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LOGOPEDIC WORK TOWARDS FORMATION OF THE PHONEMIC SYSTEM OF VOWELS IN CHILDREN WITH OPEN *RHINOLALIA*

Abstract. The article describes a scientifically-based technology of formation of the phonemic system of vowels in children with congenital cleft lip and palate (rhinolalia). From the very birth of the child, the congenital cleft lip and palate interferes with the development and functioning of his organs of speech (tongue, lips, jaw, soft palate and vocal apparatus) and leads to malfunction of speech kinesthetics and articulation control. The children cannot reproduce linguistic phonological oppositions in articulation movements. Thus, when pronouncing vowel sounds they tend to mix up articulations in height, backness and labialization; consonants are mixed up in reference to manner and place of articulation.

Inability to reproduce linguistic phonological oppositions in articulation movements and incomplete kinesthetic (articulation) perception of speech sounds bring about their inadequate oral comprehension; that is why collection of concrete phonetic images of words is difficult in these conditions and considerable problems arise with normal acquisition of the phonemic system of the language by the child.

In view of the mechanisms of underdevelopment of the phonemic system of the language in children with rhinolalia, rehabilitation program presupposes five interrelated parts: 1) formation of linguistic phonological oppositions in articulation movements; 2) development of kinetic-kinesthetic foundation of articulation movements and control; 3) corrective treatment of the phonemic system reflection in linguistic skills; 4) formation of phonemic, intonation and morphological awareness, habits and skills of speech sound analysis; 5) development of cognitive processes in the sphere of language acquisition.

Keywords: rhinolalia; logopedics; phonemic awareness; speech awareness; phonemic perception; intonation awareness; children with congenital cleft lip and palate; anatomo-physiological impairments; speech kinesthesia; speech sounds; sound perception; logopedic work.

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Congenital cleft lip and palate places the child in the life situation drastically different from that of typical children. The birth of a child with such developmental disorder is psychologically traumatic for the mother. She is constantly tormented by the feelings of despair and helplessness and is in the permanent state of emotional stress. All this severs the symbiotic ties which presuppose direct emotional interaction between mother and child. The leading activity disorders of the given age bring about psychological and speech underdevelopment. The children demonstrate low sound-producing activity; the sounds produced by the child are monotonous and intonationally flat.

Congenital cleft lip and palate affects the conditions of the course of pre-linguistic development of the child. Pre-speech vocalizations do not form at the proper time and to the full degree. The child is void of intensive babbling and natural “articulation” playing. This negatively simplifies the stage of preliminary “tuning in” of the vocal apparatus. The sounds produced by the child get a nasal tone, lack voice and do not get auditory reinforcement due to disorders of airflow, and namely increased airflow through the nose during speech.

Velopharyngeal structure disorders lead to compensatory shift of articulation zones and search for a

convenient place of articulation; as a result, incorrect forms of sound acquisition are formed. Reinforcement of inadequate articulations is also caused by the pathological position of the tongue and pharynx: the tip of the tongue is retracted from the lower front teeth, the back of the tongue is raised and pulled back in the mouth cavity, and the pharynx is raised. The movements of the tongue, lips and jaw are limited due to compensatory tension of their muscles. The child hardly feels the position and movement of the articulation organs. Vagueness of “motor images” aggravates the defect of sound production and may divert the course of lexical development, as the conditions of formation of associations between the vocal and semantic aspects of the word become more complicated, which, in its turn, leads to underdevelopment of higher psychological processes.

Anatomical impairments of speech organs bring about compensatory shift of articulation zones and stimulate search for a convenient place of articulation; as a result, incorrect forms of sound acquisition are formed.

Thus, we can observe non-differentiated articulation of vowels with indistinct opposition of the sounds in height, backness and labialization.

The vowel *a* is articulated with

the mouth almost shut, the back of the tongue slightly raised and the tip of the tongue moved back. The articulation of the back close mid vowels *y*, *o* is characterized by excessively raising the blade of the tongue and inadequate labialization, which brings these sounds close to each other in pronunciation. The front mid vowel *ə* is pronounced with excessive raising of the blade and back of the tongue and retracting its tip; the resulting sound is very close to the sound *ʏ*. While pronouncing the front close vowel *u* the tip of the tongue is retracted which makes the pronunciation of this sound similar to that of the sound *ʏ*.

