

OVERCOMING SPEECH AND MOTOR DISORDERS OF CHILDREN WITH CEREBRAL PALSY

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The issues of prophylaxis and early rehabilitation of speech disorders, in particular, caused by organic brain damages, are acquiring special significance in regard of providing appropriate psychological and pedagogical help, as well as further social adaptation of such patients. The renewal of the disordered motor ontogenesis of children with cerebral palsy is a complicated task for medical rehabilitation. This pathology is characterized with various motional disorders, causing flexion contracture and extremities deformation, figure and gait disorders, etc. Speech and movement abnormalities manifest themselves in various forms of dysarthria, whose main clinic evidence includes breath, voice, and articulation disorders. They have the same pathogenetic basis as motor disorders of the body and extremities. As any pathological movement stereotype, they are persistent and diverse, and they are enforced by the patient's inability to control his/her active movements and articulation [1,2].

In this article, we offer a developed and practically-applied multi-component system aimed at overcoming speech retardation and dysarthria manifestations of children with central nervous system affections and cerebral palsy. The use of the complex of medical, logopaedic, and pedagogical measures within the System of Intensive Neurophysiological Rehabilitation (INPR) helped to improve speech ability of 78 % children with cerebral palsy [3].

Qualified medical assistance and speech therapy should start if there is any first suspicion of motor development retardation and possible cerebral palsy. Retarded motor development in combination with increasing pathological postural reflexes and abnormal muscular tonus automatically lead to disorders of movement, speech, behavior, motivation, mental and emotional state. Therefore, the main task of neurologic and logopaedic examination is to detect these disorders as early as possible. If children from the "risk group" are brought to the International Clinic of Renewing Treatment in time, it allows the multi-disciplinary team of doctors, psychologists, educators, speech therapists to develop a long-term plan of individual neurologic and logopaedic rehabilitation of the patients with limited motor, mental, and speech abilities. The treatment using the INPR system is carried out in two stages.

First, a two-week intensive rehabilitation.

The first stage of intensive rehabilitation is provided according to the following plan of speech therapy for cerebral palsy children who have movement and speech disorders:

1. Diagnosis and normalization of speech breathing. The diagnosis consists of general clinic examination and paraclinic checkups. All the patients go through chest measuring and Stange's test. The spiograph method using the computerized apparatus Vicatest P2 of "Helige" company is applied to inspect external respiration. The static and dynamic indicators of respiration are analyzed. A method of skin miography, based on the computerized electric neuro-miograph "Cadwell Excel", is used to determine the role of extra breathing muscular system in a respiration act. Diverse complexes of breath gymnastics, vocal therapy, as well as lessons with various musical instruments are part of all treatment systems, playing and entertaining complexes.
2. Normalizing the muscular tonus: reducing spasticity and rigidity of the tongue and lips; stimulating the tonus if the articulation muscles are hypotonic in order to develop the afferentiation of oral musculature.
3. Dis-actualizing the existing pathological speech stereotype.

4. Forming the movements of orofacial speech apparatus.
5. Developing necessary articulation praxis.
6. Developing and training speech sounds (phonemes) in compliance with the speech therapy stages: automation, differentiation, application in connected speech.
7. Using supplemental positive factors of traditional and non-traditional medicine in order to improve the logopaedic, mental and motor status of the patients:
 - general and logopaedic massage;
 - biochemical correction of the spine column and big joints (stationary or outpatient treatment);
 - mobilization of temporomandibular joints;
 - elimination of trigger points of orofacial motor activity with the help of Kennon stimulator;
 - mobilizing gymnastics, passive and active gymnastics for mimic muscles and speech apparatus;
 - passive and active gymnastics for distant parts of limbs;
 - exercises for functional development of the hand functions and minor motility;
 - rhythmic gymnastics, music therapy, arthrotherapy, diet therapy;
 - use of computer games, visualization of speech therapy exercises;
 - mental therapy (overcoming personality disorders: negativism, infantilism, autistic, or neurotic character strains);
 - teaching how to provide family and home speech therapy (a school for parents).

