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Multi-disciplinary approach to speech and breathing therapy in children

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Abstract

The purpose of the paper is to identify effective methods based on an interdisciplinary approach in tackling speech disorders in children via the study of two groups of respondents, with the various applications of corrective measures. As a result, in the Experimental group (EG) the indicators of producing hushing sounds are lower in comparison with the Control group (CG). In conclusion, a well-formed

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differentiation of the movements of the organs of articulation and the completeness of the kinesthetic sensations of various positions of the tongue in the oral cavity is required for the development of pronunciation.

Keywords: Interdisciplinary, Systematic approach, Speech development.

Enfoque multidisciplinario de la terapia del habla y la respiración en niños

Resumen

El propósito del documento es identificar métodos efectivos basados en un enfoque interdisciplinario para abordar los trastornos del habla en niños a través del estudio de dos grupos de encuestados, con las diversas aplicaciones de medidas correctivas. Como resultado, en el Grupo Experimental (EG) los indicadores de producir sonidos de silenciamiento son más bajos en comparación con el grupo de Control (CG). En conclusión, se requiere una diferenciación bien formada de los movimientos de los órganos de articulación y la integridad de las sensaciones kinestésicas de varias posiciones de la lengua en la cavidad oral para el desarrollo de la pronunciación.

Palabras clave: Enfoque interdisciplinario, Sistemático, Desarrollo del habla.

1. INTRODUCTION

The problem of children's successful functioning in various fields in a contemporary school is the subject of study by specialists in various fields of pedagogical, psychological and medical sciences. This problem is due to the specificity of the ontogenetic development of complex structures of mental and cognitive processes in children (LIU, UTEMOV, & KALIMULLIN, 2017).

The main category that determines the level of development of children is speech development. The impairment of at least one of its aspects is a determinant of a negative impact on a complex system of psychological and social well-being (KE, BORAKOVA & VALIULLINA, 2017). Pathological effects of various functional disorders of speech activity that are timely detected will help to effectively overcome their harmful effects on its further development.

The formation and development of the speech pronunciation function is quite widely represented in the scientific literature, however, there is an acute question concerning the validity and reliability of modern technologies that are effective when applied with traditional corrective methods. This makes it possible to significantly expand the range of effectiveness of their impact and involve specialists of related industries in the process of correction (KONG, KAYUMOVA, & ZAKIROVA, 2017).

In connection with a rise in the number of children with articulation disorders, innovative myofunctional methods to correct possible causes of speech sound disorders are becoming more widespread: bite pathology, incorrectly formed myofunctional patterns in the form of laying the tongue between the teeth when swallowing and the act of speech, atony of the oral muscles due to a constantly open mouth, etc. The effectiveness of the results of speech therapy depends on the multidisciplinary interaction of the team of such specialists as a pedologist, neurologist, dentist, orthodontist, ENT specialist.

ARKHIPOVA (2017), CHAPALA & KOSTINA (2009) are involved in studying this problem in our country. Among foreign researchers, the following works on mythological therapy and diagnosis attract attention - by FURTENBACH, ADAMER & SPECHT-MOSER (2015), as well as the influence of incorrect myofunctional habits on the development of bite pathology. CHAPALA & KOSTINA (2009) investigated whether myofunctional disorders could also lead to speech disorders, that is, disorders at several levels of the language. They came to the following conclusion: In children with myofunctional disorders (n = 392), it was found that they are significant and 5–6% more likely to occur at the phonological, grammatical, lexical and semantic levels of the language compared to children without such disorders (n = 684). Besides, lung ventilation disorders were much more common. The focus of another practice-oriented contribution is on the exclusively phonetic aspect of articulation where the relationship between basic functions and articulation is studied (LARIONOVA, ZAITSEVA, FADEEV, ZHENZHEBIR, FILATOV & PSHAVA, 2017). We assume that not only food intake functions, but also the state of the circular muscles of the mouth, the relative position of the tongue and palate, lips and cheeks to the dentition have a significant effect on articulation. Disorders in the work of the orofacial muscles, such as the absence or impairment of the lip closure, as well as weak, too strong or incorrectly directed muscle strength is ideal ground for phonetic articulation disorders in all variations. Patients with myofunctional disorders, especially children, as well as adolescents and adults, are noticeable, on the one hand, by typical articulation disorders, and on

the other, by fuzzy or blurry pronunciation or various combinations of both.

