ALGORITHM FOR SPEECH DISORDERS CORRECTION USING PROPRIETARY CONSTRUCTION DEVICE

Summary. Currently, there is a tendency in Ukraine to increase the number of children with speech disorders. One of the most common disorders of speech function is dyslalia. Speech therapists are the main form of correctional training, children are assigned certain and consistent stages of speech therapy. Along with that, various individual and standard devices are used. The aim of the study – to conduct logopedic correction of speech disorders in patients with physiologic occlusion using the in-house designed device according to the proposed algorithm.

Materials and Methods. A survey was conducted on 73 children (24 – aged 3 to 6 years, 49 – from 6 to 12 years old) without significant orthodontic pathology in the presence of speech impairment with normal hearing and intelligence and speech correction. In addition to logopedic exercises, it was recommended to use vestibular plates Dr. Hinz - MUPPY-P with beads, removable orthodontic devices with beads, Bluegrass appliances, devices for elimination and prevention of unhealthy tongue habits. In order to identify early risk factors for major dental diseases, the hygienic state of the cavity of the mouth, the intensity of caries, the presence or absence of inflammatory processes in the tissues of periodontal disease were determined.

Results and Discussion. The first step in the algorithm for successful correction of speech disorders were to explain its necessity. The second stage involved the phonetic diagnosis of all aspects of speech, logic, intelligence, memory and thinking. Polyorphic dyslalia was diagnosed in all subjects of reporting panel. The third stage of the algorithm is to carry out work to overcome the abnormalities of the phonetic side of speech was a direct speech correction. The proposed device for elimination and prevention of unhealthy tongue habits was used in 6 cases.

Conclusions. After the speech therapy correction correct articulation and sound were formed. The proposed device for the elimination and prevention unhealthy tongue habits should be used in conjunction with speech therapy, in particular, dyslalia. In addition to the positive logopedic effect of the proposed therapeutic and prophylactic measures, we have also received improvement of the hygienic state of the oral cavity, the absence of an increase in the intensity of the caries of permanent teeth and increased motivation in patients.

Key words: speech disorders; articulation; device for elimination and prevention of unhealthy tongue habits.

INTRODUCTION Speech is the main means of human communication. The human being defines objects, their properties, and relations by a combination of sounds, words, as a result of which speech became the main tool of thinking. Any thought can be expressed with its help [1, 2].

At present increasing tendency of the number of children with speech disorders occurs in Ukraine. The etiological factors that may cause them are complex and polymeric [3–5]. One of the most common disorders of speech function is dyslalia. This disease is manifested in the replacement, distortion and the complete absence of certain sounds [4, 5].

Speech therapy classes are the main form of correctional education, children are prescribed specific and successive steps of speech therapy correction [4, 5–8].

With that, various individual and standard devices are used – vestibular plates by Dr. Hinz [3, 9, 10], Bluegrass appliances [11, 12], removable orthodontic appliances with a bead [9], pre-orthodontic trainers [3, 9, 10], etc.

The fact of increasing the number of children with speech development disorders requires a revision of the methods and forms of upbringing and training of this category of children, the creation of conditions for the harmonious development of speech [4, 5].

The aim of the study – delivery of speech therapists correction of speech disorders in patients with physiologic occlusion using proprietary construction device according to the proposed algorithm.

MATERIALS AND METHODS In order to achieve the goal set in the work, the National Children’s Specialized Hospital “ОHМАTДYТ” of the Ministry of Health of Ukraine conducted a survey of 73 children (twenty-four of them aged from 3 to 6 years old, forty-nine from 6 to 12 years old). All of them were without severe orthodontic pathology in the presence of speech disorders with normal hearing and intelligence, and to whom speech correction was performed.

Dental examination and manufacture of additional devices for the correction of speech disorders were carried out in the Stomatological Medical Center of O. Bohomolets National Medical University on the basis of the departments of Orthodontics and Prosthodontics Propaedeutics and Pediatric and Preventive Dentistry.

To identify speech disorders speech therapy diagnostics of all aspects of speech was conducted. To test logic, intellect, memory, thinking it was suggested to group objects or other things, read a small text, retell it, writes a few sentences and so on.

The children’s answers were fixed and the coefficient of logical thinking check was determined using the formula: the number of correctly completed tasks / total number of pictures * 100 %.

For a survey of phonemic perception, analysis, synthesis, and imagination, they offered the child to listen and repeat syllables and words, select a certain sound from a number of sounds, determine the presence of sound, and so on. The children’s responses were recorded in the speech survey map and the sound pronunciation coefficient was determined before the beginning of the speech correction.