The intensive rehabilitation course creates a new functional state of the child, and the complex neurologic and logopaedic examination allow the specialists to develop the directions for overcoming speech disorders and assess the obtained results at the end of the first stage of the treatment. This creates a basis for further hard work with a patient in order to cure oral speech disorders [6].

The second stage of intensive neurophysiologic rehabilitation is the period of stabilizing and potentiating the effects. It strengthens the results of the intensive rehabilitation and continues versatile impacts on the motility, as well as on mental and speech development of a patient at home in accordance with individually developed recommendations. The parents are to apply these recommendations during the next 6-8 months. They will be working with the child at home in close cooperation with medical workers, speech therapists, special educators, and psychologists.

At the stage of stabilizing and potentiating the effects, the individual work on speech rehabilitation is based on prior diagnosis and characterized with certain features (depending on the forms of motor and speech disorders).

We have developed a *complex program of logopaedic and pedagogic work to overcome motor and speech disorders*, directed at particular forms of dysarthria. This program is clearly correlated with the motor syndrome proceeding from the cerebral affection topography [7, 8]. It is based not only on our professional practice, but also on the native and foreign experience of rehabilitating these disorders.

I. Spasmodic (pseudobulbar) dysarthria

Speech therapy is carried out as a complex of measures aimed at creating a new functional state in a child's organism through activating inner protective and compensatory abilities. A generalized scheme of speech therapy is given below.

1. Normalization of speech respiration through training:

- increasing the inspiratory and expiratory volume with the subsequent vocalization of the expiration;
- creating the differentiation between nasal inspiration and oral expiration;
- lengthening the oral expiration;
- forming the rhythm city of breathing in combination with special passive and active motions of a child.

The technique of the respiratory exercises: listening to quiet, relaxing music, a child lies on a couch. After light effeurage of the child's body and extremities, the speech therapist takes the child's arms. Then he/she makes vibratory movements of the hands, moving the arms apart and upwards, thus lifting the thorax (inspiration). Then, pressing the child's arms to the child's body, the speech therapist slightly presses on the thorax (expiration). This exercise is done during 1-1,5 minutes two or three times every day.

In general, the above-described technique is used to normalize the speech respiration under all forms of dysarthria.

2. Elimination of spastic muscular tonus of the tongue, lips, mimic and masticatory muscles.

Since the tonus normalization within the INPR is provided by bio-chemical correction of the spine bone (the original technique by Prof. V.Koziavkina), we do not apply medicaments to remove spasticity. It should be remembered that there is no medicament treatment of infantile cerebral paralysis as a polyetiologic disease. Medicaments can be efficient only within the first months of a child under the acute period of hypoxic and ischemic, or traumatic cerebral affection. When a child is one year or older, the role of medicaments is mostly symptomatic. In individual cases, doctors can prescribe:

- medicament therapy (Oral muscle relaxants: Tolperison Hydrochloride, Baclofen-Lioresal, Tisanidin (Sirdalud), Dantrolen, Diazepam, Mydocalm. Their dose is selected individually. These drugs are taken 50-60 minutes before a speech therapy session);
- cooling treatment as local hypothermia of oral muscular system or distant zones of the dominant hand;
- wax and paraffin applications on the face, neck, extremities; herbal applications on the tongue,
- relaxing massage to lower the tonus of mimic, masticatory, and tongue muscles (clinically, the patients have a rigid tongue, shifted back into the oral cavity). Correcting the pathologic position of the tongue in the oral cavity is done by:

a) logopaedic instruments (ball massage probes, Y.Novikova probes, V.Bogutsky probes). A special technology for relaxing the tongue muscles is the massage in the direction from the periphery to the tongue center;

b) point massage 3-5 times daily, done by a speech therapist or by the parents at home: vibrating movements with a forefinger in the submaxillary fossa area during 15 min; vibrating movements with two forefingers at the angles of the mandible during 15 min; light percussion, stroking of the tongue with a wooden spatula placed over the tip of the tongue (15 sec).