Various forms of resonance disorders, such as hypernasality, hyponasality, and mixed forms, can also occur in connection with the dysfunction of soft tissues at rest. Since orofacial dysfunction can also lead to impaired ventilation of the middle ear and, thus, to impaired sound conductivity of poor quality, the development of auditory processing and perception performance may be impaired and lead to speech impairment.

In the comparative study, conducted by CLAUSNITZER & CLAUSNITZER (1990) about the relationship between the formation of S-sound and the shape of the dentition, she, as an orthodontist, and he, as a clinical speech therapist, examined 800 children with bite abnormalities with a mean age of 10 years; and 90 children with an orthognathic bite with a mean age of 10 years. The difference between sigmatists and children with normal pronunciation was made acoustically. Statistical analysis using the chi-square test showed that in patients with an occlusion abnormality, the error probability was significantly higher than 1%.

Other authors have also shown a close relationship between S-sound errors and occlusion abnormality. In their study of 3086 schoolchildren in CHAPALA & KOSTINA (2009) diagnosed sigmatism, especially in the case of an open bite, and the correlation between this verbal error and an open bite was clearest. Only a few authors specifically considered the correlation between sigmatism and the size of the upper jaw in their studies. CHAPALA & KOSTINA (2009) already concluded from his study Speech function in case of loss of teeth and or having

dentures that speech disorders can be attributed to several main reasons. In case of loss or removal of a permanent tooth and belated making of a denture, a narrowing of the upper jaw occurs, which leads to the same speech disorders as with various dental abnormalities that arise with a narrow upper jaw. A computer study conducted by CHAPALA & KOSTINA (2009) about the relationship between S-sound formation and dental abnormalities in 120 German-speaking children aged seven to twelve showed that the transverse width of the upper jaw is the most significant parameter in this context. If the upper jaw is too narrow, the groove required for the sound [s] becomes too narrow, which changes the frequency spectrum.

Thus, in the scientific world, a tendency has arisen to associate impaired sound pronunciation with various forms of occlusion abnormalities (KVON, LUSHCHIK, KARPENKO, ZAITSEVA, KULKOV, GALUSHKIN & YAKUPOVA, 2017). CLAUSNITZER and CLAUSNITZER (1990) show that interdental and ocular sigmatism are associated with dental abnormalities. An interdental S-sound defect was diagnosed with an open bite in 60.8% of cases. In the second place is the mesial occlusion of 41.0%, and in the third place is a lateral disorder of occlusion (crossbite) of 27.3%.

Thus, we see that the most common abnormality of occlusion in the form of a distal bite with protrusion/retrusion of the upper incisors and the sigmatism of the group of sibilants accompanying it is not sufficiently covered in the scientific literature, so the topic of our work is very important. Speech therapists starting work with children, as a rule, cannot get a reliable assessment of the condition of the child's articulating

apparatus, since there is no conclusion of the orthodontist in the referral of the Central Psychological, Medical, Pedagogical Commission. Preventive work with preschool children has completely dropped out from the activities of the orthodontist in recent years, while, according to the order of the Ministry of Health and Social Development of the Russian Federation dated May 14, 2006 No. 289, the orthodontist is obliged to provide preventive, diagnostic work with children as well as medical care from the first months of life (BERNSTEIN, 2012). Thus, close contact between the speech therapist and the orthodontist leads to an expansion of the professional horizons and better correction of errors in the pronunciation of speech. In its turn, interaction with an otorhinolaryngologist gives an idea of the patency of the nasal passages, the condition of the airways, which will affect speech breathing and prosodic components in corrective work.

In CHAPALA & KOSTINA's (2009) opinion the formation of a permanent bite in each person occurs on an individual time basis and with different results, but there are average statistics which are usually relied on. The child is in a state of mixed dentition from 6 to 12 - 14 years of age.

Period I - early shift (6 - 8 years). The central incisors (6 - 7 years) and lateral incisors (7 - 8 years) on the upper and lower jaw change and the first permanent molars erupt (6 - 6.5 years)

Period II - late shift (9 - 12 years). The first premolars (9 to 10 years), then the canine teeth (10 to 11 years), followed by the second premolars (11 to 12 years) and the second molars (12 to 13 years)

erupt.

Thus, by the age of 12 - 13 years, the final replacement of primary teeth by permanent teeth occurs. The process of formation of tooth roots is completed only by the age of 15.

