia or extrapyramidal paralysis. In a child with a disability, this hand often plays a supporting role and initiates movement. Supports on the hands and grip make it easy to change positions and allow you to acquire new skills. The hands are also an important means of communication with the environment, with frequent speech disorders occurring in children with cerebral palsy, they allow to signal needs and express emotions. Therefore, in each case, an effort should be made to improve the hand, assuming that functional upper limbs can help a child with cerebral palsy in achieving functional independence and communication with the outside world.

Hand therapy

In the process of planning the therapy of the hand of children with cerebral palsy, it is important to know the symptoms resulting from the area of brain damage. They can be grouped into three basic neurological teams:

1. **SPASTIC SYNDROME.** It is created as a result of damage to the pyramid system. Characters with dominant spasticity occur most often. They are characterized by high muscle tone, which reacts with even greater tension to the test of dynamic stretching. The antagonistic muscles are not able to resist such a strong tension, as a consequence of which the different parts of the body are incorrectly positioned, and in the long-term to contractures and

deformations. Spasticity movements are slowed down and not very precise. Movement coordination is disrupted, often accompanied by associated reaction. The most frequently perpetuated abnormal pattern of the upper limb is abduction and internal rotation of the shoulder, forearm adjustment in the flexion and pronation, flexion of the wrists and fingers, thumb tucked in the hand [1].

2. **EXTRAPYRAMIDAL SYNDROME (ATHETOTIC).** The symptoms of athetosis include involuntary movements, independent of our will, aimless. They intensify under the influence of emotions, while they limit under the influence of fatigue, in the position on the stomach and when the child focuses on something. Involuntary movements can affect every part of the body, and sudden muscle contraction can cause loss of balance. The presence of involuntary movements sometimes makes it impossible to perform any kind of motion. In conducting therapy in children with athetotic syndrome, it is particularly important to conduct relaxation exercises, too much emotional tension increases the number of involuntary movements. Intellectual level of these children is often very high, you can count on good cooperation with them. Exercises should be carried out at a slow pace and focus on a small number of movement activities. It is very important in this type of paralysis to quickly master the supports and grip. Initially, focus on symmetric exercises to stabilize the head and torso, which limits involuntary movements. Therapy should be conducted with loud speaking, talking with others.

3. **CEREBELLAR SYNDROME (ATACTIC).** The result of the damage of the cerebellum arises. It is characterized by balance disorders, unbalanced movements with poor coordination. Often, the movement does not go to the object, there is an intention tremor. In most cases, there is a reduced muscle tone. When it comes to hand movements, they are not very precise. The cerebellar syndrome is characterized by reduced muscle tone, so in therapy we should pay special attention to improvement in accordance with the development principle, to go to exercises in higher positions when we are sure that the child can cope with them. This prevents damage to the osteoarticular system. It is advisable to use exercises with resistance, isometric exercises and pressure in the joints. During therapy, we call parts of the body, movement and directions. In this way we facilitate the feeling of the body in space. Stimulating hands and feet allows for the relief of symptoms of hyperalgesia that occurs in this syndrome [1,2,3].

Spastic syndrome is the most common cause of almost 75% - 85% of all cases of cerebral palsy. Therapy team working with dominant spasticity should requires certain rules. Because in children with cerebral palsy, excessive emotions are manifested by the increase in muscle tone and the appearance of abnormal motor reactions. Therapy should be carried out patiently and

unhurriedly, without excessive emotional arousal. The movements should be carried out gently and slowly. Because the spastic muscle reacts with even greater tension to fast movements. It should precede treatment exercises using muscle relaxants. You can apply a gentle massage, warm water baths.

Therapy of a patient with increased muscle tone within the upper limb begins with the construction of correct body linearity. It is very important to create the right conditions to work with the upper limb by strengthening the work strategy on the body. Strong trunk = less muscle tone on the periphery. After preparing the patient, we want to get the correct positioning of the humerus head within the shoulder joint by placing the upper limb in the external rotation, regaining proper operation of the scapula in the adduction and internal rotation. We develop muscle structures that are responsible for maintaining the upper limb properly in the body space. Gradually, we go to the distal parts of the upper limb. During therapy, we try to reverse pathological patterns such as increased pronation of the forearm, flexion of the wrist and flexion of the fingers. During the therapy we use deep massage of the extensors and flexors of the forearm, wrist and fingers. Joint approximation and vibrations are also used to stimulate deep sensation. We make movements in a closed space in order to build the orientation of the body [4,5].

The basis for the development of the correct grip and manipulation of the hand in children is the head control and stabilization of the shoulder girdle, both in the lying, sitting and standing position. The head control enables the child to develop hand activities under the control of sight, i.e. the development of eye-and-hand coordination. It is important to correct the position of the head in the axis of the body during the exercises. The asymmetrical setting disturbs the control of movement by the eyes. When the child reaches successively stabilize the trunk and pelvic girdle, open up new possibilities for the use of his hands. Therefore, torso stabilization exercises performed in different positions are so important for the development of hand function. By improving the hand activities we take into account the way of reaching, gripping and releasing the grip

Exercises correcting some incorrect arm and hand movement patterns

Incorrect hand-pulling patterns are corrected during exercises that correspond to the next stages of proper child development:

- up to 5 months: reaching hands in three positions on the back, on the stomach, on the side;

- between 5 and 7 months: we use the exercises from the previous stage, and reaching hands during sideways rotation, reaching hand while the other is supported;
- between 7 and 9 months: reaching hands in a supported kneeling, and in a straight kneeling when the other hand is supported on a table;
- between 9 and 12 months: reaching out while sitting alone, kneeling straight and standing when the other hand is holding a flat plane,
- over 12 months: reaching out in standing.

