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ASSESSMENT OF FACIAL MUSCULATION PRACTICE AND IDEOMOTOR APRAXIA IN CHILDREN WITH SPEECH DISORDERS³

Abstract: Speech is a fundamental instrument of learning, social interaction and academic achievement in childhood. Speech development is closely linked to the maturity of motor, cognitive and perceptual functions, which together form the basis of successful school inclusion. In this context, the assessment of facial muscle practice and ideomotor practice has not only diagnostic, but also pedagogical significance, as it allows for the early detection of factors that may affect the child's speech and academic development. The goal of the research is to examine at what age the need for practicing orofacial and ideomotor practice can be observed in children with developmental articulation disorders in order to work on proper development stimulation in time. 45 children with developmental articulation disorders participated in the study. The sample is voluntary and includes children of both sexes (26 boys and 19 girls), aged 3 to 6 years. The sample included children attending the preschool institution "Cvetić", whose parents were informed about the aim and procedure of the research and gave written consent for their child to participate. The research used the Practical Organization Assessment Test. The test consists of five subtests, and for the purposes of this research, data from two subtests were analyzed: assessments of facial muscles and ideomotor practice. These subtests were selected because they provide insight into the qualitative and quantitative aspects of practical abilities that are relevant to the research goals. Data processing was performed in the SPSS program, using the t-test and Pearson's correlation coefficient. The results of the conducted research showed that there is no statistically significant relationship between gender and the level of development of facial muscle practice and ideomotor practice in preschool children, which indicates that these abilities have a similar developmental course in boys and girls. In contrast, a significant relationship was found between age and achievements in tests of facial muscle practice and ideomotor practice - older children show better organization, coordination and control of movements compared to younger children. The results emphasize the importance of encouraging motor and speech development in preschool age, as a prerequisite for successful articulation and school readiness.

Key words: facial musculature practice, ideomotor practice, developmental articulation disorder, academic success

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Introduction

Speech development is one of the key aspects of a child's overall psychological and academic development. Speech is not only a means of communication, but also the basis for cognitive processing, language acquisition, reading, writing and understanding complex symbolic systems that form the backbone of school learning (Snowling & Hulme, 2020). That is why speech disorders at an early age are increasingly seen as risk factors for later school failure and learning difficulties (Bishop & Snowling, 2004).

Among the most common speech disorders in children, developmental articulation disorder stands out (Grigorova et al., 2020), which implies difficulties in the precise and correct production of certain voices, without the existence of structural anomalies or a significant sensory deficit (American Speech-Language-Hearing Association [ASHA], 2023). According to studies, a large percentage of preschool children show some form of articulatory and phonological problems, such as sigmatisms, rotacisms, and mixtures of different phonetic errors (Preston et al., 2012; Shriberg et al., 2019).

One of the ways to better understand these motor components is to assess the practice of facial musculature, i.e. the ability to plan and control voluntary and imitative movements of the face and lips, as well as the assessment of ideomotor apraxia, which refers to difficulties in carrying out learned actions despite preserved motor power and understanding of the task (Dewey, 1993; Goldenberg, 2013; Ziegler et al., 2012). Numerous studies indicate that children with speech-language disorders, including articulatory and phonological disorders, often show lower results on tests of orofacial practice and movement imitation (Newmeyer et al., 2007a; Zuk et al., 2018).

Regarding articulatory disorders, some studies have found a relationship between impaired praxis/orofacial motor skills and the severity or form of articulatory or phonological errors. For example, research by Newmeyer et al. (Newmeyer et al., 2007a) showed that children with disorders of sound products have more frequent abnormalities in oral-motor imitation and worse fine motor skills in general. Also, the study by Bertagoni and colleagues (Bertagnolli et al., 2015) indicates that in children with articulation disorders, the practice of the orofacial system can be significantly impaired compared to control groups.

Earlier studies (Dworkin & Culatta, 1985) found no significant differences in the structural or neuromuscular characteristics of the oral mechanism in the group with articulation disorder compared to typically developed children. This indicates that a detailed analysis is important, and that it cannot be assumed that every articulation disorder also implies a disorder of motor programming of movements.