All vowels are pronounced with a nasal tone: *a* is the least nasalized sound, *u*, *y* are the most nasalized ones.

Inability to reproduce the articulatory phonological oppositions in vowels and inadequate voice resonance prevent clear comprehension of sounds in the child's speech.

Absence of well-formed kinesthetic perceptions does not allow children to employ differences in articulation for realization of the sound composition of a word; this fact explains why they often mix up and replace vowels. In most cases, inadequate distinction between the members of the oppositional pairs of vowel phonemes (*a-o*, *o-y*, *ʏ-u*, *etc.*) is observed in oral speech. But replacement and confusion reflect-

ing more complex phonemic relations are also found; they may lead to crude oral speech deformation.

With reference to *uranoplasty*, logopedic training is divided into two stages: pre-surgical and post-surgical ones. The pre-surgical stage of logopedic support is aimed at:

- formation of the skill to take various articulatory positions in accordance with the sound under study;
- shift of articulatory focus into the front parts of the mouth resonator;
- stimulation of movements of the tip and the middle (front) of the tongue;
- development of differentiated kinesthetic perceptions;
- training the muscles of the vocal apparatus for the oncoming *uranoplasty*;
- development of correct pronunciation and phonemic system of language (phonemic awareness and sound analysis);
- development of breathing.

During the post-surgical period, the state of the palate and pharyngeal muscles plays an important role in normalization of the phonetic system of the language.

That is why special attention should be paid to exercises allowing relaxation and activation of palatal and pharyngeal reflexes after *uranoplasty*. These exercises include the techniques of relaxation; massage of the palatopharyngeal

and palatoglossal arches, the soft palate and pharyngeal muscles; gymnastics for stimulation of the palate and pharyngeal muscles; gymnastics for training control of velopharyngeal closure.

If uranoplasty is performed at an early age (1.5-2.5 years), relaxation and activation of the muscles of the soft palate and the posterior pharyngeal wall are trained on the material of vowels and semantically significant sound imitations. The following exercises may be planned.

- Prolonged pronunciation of each vowel separately.
- Prolonged pronunciation of combinations of two-three vowels.
- Abrupt pronunciation of each vowel separately and in combinations (á-ó-ý).
- Vocalization of vowels. Vowels are vocalized smoothly and abruptly.
- Singing vowel sounds with falling and rising intonation (the bear sings in a deep voice: *a-a-a*, a fox — in a gentle voice: *a-a-a*).
- Singing semantically significant sound imitations (a goose sings in a deep voice: *za-a*, a gosling – in a high-pitched voice: *za-a*).
- Abrupt singing a sound at the same pitch: *a-a-a*.

Formation of articulatory praxis in children at an early age is carried out indirectly because they show underdevelopment of control and management of the speech organs.

The children do not feel the location of the tongue, lips and jaw while pronouncing a sound. That is why articulatory gymnastics should be carried out not by direct verbal instruction of an adult but in an indirect way, by means of bringing out a certain articulatory movement, position or sound by means of game therapy. Indirect methods presuppose a wide use of toys, fairy tale masks, stencils, imitating sound-tracks (of singing birds or animals), rhymes, games with stories, fairy tales and texts for dramatization.

If uranoplasty is performed at a preschool age, random purposive exercises may be employed.

Passive and active massage with the fingers can be used in order to make the soft palate more elastic and flexible.

Passive massage with the fingers. Two kinds of passive massage can be used.

1. Make gentle stroking, spreading and pressing movements with the right hand thumb forwards and backwards along the line of the operation wound on the palate beginning from the upper front teeth up to the soft palate and right and left of the border between the hard and soft palate. As a result of systematic practice the child should demonstrate a pharyngeal reflex (also known as gag reflex) response which would indicate that the soft palate has begun functioning normally. From this time on, the logo-

pedist keeps focusing the child's attention on emergence of the pharyngeal reflex and explains its role in the process of speech normalization. The child tries to trigger the gag reflex intentionally; as a result the muscles of the soft palate and posterior pharyngeal wall respond with brisk contraction.