We should practice reaching out patterns in all directions, the movements are performed in turning by each arm and both hands. Bilateral symmetric patterns of hand extraction are used to support and change position, counteract asymmetry. Bilateral opposing patterns, are used to control creep movement and perform alternate hand movements. The asymmetrical double pattern serves the development of complicated motor activities. In children with cerebral palsy, unfortunately, there are a lot of disorders in the upper limb, the therapist trying to correct them and facilitating correct movement. Here are some examples of therapy with incorrect grip patterns [4,5]:

- gripping in only one hand position: we practice the grip in different directions and assume different body positions;
- bending the wrist with a monkey grip, a the tweezers' grip or a lack of grip: during the grip, we adjust the wrist, press it down, simultaneously lift the captured object and recommend lifting the hand in its direction. For some children, you will need to use a wrist splint to allow grip. With a high flexional spasticity of the fingers and wrist, we set the palm in the intermediate position;
- excessive bending of the fingers during the grip in the interphalangeal joints when extending in metacarpophalangeal joints: the corrective exercise for this kind of grip is done by placing the child's hand on the roller, lifting his metacarpophalangeal joints from the dorsal side, we recommend pressing it with straight fingers (Fig. 1), in this position we can stimulate the rectifiers in the direction of the head;



Fig. 1. Correction of excessive flexion of fingers (own material)

- adduction of the thumb and grip in elbow setting: we adjusted this setting by hand exercise hand bend in the radial direction, for exercises we can use lifting spoon to the mouth. Correcting the position of the thumb starts with the hand position in the supination or intermediate position and we abduct the thumb by pressing its base. The thumb can also be adjusted with special stiffeners, correcting the position of the thumb during the performance of the tweezers grip (Fig. 2) [4];



Fig. 2. Thumb release, pliers grip (own material)

- no possibility of grabbing both hands simultaneously: we correct by performing activities requiring the use of both hands in different positions, for example: kneading the dough, rolling, holding the pot by the handles, pushing hard things, one hand-holding disorder can result from both hand-holding disorder (Fig. 3);



Fig. 3. Work with both hands (own material)

- accompanying grip: occurs when a child grabs an object with a more efficient hand and the other hand tightens at the same time. A frequently observed pattern in spastic children. We practice the elimination of this kind of grip by arranging the weaker hand of the child on the table with the elbow extended in external rotation and we load it axially and the other performs the grip. We need to give meaningful task. Accompanying reactions may also occur in other parts of the body and should be corrected (Fig. 4);



Fig.4. Accompanying grip (own material)

During the grip exercise, the child should assume the correct posture. Doing exercises should follow the movements of your hands, and the therapist tell him what he is doing. Grip exercises are preceded by open hand techniques. We begin the exercise of the grip from the easier positioning of the hand in the pronation then we go to the intermediate position and in the supination. We improve the child's grip in accordance with the development principle.

Incorrect releasing of the handle:

- the child can not release the object from his hand: this is because of excessive muscular tension within the flexors;
- releasing the item is possible only with palmar flexion in the wrist: the child to release the object from the hand bends the wrist helping with the other hand or other part of the body, if the child has a corrected wrist bend, learns to release the handle in the intermediate position of the hand actively or with the help of a therapist;
- release of the grip at the palm flexion of the wrist and thumb adduction: the exercise of slowing the grip in the supine position of the forearm and abduction the thumb, to the thumb exercise large items keeping in hand are used;
- releasing the grip at the elbow position of the hand: it is corrected when objects are thrown into the container from the radial side;

- releasing the grip with spreading fingers: such hand positioning occurs in dyskinetic forms, the therapist helps the child hold the hand from the elbow side, and the release of the object takes place on the radial side. Sometimes the child avoids contact with objects due to hypersensitivity of the hands, we try then to work on hand desensitization by using appropriate stimuli. Large difficulties in gripping and releasing the grip have children with involuntary movements.

The position for exercise must give a sense of security, while allowing you to do exercises. The first tasks depending on the general purpose of the therapy begin in the positions that facilitate the task. Increasing postural control. In the absence of proper head control and stabilization of the shoulder girdle, the child lying on the stomach puts a wedge under the chest and a wedge lying on the back under the head. In the sitting position with poor stabilization of the torso and the pelvic girdle, the child must have a backrest behind the back and a properly adapted depth and height of the seat. Feet must be based on the ground, and will adhere to the entire length of the seat. The hand table should be close to the child and reach for the child to the height of the alveolar process. We always try to correct the position of the head to be in the axis of the body. We start the exercises with large joints and large muscle groups, then move to smaller, more precise ponds. You can use a top with a recess in the shape of a concave arch or washers to prevent the elbow from sliding off the table. In the planning of exercises, we apply the principle of grading difficulties, going from easy to difficult exercises. The aids used in the exercises must be attractive to the child, therefore adapted to their age and interests [5,6].

Summary

The goal of every therapy, including hand therapy, is to develop the functional capabilities of the child, which will allow him to achieve the greatest possible independence and independence as well as active participation in social life. Transferring kinesitherapeutic exercises into simple and complex activities of everyday life that facilitates participation in the environment. In the case of children with cerebral palsy, often the full functionality of the hand is not achieved, we help the child to adapt to living with limitations.

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