3. Passive gymnastics of the lips and the tongue aims at developing kinaesthetic senses necessary to improve mobility and activity of these organs. It involves conscious muscular resistance of the child. The gymnastics is provided with the speech therapist's hands or with a spatula.

Exercises for the lips:

- with the fingers, a speech therapist kneads and strains (towards the ears) the lips of a child until a resistance is felt; the speech therapist makes a tubule of the child's lips until the child starts resisting to such movement; the speech therapist moulds the lip positions that are further necessary to articulate the sounds *a, o, y, i*;
- at home, parents stimulate the child to reach out with the lips towards some delicious food (for example, a spoonful of jam or condensed milk), repeating this procedure 3-5 times every day.

Exercises for the tongue:

- with a spatula, a speech therapist presses on the tip of the tongue making the tongue move backward and lift its upper surface;
- with a spatula or sterile hands, a speech therapist deflects the tongue to the right and to the left from the middle line;
- if a child's tongue is deviated from the centerline, a speech therapist first passively strains the tongue along the direction of deviation and only after that begins gradual straining in the opposite direction;

Home exercises aim at forming a stereotype and a scheme of chewing process:

- when spoon-feeding a child, the parents place their fingers under the chin of the child and rhythmically push the lower jaw up and down if the child attempts at independent chewing. It is repeated 2-3 times when feeding the child, thus shaping a scheme of chewing movements.

4. Active gymnastics aims at developing the strength, mobility, symmetry of the muscles, as well as precision, speed, fullness of movement amplitude. It is done by a child having visual control in front of the mirror under the surveillance of a speech therapist. The exercises are selected individually, depending on what phonetic group of sounds needs practicing.

Recommendations: active movements of the tongue can be strengthened with *food encouragement* (wild rose syrup; jam; condensed milk.) Sweet syrup is dropped in the middle of a lip, which stimulates the tongue to move forward to lick off the drop. In a similar manner, the angles of lips are stimulated, which stimulates side movements of the tongue. These exercises are done 2-3 times every day before meals in order to strengthen the tongue muscles.

5. Developing minor motor activity.

Articulation motor activity is closely connected with developing subtle movements of fingers.

1) Exercises for improving finger movements should be done in playing activity, in everyday life. First, coordinated manipulations with big objects are developed. Then – with small objects (rearranging, spreading out on cardboard paper taking into account the shape, size, color.) Putting small objects (buttons, sticks, seeds) in small boxes or bags. Stringing rings, buttons, and beads onto a thread; moving the abacus balls; contour paper cutting or coloring, etc. Squeezing a rubber sponge or a tennis-ball.

2) The dynamic organization of finger movements is developed when doing exercises of two kinds: successively organized movements or simultaneously organized movements.

3) Playing activity: modeling, mosaic (puzzle) solving, and meccano work.

4) Developing the precise and smooth motions necessary to develop writing skills, coloring; accurate outlining of objects; painting objects using dotted outlines; linking such dots and outlines with lines of various directions; cross-hatching of pictures.

6. Forming self-service skills.

1. Exercises with buttons. Grasping buttons of different size and shape: first, with three fingers; then, with two fingers. The buttons can be fixed to a panel or cardboard with elastic strings. A child grasps the necessary button, pulls it, and then releases it.
2. Fastening and unfastening buttons on a special cloth with sewed buttons and buttonholes of various sizes. Then these movements are perfected using dolls' dresses and the child's clothes. These exercises are elements of work therapy and they are directed at gradual improving hand praxis and self-service skills.

II. Hyperkinetic (subcortical, extrapyramidal) dysarthria

Speech correction scheme.

1. Normalization of speech respiration is based on the same principles as in case of spastic dysarthria.

2. Medication (Seduxen, Relanium, Fenibut, Noophen, Thioredazine, Sonapax, Nakom are used to reduce hyperkinesia. Practicing neurologists know well that if one manages to lower the intensity of hyperkinesia, the patient's spasticity starts to increase, and medicament suppression of spasticity intensifies hyperkinesia).