2. Make gentle stroking, spreading spiral movements along the border between the hard and soft palate with the right hand thumb. This is followed by reflex contraction of the pharyngeal and soft palate muscles which may serve as a certain kind of the muscles gymnastics.

Active massage with the fingers. Two kinds of active massage can be also used.

1. Gentle stroking, spreading spiral movements along the line of the operation wound on the palate are made during prolonged pronunciation of the sounds *a* or *ə*.

2. Strong pushing movements of the thumb against the soft palate muscles are performed while the child pronounces the sounds *a* or *ə* in a brief and abrupt manner.

The two latter kinds of massage are more efficient because the contraction of the palatopharyngeal muscles in this case is achieved not only by way of passive mechanical stimulations but also through active movements caused directly by phonation. Massage begins with one-minute sessions performed 5 times a

day and reaches up to 10 procedures a day lasting three minutes each.

It is necessary to massage the mylohyoid muscles: they are situated in the group of neck muscles and, consequently, their stimulation will provoke activity of the palatopharyngeal muscles.

Stimulation of the mylohyoid muscles. *Stroking massage.* The mouth is open wide; the tip of the tongue is pulled to the chin. Continuous stroking movements are performed on the back of the tongue. The movements go both horizontally and vertically. Continuous movements (8-10 times) are followed by continual ones.

Vibration massage. The mouth is open wide; the tip of the tongue is pulled to the chin. Fine quickly alternating trembling movements are applied to the back of the tongue. The movements are rhythmical and follow one another in a quick succession, which causes contraction of the pharyngeal muscles and makes them resilient and elastic.

Stimulation of the palatopharyngeal muscles. Gymnastics is often used alongside with massage to activate the work of the palatopharyngeal muscles.

The following exercises may be used to stimulate the palatopharyngeal muscles:

– stimulation of the root of the tongue with a tongue depressor to evoke reflex contraction of the palatopharyngeal muscles;

– imitation of chewing to cause energetic contraction of the muscles of the posterior pharyngeal wall, larynx and soft palate;

– swallowing small portions of water or imitating swallowing movements in order to raise the soft palate higher and to make the muscles of the back of the throat contract more actively (sequential swallowing movements prolong the time during which the soft palate is raised);

– coughing in order to evoke more energetic contraction of the palatoglossal arches and the posterior pharyngeal wall (coughing causes complete palatopharyngeal closure).

Random coughing is repeated 2-3 times during one inhalation. During this time, a complete closure of the soft palate with the posterior pharyngeal wall should be preserved, and the exhaled airflow should be directed through the mouth cavity. At first, coughing is advised to be produced with the tongue put out so that the root of the tongue would not go back to touch the pharynx. After that, coughing with random pauses is practiced (counting 1—2, 1—2—3, 1—2—3—4, etc.) during which the closure between the soft palate and the posterior pharyngeal wall is preserved. Systematic practice of these exercises trains the child to raise the soft palate actively, to keep it in this position and to direct the airflow through the mouth;

– imitation of yawning: the child opens the mouth wide and pulls the air in hard (in follow-up exercises yawning is not accompanied by perceivable inhalation);

– imitation of the gagging movement; first it is performed with the tongue put out, which activates the muscles of the palatoglossal arches and the posterior pharyngeal wall;

– imitation of whistling;

– singing the vowels *a, ə, o, y*;

– saying the vowels *a* and *ə* and their combinations out loud:

a — ə, a — ə — a, a — ə — ə — ə, ə — a, ə — a — ə, ə — a — a — a.

The child pronounces them 2-3 times one after another in a half loud voice with the mouth open wide and the tip of the tongue touching the lower front teeth (the exercise is repeated up to 12-15 times a day);

– rinsing throat with warm water in small portions with the head slightly thrown back;

– throwing the head back overcoming a resisting force (the logopedist puts their hand on the back of the child's head and asks the child to throw his head back);

– lowering the head overcoming a resisting force (the logopedist puts their hand on the child's forehead and asks the child to lower his head fast);

– throwing the head back and lowering it simultaneously pressing the chin against both clenched fists;

– putting the tongue out towards the chin and then pulling it

into the mouth overcoming a resisting force (the child is asked to stick the tongue out towards the chin and then pull it into the mouth; the logopedist tries to keep the tongue outside the mouth by pulling at it lightly with their hand).