To overcome violations of the phonetic side of speech, speech correction was performed directly. Usually, 10 lessons were prescribed 3 times a week, if necessary, the number of lessons was increased.
Of the 24 children aged 3 to 6 years in twelve cases, we further recommended, together with speech therapy classes, to use at home the standard vestibular plates Dr. Hinz – MUPPY-P with a bead, from 49 children aged from 6 to 9, eight used removable orthodontic apparatus with a bead, nine – non-removable Bluegrass appliances. A device for eliminating and preventing unhealthy tongue habits (declarative patent of Ukraine No. 126393 of June 11, 2018) was used in six cases [13].

In order to early identify risk factors for major dental diseases in children undergoing examination and speech correction, therapeutic measures were taken, namely, the hygienic condition of the oral cavity, the intensity of caries, and the presence or absence of inflammatory processes in periodontal tissues. We determined the risk factors for the occurrence of a pathology of hard tissues of teeth and periodontal.

RESULTS AND DISCUSSION The first step of the successful speech correction algorithm was an explanation of its necessity. At the beginning of the treatment, the children and their parents were interviewed to clarify the consequences of not treating and supported the interest of those who were already aware of the presence and the need to correct problems with pronunciation.

The second stage of the algorithm, which provided for phonetic diagnostics of all sides of speech and consisted of speech (pronunciation of the suggested list of words) and subject (children were provided with subject and plot drawings) parts, allowed identifying the wrong sound (phonemic speech design): distorted pronunciation of sounds, replacement of sounds or in mixing them. To test logic, intellect, memory, thinking, it was suggested to group objects or other things, read a small text, retell it, writes a few sentences and so on. Diagnostics included checking pronunciation, vocabulary, grammar, and phonetics. When collecting the history, most patients pointed to a typical complaint, namely that the “something wrong” with the tongue.

During the examination, we identified dyslalia of functional and mechanical origin and its mixed forms.

One of the reasons for functional dyslalia in four children, in our opinion, was communication in the family in different languages, when the child transfers the peculiarities of the pronunciation of one language into another. These were children from families where the father or mother did not speak Ukrainian, which is connected with the lexical component of speech and the phonetic component in various speech groups.

Also, in four other children was noted the incorrect pronunciation of sounds by parents, which is onomatopoeia, since children spend most of their time directly at home and imitate the distorted sound of adults.

Three children had younger brothers and sisters, naturally, communicating with them and adopting their sound pronunciation. This may be the cause of infantilism and emotional-volitional immaturity since children tend to imitate their elders.

Unhealthy habits, noted in most children, most often: biting the lower or upper lip, sucking fingers or tongue and fingers, supporting the chin with the hand. All the above habits in the future, in our opinion, lead to the emergence of dental anomalies. Parents of fifteen children indicated mouth breathing. Since the correct speech breathing is breathing in – by the nose, breathing out through the mouth, they were advised to consult an otolaryngologist.

Late termination of the use of the pacifier (longer than one year) was diagnosed in two cases, which could also lead to the formation of abnormal articulation skills and cause abnormal bite formation.

Extra-oral examination focused attention on the position of the chin, lip closing, the severity of the nasolabial and chin folds, proportionality and symmetry of parts of the face. The listed criteria for all patients met orthodontic “norm”.

On examination of the oral cavity, anomalous attachment of the frenulum was found in 28 people out of 73 (shortening the frenulum of the upper lip in 12 people, the tongue – in 16), which makes it impossible to lift it sufficiently with high-lingual sounds. Consultation of a pediatric dental surgeon is recommended for these children and, if indicated, a plastic surgery of the frenulum is performed.

In the surveyed, physiological and pathological defects of the dentition were noted, since children were involved in the treatment during the period of temporary and transitional dentition. The criterion for the influence of defects in the dentition on speech was articulation, a constant form of pronunciation of sounds. For each sound it is different, and if it is correct, then the pronunciation defect is temporary and is not subject to correction.

Determining the shape and size of the language is quite a subjective criterion. When examining the tongue, teeth were imprinted on its lateral surfaces in thirteen people, which indicated a lack of oral cavity volume. In further speech diagnostics, the tongue tone, speed, and the number of movements were checked.

When examining the dentition we paid attention to the shape, interposition, the presence of sufficient space for the teeth. In all patients examined, the ratio of the first permanent molars (key of occlusion) was within the normal range.

Children were offered to consider pictures and perform tasks to check logical thinking depending on age: “Find an extra object (thing)”, “Find a family”, “Find a similar picture”, “Show and give the name of the object” and others. We demonstrated cards and offered to make the text of a series of drawings, group items or other things.