3. Inhibition of hyperkinesia in mimic, masticatory, and tongue muscles using the original technique of Prof. K.Semenova and Y.Arkipova (1982).

1. Preparatory exercises. Before logopaedic massage, the following exercises are done: the speech therapist lightly shakes an arm and the opposite leg of the child with the subsequent making the cross movement in turn: an elbow towards a knee, after 2-3 movements with the left and the right arms in turn, which helps to reduce hyperkinesia symptoms. After that, point massage to the tongue is started.

2. Point massage to the tongue:

- cross point massage around the lips. The left forefinger is put in the middle of the left nasolabial fold of a child, and the right forefinger is under the lips angle, on the right. With the forefingers, simultaneous circular movements are made in these points. Then the fingers change the position: the right forefinger is put on the right nasolabial fold, and the left forefinger is lowered under the lips angle, on the left. Then the same circular movements are made;
- the left forefinger is put in the middle of the nasolabial fold on the left, and the right forefinger – under the lower jaw angle, on the right. Circular movements are made in these areas; then the same movements at the opposite side;
- the left forefinger is placed in the middle of the nasolabial fold on the left or under the lip angle on the left, and the right forefinger is fixed under the mastoidal sprout behind the ear. Make deep point massage of inhibitory type (counter-clockwise); then do the same exercise on the opposite side;
- if hyperkinesia are full-blown: fix the left forefinger in the zone of the nasolabial fold or under the lip angle, on the left; with the right finger, press the point under the interior angle of the right shoulder blade; make circular movements in these points. Then make the same movements on the opposite side;
- if hyperkinesia are persistent, use the points under the knee or above the knee at the upper edge, and the point in the area of either nasolabial fold. Give point cross massage. The special feature of these methods is that they are selected individually, with caution. Repeat every movement 3-4 times. If the exercises are done incorrectly, the hyperkinesia may intensify. Do these exercises several times a day.

4. Massage combined with passive gymnastics: forming the flaccid posture and initial state; inhibition of functionally-caused hyperkinesia of face, shoulder girdle, muscles of neck, and extremities.

5. Active gymnastics – developing smooth, synchronous coordinated movements of the speech apparatus.

III. Bulbar dysarthria

It is more often observed under perinatal encephalomyelopathy, when the clinical presentation of speech disorders is caused with affections of cranial or spinal peripheral motoneurons due to the processes in the cerebral column (bulbar syndrome) and/or in the cervical part of spinal cord. The lesion of peripheral motoneurons is not regarded as infantile cerebral paralysis.

The speech therapy scheme:

1. Normalization of speech respiration.

2. Medicament treatment (under hypotonia and hypotrophy of muscles, neurologists prescribe the drugs improving nerve and muscular conduction. These drugs are taken 30-40 minutes before speech therapy lessons. They are: Proserin, Oxazil, Calimin. The therapy complex includes the medicaments stimulating metabolism and preventing development of dystrophic changes in muscular tissue: Adenosine Triphosphate (ATP), Riboxine, Nerobol, Carnitine Chloride, Phosphaden, Aktovegin, Cardonat).

3. Muscle massage to strengthen oral muscular system.

1. Strengthening the facial muscles by effeurage, rubbing, deep petrissage, and vibration. Begin the massage with light effeurage in the direction from the centerline of the face towards the periphery: stroke the forehead from the middle towards temples, cheeks – from nose towards ears, from chin towards auricles; soften up jaw and cheek muscles. Gradually intensify the massage movements. Give 8-10 movements twice a day.

2. Labial muscles are strengthened by effeurage, softening up, rubbing, and vibration of labial muscles. The sequence of the massage movements: from the middle of the upper lip towards angles of the mouth; from the middle of labium towards the angles; by stroking nasolabial folds from the angles towards wings of nose; by tingling the lips. 8-10 movements are done twice a day.