Exercises based on overcoming a resisting force actively stimulate the palatopharyngeal muscles to activity, make them resilient and elastic and enlarge the volume of the pharyngeal muscles. This, in its turn, reinforces the palatopharyngeal closure after uranoplasty even in the cases when the soft palate has been shortened. As a result, voice nasality is reduced. 3-4 exercises are done during one session. Each exercise is recommended to be done 2-4-times at 6-8 sessions a day.

Maximum motor activity of the palate muscles is observed during swallowing reflex; that is why exercises on its stimulation should be included in each training session. If the child cannot evoke it himself the logopedist helps him by touching the back of the throat with a tongue depressor.

The above described exercises are widely used in the pre-surgical and post-surgical periods. Their systematic performance during the pre-surgical period prepares the child for the coming uranoplasty and shortens the time of follow-up rehabilitation work. Alongside with the abovementioned exercises the child is prescribed electro-

stimulation of the soft palate muscles (15-20 sessions) with each procedure lasting 10 minutes (5 minutes for each half of the soft palate). Vibration massage of the side and back walls of the pharynx (15-20 sessions) with each procedure lasting 5-7 minutes (in the lying and sitting position) and electrophoresis with potassium iodide, dibazol and proserin are also effective.

After uranoplasty, children with congenital cleft lip and palate often have massive scars in the zone of palatal arches which limits mouth opening and aggravates voice nasality. It is well known that in the process of speech sound production the volumes of the mouth and nasal cavities are in inverse relation to each other: the wider the mouth cavity while pronouncing a sound, the narrower the pharynx, which produces favorable conditions for palatopharyngeal closure. In addition, there exists close relationship between the movements of the lower jaw, soft palate, pharynx and larynx: the lower the jaw is dropped, the higher the soft palate is raised and the wider the pharynx is open; all this enhances the work of the vocal cords. That is why special attention is paid to the lower jaw gymnastics after uranoplasty. And it is especially important to synchronize the activity of the palatopharyngeal ring muscles with the activity of the muscle structures of the front areas of the mouth cavity. For

this purpose, it is important to stimulate the palatopharyngeal ring muscles by moving the tongue forward into the front areas of the mouth cavity and relaxing the root of the tongue.

Lower jaw gymnastics.

Exercises to stimulate the lower jaw movements:

- lowering the jaw and putting the tongue out towards the chin as far as it would go;
- lowering the jaw and putting the tongue out towards the chin as far as it would go simultaneously pronouncing the sounds *a* or *ə* with a hard glottal attack to oneself;
- lowering the jaw and putting the tongue out towards the chin as far as it would go simultaneously pronouncing the sounds *a* or *ə* with a hard glottal attack in a whisper;
- lowering the jaw while overcoming a resisting force (the logopedist holds the jaw with their hand);
- lowering the jaw while overcoming a resisting force and pronouncing the sounds *a* or *ə* with a soft glottal attack;
- lowering the jaw while overcoming a resisting force and pronouncing the sounds *a* or *ə* with a soft glottal attack in a whisper;
- opening the mouth and throwing the head back;
- opening the mouth and throwing the head back overcoming the resisting force of the logopedist's hand pressed against the back

of the head;

- opening the mouth and turning the head from side to side;
- pronouncing a row of vowels which need different opening of the mouth to oneself or in a whisper: *a — u, a — ə, a — o, a — y, a — u — a, a — ə — a, a — o — a, a — y — a*, etc.

Exercises for the lower jaw overcoming a resisting force, with head movements or pronouncing sounds *a* or *ə* with a hard glottal attack activate the palatoglossal and pharyngeal muscles, make them more active, resilient and elastic, thus preparing them for uranoplasty, and during the post-surgical period facilitate normalization of articulation and voice production. Mechanical therapy is widely used in order to make the movements of the lower jaw more active during the post-surgical period: a special device is inserted in the mouth cavity to regulate raising and lowering of the lower jaw.