Using diagnostic schemes, it was found that out of seven children aged 3 to 6 years in ten assignments, 97.94 % received the correct answers in 90 % of cases, out of twenty-nine children aged 6 to 12 years (Table 1).

The children’s responses were fixed and the coefficient of logical thinking was calculated according to the formula: the number of correctly completed assignments / total number of pictures * 100%.

For the examination of phonemic perception, analysis, synthesis, and presentation, the child was encouraged to

| Number of children | Age       | Number of tasks | Correct answers | Uncorrect answers |
|--------------------|-----------|-----------------|-----------------|-------------------|
| 24                 | 3 – 6 years | 10              | 63 (90 %)       | 7 (10 %)          |
| 49                 | 6 – 12 years | 10              | 284 (99.39 %)   | 3 (0.61 %)        |
listen and repeat the wares and words, to select a certain sound from a series of sounds, to determine the presence of sound, and so on. The children’s responses were recorded in the speech survey card. If the child correctly spelled the sound, then the «+» sign was put, if it distorted or did not pronounce at all – «-», if one sound was replaced by another, then the substitute sound was written: [c-у], [c-c], [c-у] (s-sh; s-s; ch-shch).

The results were translated into points as follows: «+» – 0 points, «-» – 1 point, replacement of one sound to another – 2 points.

Analyzing the children’s responses, they determined the coefficient of sound reproduction at the beginning of the speech correction, taking into account the sibilant («з», «з'», «с», «с'», «ч», «ч'») (z; z'; s; s'; ts'; ts'), hissing («ж», «ч», «ш», «щ») (zh; ch; ch; sh; shch), consonorous («н», «н'», «р», «р'») (l; l'; r; r') (total – 14 sounds) made a conclusion about the severity of the phonemic speech for each child (Table 2).

It should be noted that the replacement or passage of sounds under the age of 4–5 years is an option of a physiological norm for the proper development of articulation motility and articulation (sound reproduction). If there is a replacement of sounds at an older age, then this is a sign of phonetic and phonemic underdevelopment of speech.

Separately, the defects of the pronunciation of the voiced consonorous sounds are the defects of the pronunciation, which are expressed in replacing the voiced consonorous sounds with paired voiceless sound: [б-п], [д-т], [в-ф], [з-с], [ж-ш], [г-к]. They were observed quite rarely (in the age group up to 6 years – 2 children, 6–12 years old – 1 child), and also refer to phonetic and phonemic underdevelopment of speech, but did not enter the object of our study.

As a result of our survey of 73 children, it was found that violations of the sound transmission of sonorous sounds «п» (l) occur most often – 20 cases in the age group of 3 to 6 years old and 31 in the age of 6 to 12 years, and «р» (r) – respectively 21 and 35 cases. Most of the disturbances in the sound pronunciation of sibilant and hissing sound are noted in children aged 3 to 6 years.

The replacement of sounds in children over 6 years old, with the formed phonetos, was not observed. Coefficient of sound pronunciation prior to the beginning of speech correction was in the age group from 3 to 6 years: sibilant – 116, hissing – 81, sonorous – 61 (total – 258), which is significantly more than in the age group from 6 to 12, respectively: 19, 10 and 72 (total – 101). Thus, all patients were diagnosed with polymorphic dyslalia.

**Clinical example**

Patient P., 7 years 6 months. Speech unfolded phrase. Vocabulary is age appropriate. Voice voiced modulated. Articulatory motility is normal. Skips «р» (r) sounds when consonorous match. Sound pronunciation: interdental sibilant and hissing sounds are distorted; there are no «р» (r) and «р» (r'). Diagnosis: polymorphic dyslalia.

The third stage of the algorithm for conducting work on overcoming violations of the phonetic side of speech was direct speech correction, which included: the formation of the correct pronunciation of phonemes, phonemic perception, and differentiation, skills of phonemic analysis and synthesis.

Early intervention, in the presence of speech pathology, is the most effective, since it allows you to quickly eliminate speech defects. For a long time, the existing unhealthy habits lead to a change in the growth of certain segments of the dental apparatus.

For the formation of skills of correct articulation of the language by a speech therapist, additional means were used: a speech therapy device for “raising the tongue” (Fig. 1), an individual sound detector for setting sounds (Fig. 2), a speech therapy device for developing conversational breathing “moustache-whistle” (Fig. 3) probes for myogymnastics (Fig. 4), mills of various shapes (Fig. 5), and others.