3. Tongue muscles can be strengthened using logopaedic tubes which are moved in center-periphery direction.

4. Exercises to be done at home:

- massage using a wooden spatula: give a massage to longitudinal muscles of the tongue, stroking the tongue in the direction: central part – upper surface of tongue – tip of the tongue;
- strengthen the vertical muscles by rhythmical pressing on the tongue;
- influence the transversal muscles by stroking the tongue crosswise;
- light vibrating movements with a spatula during 5-10 seconds help to activate the tongue muscles.

4. Articulation gymnastics (passive and active).

1. Strengthening muscles using food speech therapy (chewing crackers in one or the other half of the oral cavity; rolling a button or a lollipop in the oral cavity.)

2. If there is hypotonia of the muscles (not connected with infantile cerebral palsy), for example, Down's disease with diffusive muscular hypotonia, the method of orthopedic and stomatological aid is used (Castillo-Morales method). Specially qualified orthopaedic dentists make a prosthetic plate with a plastic pea in the middle to be placed on the hard palate. The children cannot help touching the plate constantly with the tongue (probing the pea). In such a way, the tongue muscles gradually become stronger.

IV. Atactic dysarthria

The scheme of speech therapy.

1. Normalization of speech respiration.

2. Medicament treatment (ataxy is accompanied with muscular hypotonia; therefore, the same drugs can be prescribed as for bulbar dysarthria).

3. Muscle massage to strengthen oral muscular system (similar to bulbar dysarthria).

4. Articulation gymnastics (passive and active).

5. Forming the precise balanced trajectory of articulation movements of the orofacial system.

6. Developing the synergy of phonatory and respiratory articulation activity in the speech process.

7. Dynamics of pronouncing various types of syllable (direct; inverted; with colliding consonants).

All forms of dysarthria of patients with infantile cerebral palsy are characterized with disorders of **phonation and articulation praxis**.

Under this complicated pathology, the phoneme training and forming of articulation praxis are the main tasks of the most challenging stage of logopaedic work with cerebral palsy children. Below we offer the generalized directions of such work. All the tasks should be individualized and specified in each particular case.

Developing the volume, pitch, controllability of the speaking voice.

- Massage, passive gymnastics of muscles of neck, shoulder girdle, and trunk.
- Passive and active gymnastics (isometric and isotonic.)
- Activation of voice modulation.
- Training aural attention to prosodic elements of speech.
- Psychotherapeutic lessons-discussions to increase the motivation for treatment and create emotional and positive atmosphere for developing voice functions.

Forming the articulation praxis.

Kinaesthetic:

- Correcting articulation praxis of the sounds which a patient can already pronounce, yet incorrectly.
- Training accurate articulation positions – dorsal, alveolar, palatal, labial – to articulate necessary sounds; training in the ways of reproducing fricative, resonant, and vibratory

sounds.

- Doing exercises on differentiating the sounds in syllables with colliding consonants.

Kinetic:

- Developing the muscular mobility of orofacial system.
- Training in producing sounds in a series of sounds. Pay attention that consonants in words are pronounced accurately.
- Training in differentiating articulation movements (exercises on syllables).
- Training in quick producing accurate articulation movements (syllable complexes).
- Distinguishing sounds which are differentiated by the place and way of their formation.

Training in phonetic and morphological analysis and synthesis.

Establishing certain aims for developing speech activity skills.

We have proposed a differentiated system of logopaedic correction of complicated speech disorders of children with cerebral paralysis. It takes into consideration: the causes and localization of cerebral affections; the structure of a speech disorder; the nature and prevalence of sensomotor deficiency; the intensity of concomitant somatic, mental, emotional, volitional, and motivational symptoms. Each of the above-presented stages of long-term speech therapy within the Intensive Neurophysiologic Rehabilitation (INPR) has specific individual goals and tasks, methods and technique for renewing oral speech functions. Successful overcoming of speech disorders provides a basis for further development of writing speech and enables a child to study at school, integrate into children groups, obtain vocational training, and, finally, adapt socially.

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