Chewing gymnastics is prescribed in order to prevent developing massive scars in the zone of the palatal arches after uranoplasty.

It is not only the voice timbre that suffers from rhinolalia. Congenital cleft lip and palate brings about systemic disorders of the whole motor vocal apparatus: energetical, generating and resonatory (E. S. Almazova, L. I. Vansovskaya, I. I. Ermakova, A. I. Ippolitova, etc.). That is why violations of the timbre, modula-

tion, pitch, tone, intensity, loudness and voice projection are the main characteristic features of speech function disorders.

In this context, the complex orthophonic method consisting in the combination of articulatory, breathing and voice exercises appears to be the most suitable method of voice correction in cases of rhinolalia.

The content of this method for children with rhinolalia was designed and tested by A. V. Dorosinskaya. Rehabilitation of the motor function of all components of the vocal apparatus and the motor sphere development is carried out at lessons of phonologorhythmics.

Phonologorhythmics is a method presupposing an interdisciplinary approach to child rehabilitation based on integration of the methods of phonopedics and logorhythmics.

Training is based on the principle of complex rehabilitation and development of the vocal apparatus in its closest interrelationship with the motor sphere development.

Phonologorhythmics is involved in rehabilitation activity at the following stages.

1. At the preparatory stage which presupposes development, education and rehabilitation of non-speech processes (the psychological basis of speech); work towards formation of diaphragmatic breathing, putting the tongue in the front zones of the mouth cavity, and also work aimed at the formation of articulatory

praxis and vowel and consonant phonation accompanied by music and movement.

2. At the stage of formation of primary articulatory habits and skills (the stage of development, automation, differentiation of vowels and consonants, correction of voice management and development of the correct voice stereotype skills.

3. At the stage of formation of communicative habits and skills, presupposing reinforcement of motor, voice, breathing and speech habits, development of speech prosody, reinforcement of the habits of correct usage of sounds in different kinds of speech and communicative situations.

The content of the lessons is made up of practical material allowing the teacher to provide the child with the image of a sound, its physical material essence through development and interaction of hearing, visual and motor perception. This makes it easier to represent the sound as a phoneme.

Sound image materialization is achieved through the following:

- by way of introducing a functional toy or a concrete game character. Each sound is associated with a concrete game image, for example, the sound *ж* is associated with the image of a bug or hedgehog (because the names of these living beings contain the sound *ж* in Russian);
- through introducing game-

like exercises allowing the teacher to associate a sound with a complex of articulatory, breathing and movement exercises united by a common game plot of the lesson.

The author uses specific movements and certain positions of the child in order to form a correct phonation and articulation image of the sound, which is connected with the need to do the following:

- to relax the body and pharyngeal muscles;
- to reapportion the muscle tone;
- to shift the pathologic tongue positions into the front zones of the mouth cavity resonator, which facilitates the emergence of a properly directed oral airflow, normalization of the phonation exhalation, prevention of hypernasality and prevention and rehabilitation of laryngopharyngeal articulation.

For example, during the lesson the children take the prone position or go on all fours when their arms and legs turn into the paws of an animal (“I am a hedgehog”, “I am a puppy”, “I am a little dog”) and perform the corresponding movements).

Music and the movements performed at the lessons deepen the character images, make them more salient, create good atmosphere, facilitate more concrete perception, development of musical ear, sound pitch, timbre and dynamic awareness, and widening the vocal range.

Systematic lessons include exercises in playing children musical instruments which keep producing sound long after a stroke had been made (bells, metallophone, spoons, cymbals, etc.). The piano also refers to these instruments. The children play it first pressing one key trying to play the rhythmic pattern of a music piece. Then the children are taught to play simple melodies consisting of two or three neighboring sounds. The positive effect of instrumental exercises consists in activation of perception of the length, intensity and frequency of the sound, and of timbre and rhythm awareness.

Thus, the content of the work aimed at the formation of the vocal function is realized by the author with the help of phonologorhythmics which focuses on the rehabilitation of the functional relationships between all parts of the vocal apparatus.

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