An important component in the treatment of children of the younger age group is the translation of treatment into the game. Preventive exercises, namely: to blow bubbles, drink juice through a straw, playing the flute, which children like a lot – this is the element of treatment. These exercises have a positive effect on the elimination of speech disorders. Children can do exercises both at home with their parents and in groups of children’s groups in the presence of a speech therapist, also recommended orofacial gymnastics.

When conducting a speech therapy correction, cooperation and understanding between the child and the speech therapist are important. The child should clearly and intelligibly perform the proposed exercises, and parents

| Number of children, 73 | Age group | Number of interrupted sounds |
|-----------------------|-----------|-------------------------------|
|                       |           | sibilant | hissing | sonorous |
| 24                    | 3–6 years | «з» (z) – 15 | «з» (z) – 19 | «п» (l) – 20 |
|                       |           | «з'» (z') – 7 | «ч» (ch) – 18 | «п'» (l') – 8 |
|                       |           | «с» (s) – 16 | «ш» (sh) – 20 | «р» (r) – 12 |
|                       |           | «с'» (s') – 4 | «щ» [shch] (shch) – 20 | «р'» (r') – 21 |
|                       |           | «т» (ts) – 10 | [ч - ш] (ch-shch) – 2 | «р» (r) – 35 |
|                       |           | «т'» (ts') – 8 |                                    | «р» (r) – 2 |
|                       |           | [с - у] (s-sh) – 15 |                                    |                  |
|                       |           | [ч - ш] (ch-sh) – 12 |                                    |                  |
|                       |           | [с - у] (s-sh) – 11 |                                    |                  |
| Total points, 258     |           | 116      | 81      | 61       |

| 49                    | 6–12 years | «з» (z) – 6 | «з» (z) – 2 | «п» (l) – 31 |
|                       |           | «з'» (z') – 3 | «ч» (ch) – 3 | «п'» (l') – 4 |
|                       |           | «с» (s) – 4 | «ш» (sh) – 2 | «р» (r) – 4 |
|                       |           | «с'» (s') – 4 | «щ» [shch] (shch) – 3 | «р'» (r') – 35 |
|                       |           | «т» (ts) – 2 |                                    |                  |
|                       |           | «т'» (ts') – 0 |                                    |                  |
| Total points, 101     |           | 19       | 10      | 72       |
should follow the advice and recommendations received. Usually, 10 classes of speech therapy correction were prescribed 3 times a week. If necessary, the number of classes increased.

Of the 24 children aged 3 to 6 years, in 12 cases, in addition to our speech therapy sessions, we have recommended to use at home standard vestibular plates Dr. Hinz – MUPPY-P with a bead, allowing you to fight the habit of sucking fingers, translate mouth breathing into the nasal, develop circular muscle of the mouth and normalize lip closures, correct infantile swallowing, exercise myofunctional training, stimulate the process of natural self-regulation of the growing organism, correct the defects of the tongue, forming the upper position of the tongue and the correct articulation mode (Fig. 6).

Use of vestibular plates Dr. Hinz for 6–7 months allowed to improve the tone, and contributed to the training of flaccid muscles and tissues of the oral cavity, because they provoke weakening or, if necessary, relieve the tension of the muscles of the vocal apparatus. Placing the plate in the mouth, the child immediately begins to instinctively roll the bead with his tongue across the hard palate, thus stimulating the tone of the lingual muscle.

Eight children for the period of 6–8 months simultaneously with logopedic exercises used removable orthodontic instruments with a bead (Fig. 7), which also contributed to the elimination of laying the tongue between dental rows, infantile swallowing type, speech therapies, etc.

Component parts of such devices are a shortened basis of the apparatus, vestibular arc, bracket on the edge of the front and middle 1/3 of the sky, bead, fixing clamp. In our opinion, the main flow of the indicated technical solution is the cumbersomeness of the device due to the size of the structure, which overlaps articulation zones and impedes qualitative treatment.

Nine children used the permanent Bluegrass appliances (Fig. 8) for a month, consisting of orthodontic rings to the first permanent molars, connected by an arc, moving into the
of a replaceable bite.