2. METHODOLOGY

To identify the corrective effect of the use of the device Myobrace K1 in the speech therapy practice, it is tried to determine whether the device Myobrace K1 affects the transition from mixed and oral breathing to a physiological one. Following the plan of scientific research during 2018-2019, a study was conducted to introduce the MyobraceK1 device in the structure of a therapy class. Forty-eight children aged 6-7 were selected at SBEI Secondary School 2120 in Moscow. The selection was based on an analysis of medical, psychological and pedagogical documentation, the conclusion of an orthodontist and an ENT doctor. All children were diagnosed with distal occlusion, excessive incisive overlap, accompanied by phonetic underdevelopment of speech in the form of organic dyslalia.

An ENT examination showed that 10 children have adenoids of the 1-2 degrees of severity, which led to a transition from a physiologically normal nasal type of breathing to an oral and mixed one. All children were tested for water retention in the mouth for 1 minute and with the help of their parents, a video was taken of the night sleep (30 sec) for 1 week. According to the results of these tests, it was found that in 20 children, the oral and mixed type of breathing is present during the day

and during night sleep, it is accompanied by snoring; the remaining 28 children had the oral and mixed type of breathing only in the daytime. The sample of the experimental group was random. It comprised 36 children who agreed to carry the MyoBrace K1 in their mouths and use it in class. In agreement with the parents, classes with a speech therapist were held at the myofunctional orthodontic center Myodent in Moscow, which uses in its work protocols for the treatment of occlusion abnormalities according to the Myobrace system and equipped with the required number of K1 devices.

The control group of 12 children underwent traditional speech therapy at the State Budget-funded Educational Institution Secondary School number 2120 without K1 devices. In both groups, the program and format of classes were the same. Each class included a task for the development of fine motor skills of hands, prosody of speech, auditory attention, articulation and breathing exercises, teaching proper pronunciation, automatic production and differentiation of sounds. The children of the EG performed breathing exercises and the development of fine motor skills of hands with the K1 device in the mouth and carried the K1 device daily for 1 hour in the afternoon and all night. In assessing the state of facial and oral praxis, we used the samples borrowed from the abstract of the thesis for the degree of Ph.D. in Medicine (HARKE, 2007).

3. RESULTS AND DISCUSSION

Comparing the results of the two groups on the dynamics of praxis (27 samples), we used the Wilcoxon T-test (Table 1, 2) which

revealed significant differences in the state of the facial muscles (FM) and lip muscles (LM) in the EG before and after the study, as evidenced by the indicator P-value = 0.001. The P-value of the control group with a larger value indicates that there was no significant dynamics in the state of the muscles before and after the study.

Table 1: Dynamics of the facial and oral praxis in the EG before and after (p-value - corresponds to 0.001; FM - facial muscles; LM - lip muscles)

Variables	Number of people	Wilcoxon T-test	Z-test	p-value
FM_beforeo&LM_after	36	0,00	5,23	0,000 ***
LM_before&LM_after	36	0,00	5,23	0,000 ***

Table 2: Dynamics of the facial and oral praxis in the CG before and after (p-value corresponds to 0.01; FM-face muscles; LMG-lip muscles)

Variables	Number of people	Wilcoxon T-test	Z-test	p-value
LM_before&FM_after	11	0,00	2,93	0,003 **
LM_before&LM_after	11	0,00	2,93	0,003 **

To compare the EG and the CG between themselves according to the state of the facial and oral praxis and the speed of speech production of hushing sounds, the Mann-Whitney U-test was used (Table 3). As a result of statistical analysis, we concluded that in the EG the indicators of producing hushing sounds are lower in comparison with the CG, which indicates faster automatic production of sounds in the EG.

Table 3: Indicators of Mann-Whitney U-test (U = 5.02; p <0.05 - corresponding values for each variable)

Variables	Rank sum	Rank sum	Mann-Whitney U-test	Z-test	p-value		Number of subjects	Number of subjects
	EG	**CG**					**EG**	**CG**
FM_before	900,5	275,5	197,50	0,43	0,668		36	12
LM_before	871,5	304,5	205,50	-0,24	0,812		36	12
FM_after	1093,5	82,5	4,50	5,02	0,000	***	36	12
LM_after	1064,5	111,5	33,50	4,33	0,000	***	36	12
Sound Ш (sh)	666,0	510,0	0,00	-5,13	0,000	***	36	12
Sound Ж (zh)	666,0	510,0	0,00	-5,13	0,000	***	36	12
Sound Ч (ch)	666,0	510,0	0,00	-5,13	0,000	***	36	12
Sound Щ (sh')	666,0	510,0	0,00	-5,13	0,000	***	36	12