Type of swallowing. Age indications: temporary and first period deformities by eliminating unhealthy tongue habits, infantile particular dyslalia, the prevention of dental and maxillary the prevention and treatment of speech disorders, in stimulating the muscles of the tongue.

during a conversation the child involuntarily rolls it in the sky, the form of a bead, allows you to control the usual palatal speech disorders; the use of a functionally active element in turn has a positive effect on the quality of the elimination of increases the articulation zones of the language, which in forming the root of the permanent teeth; compactness caries on the non-mineralized cervical area the stage of hygienic condition of the oral cavity, eliminates the risk of structure, in turn, facilitates hygienic care and improves the makes the device compact, by reducing the size of the

The device we proposed for eliminating and preventing unhealthy tongue habits was used in 6 cases over a period of 2 to 4 weeks. The device contains a bracket that is soldered to two thin-walled perforated casting crowns designed to be fixed on temporary canines to a composite flowable light curing material (Filtek flow 3M ESPE) or a hybrid glass-ionomer cement with a triple hardening mechanism (Vitremer 3M ESPE), in the middle part of which is attached functionally acting element in the form of a bead (Fig. 9).

The advantage of the device proposed by us, in our opinion, is the following: fixation on temporary pointed tooth makes the device compact, by reducing the size of the structure, in turn, facilitates hygienic care and improves the hygienic condition of the oral cavity, eliminates the risk of caries on the non-mineralized cervical area the stage of forming the root of the permanent teeth; compactness increases the articulation zones of the language, which in turn has a positive effect on the quality of the elimination of speech disorders; the use of a functionally active element in the form of a bead, allows you to control the usual palatal position of the tongue, to activate the root of the tongue, as during a conversation the child involuntarily rolls it in the sky, stimulating the muscles of the tongue.

Clinical indications for the use of the proposed device is the prevention and treatment of speech disorders, in particular dyslalia, the prevention of dental and maxillary deformities by eliminating unhealthy tongue habits, infantile type of swallowing. Age indications: temporary and first period of a replaceable bite.

Fig. 9. A device for eliminating and preventing unhealthy tongue habits in the oral cavity.
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та мислення. В усіх обстежених діагностовано поліморфну дислалію. Третім етапом алгоритму – проведення роботи щодо подолання порушення фонетичного боку мовлення була безпосередньо мовлення корекції. Запропонований пристрій для усунення та профілактики шкідливих язикових звичок застосували у 6 випадках.

Висновки. Після проведення логопедичної корекції сформувалися правильний артикуляційний уклад та звуковимова. Запропонований пристрій для усунення та профілактики шкідливих язикових звичок дійсно використовували у комплексі з логопедичною корекцією, що підтвердило ефективність пристрою.

Висновки: мовлення порушення; артикуляційний уклад; пристрій для усунення та профілактики шкідливих язикових звичок.

Ключові слова: мовлення порушення, артикуляційний уклад, пристрій для усунення та профілактики шкідливих язикових звичок.

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АЛГОРИТМ КОРЕКЦІЇ РЕЧЕВИХ НАРУШЕНЬ С ИСПОЛЬЗОВАНИЕМ УСТРОЙСТВА СОБСТВЕННОЙ КОНСТРУКЦИИ

Резюме. Свій час в Україні набуває тенденцію до росту числа дітей з речевими нарушениями, серед яких, найбільш поширенними є дислалія. Логопедичні заняття – основна форма корекційного навчання, до якого відносяться визначення та розроблення стратегії логопедичної корекції. З метою виявлення речових нарушень рекомендовано використовувати функціональну вагу Dr. Hinz – MUPPY-R з бусинкою, яка використовується в комплексі з логопедичною корекцією.

Матеріали та методи. Проведено обстеження 73 дітей (24 – від 3 до 6 років, 49 – від 6 до 12 років) з речовими нарушениями, що включали нарушень речі з нормальним слухом і інтелектом. Основним етапом корекції є проведение роботи щодо подолання нарушень фонетичного боку мовлення, яке було використано в комплексі з логопедичною корекцією. Запропоноване пристроє запропоноване для використання у випадках, коли виявлено раннє виявлення факторів ризику основних стоматологічних захворювань.

Результати та обговорення. Першим етапом корекції було проведення логопедичної корекції речових нарушень з метою виявлення факторів ризику основних стоматологічних захворювань. Другим етапом було проведення логопедичної корекції, що включало використання пристрою Dr. Hinz – MUPPY-R з бусинкою, яка використовується в комплексі з логопедичною корекцією. Запропонований пристроє використовується в випадках, коли виявлено раннє виявлення факторів ризику основних стоматологічних захворювань.

Висновки. Після проведення логопедичної корекції сформувалися правильний артикуляційний уклад та звуковимова. Запропонований пристрій для усунення та профілактики шкідливих язикових звичок застосовували у 6 випадках.

Висновки: мовлення порушення; артикуляційний уклад; пристрій для усунення та профілактики шкідливих язикових звичок.

Ключові слова: речові науки; профілактика шкідливих язикових звичок.