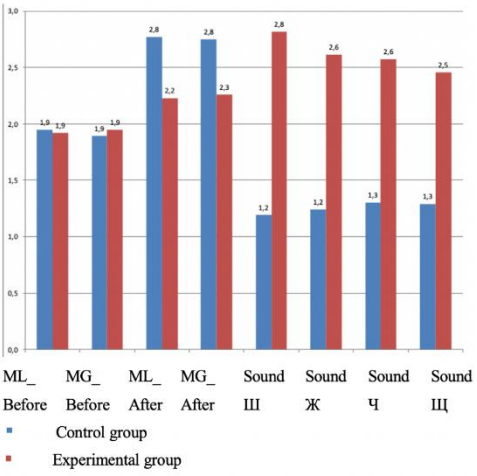

Figure 1: A comparative analysis between the EG and CG (producing hushing sounds (months) and the condition of the facial and oral praxis before and after the study

In the context of the study of the breathing pattern, the Pearson's chi-squared test$\chi 2$ was used which showed that the groups significantly differ in the type of respiration: 88.9% of the experimental group switched to the physiological type of breathing, and 11.11% have partial improvements (Table 4, Figure 2). In children of the control group, there are no significant changes in this indicator.

Table 4: Values of Pearson's test$\chi 2$ according to breathing patterns

	Breath patt_after	Breath patt_after	Breath patt_after	Row
	0	1	0,5	Totals
Experimental group	32	0	4	36
Column %	100,00%	0,00%	100,00%	
Row %	88,89%	0,00%	11,11%	
Total %	66,67%	0,00%	8,33%	75,00%
Control group	0	12	0	12
Column %	0,00%	100,00%	0,00%	
Row %	0,00%	100,00%	0,00%	
Total %	0,00%	25,00%	0,00%	25,00%
Totals	32	12	4	48
Total %	66,67%	25,00%	8,33%	100,00%

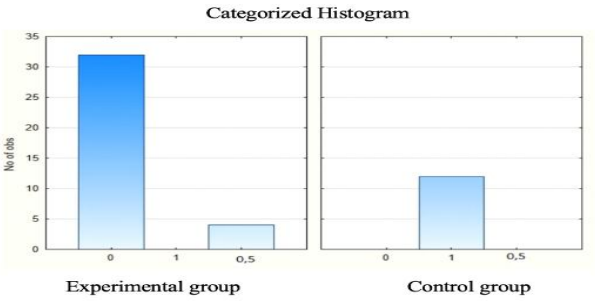

Figure 2: Values of Pearson's test$\chi 2$ according to breathing patterns

4. CONCLUSION

As a result of the study, the corrective effect from the use of the Myobrace K1 device in the speech therapy practice was found in the following areas:

1. With the use of the marker tongue (3), the correct upper position of the tongue with an emphasis in the front third of the hard palate was developed, which led to an improvement in the shiftability of the tongue from the upper lift to the lower one, which is important when working with the differentiation of sibilants.

2. The elevator (2) preventing the lowering of the tongue behind the lower teeth, contributed to the development of the cacuminal position of the tongue necessary to pronounce hushing sounds and produce them automatically.

3. Stereognosis has formed in the articulation organs which activated kinesthetic afforestation's and contributed to the creation of a sensorimotor basis for the appearance of a group of hushing sounds. The created articulation basis will contribute in the future to the appearance of sonorant sounds by imitation.

4. The high bumper (1) with massage bristles (4) contributed to the activation of the closing function of the lips, which led to

improved labialization of sounds and had a positive effect on the prosodic side of speech.

5. The transition to the physiological type of breathing led to a prolongation of speech exhalation, which made it possible to pronounce whole phrases on one exhalation. This indirectly accelerated the automatic production of sounds in speech.

6. Although the child's cognitive sphere was not the subject of this study, it was found that children who regularly used K1 during the experiment improved such indicators of voluntary attention as stability, concentration and volume, which may be indirectly associated with the development of nasal breathing, which improves brain oxygenation. Thus, a well-formed differentiation of the movements of the organs of articulation and the completeness of the kinesthetic sensations of various positions of the tongue in the oral cavity is required for the development of pronunciation, as well as the mastery of arbitrary components of motor activity (kinetic praxis).

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