Disruption of facial musculature practice and ideomotor practice do not only affect articulation, but indirectly also affect academic success. Speaking and articulatory competence influence the development of phonological awareness, which is the basis for mastering reading and writing (Catts et al., 2002; Lewis et al., 2011). Children with articulation disorders often have difficulty understanding and processing the sound patterns of words, which can affect their performance in subjects that require verbal expression, reading, dictation, and oral presentation (Nathan et al., 2004). In this way, motor aspects of speech may represent an intermediate factor that connects speech-language difficulties and school success.

One of the components that is increasingly proving to be important in the understanding and diagnosis of such disorders is facial musculature practice (orofacial practice) - the ability to voluntarily and imitatively manage facial and oral muscles, as well as planning and performing

motor actions related to speech. Especially in children's speech disorders where articulation is impaired, examination of such motor functions may indicate the presence of ideomotor apraxia or other motor components of the disorder (Bertagnolli et al., 2015; Dewey, 1993; Newmeyer et al., 2007b).

Research into the practice of facial musculature and ideomotor apraxia in children with developmental articulation disorders can therefore have a double significance: on the one hand, it contributes to a better understanding of the neuromotor bases of speech disorders, and on the other hand, it has pedagogical implications in the field of early intervention, school adaptation and individualized teaching. Early recognition of motor difficulties can help not only in speech therapy, but also in the prevention of later academic difficulties.

Research methodology

The aim of the research

The goal of the research is to examine at what age the need for practicing orofacial and ideomotor practice can be observed in children with developmental articulation disorders in order to work on proper development stimulation in time.

Sample survey

45 children with developmental articulation disorders participated in the research. The sample included children of both sexes (26 boys and 19 girls), aged 3 to 6 years. The sample was formed based on the voluntary registration of parents or guardians. The research was conducted in the "Cvetić" pre-school institution, crèche and kindergarten. Assessment of ideomotor practice and facial musculature practice was performed individually for each child, in a separate room isolated from noise, in order to provide optimal conditions for the assessment and reduce the possibility of stress or anxiety of the child. All data collected during the research were treated as confidential. The names of the participants were not disclosed in the analyzes or reports, and the results were used solely for the purpose of scientific analysis. The room is adapted for working with small children, and the duration of each test is adapted to the abilities of the participants.

Research instrument

The test of practical organization was applied for the purpose of assessing children's practical abilities. This test consists of five subtests, and for the purpose of this research, data from two subtests of children (facial musculature practices and ideomotor practices) were evaluated. Tests were conducted individually in conditions that ensure minimal noise and adequate space for the child's concentration.

Facial musculature practice subtest - This subtest aims to assess the control, coordination and precision of facial, lip and tongue muscle movements. The examinee performs a series of motor tasks that include: inflating the cheeks, sticking out the tongue, whistling, combined tongue movements. The assessment is based on the success of the task, accuracy and time coordination of movements. The results of this subtest provide insight into the fine motor control of oral structures and may indicate specific difficulties in practical abilities.

Subtest of ideomotor practice - The subtest of ideomotor practice aims to assess the examinee's ability to perform motor actions based on verbal instructions, without a visual model. The examinee receives simple and more complex tasks, which may include: waving the hand, clapping, sending a symbolic kiss, performing a sequence of movements. Accuracy, regularity, speed and

ability to follow instructions are evaluated. The results of this subtest serve to assess the ability of motor planning and control in accordance with verbal instructions.

Data processing

Data processing in the research was carried out using quantitative methods of statistical analysis. The collected results of facial musculature practice testing and ideomotor practice were entered in tabular format using the statistical data processing program SPSS version 24.0. Tables and graphs were processed in the Excel program. The research used measures of descriptive statistics (average, median, standard deviation, minimum, maximum result value and range). The results were analyzed using the t-test and the Pearson correlation coefficient.

Research results

Differences in the level of development of facial musculature praxis and ideomotor praxis in children

Table 1. Descriptive measures of the development of facial musculature praxis and ideomotor praxis in children

Type of praxis	M	SD	min	max	Raspon
Facial musculature praxis	12,63	5,58	2	19	17
Ideomotor praxis	28,76	9,85	8	42	34

Table 1 shows the descriptive characteristics of the subjects in terms of the level of development of facial muscles and ideomotor praxis. Based on the results of the descriptive characteristics, we see that children have better results on the subtest of estimated ideomotor praxis, that is, that their facial muscle praxis is less developed.

Table 2. Differences in the level of development of facial muscle praxis and ideomotor praxis in children in relation to gender

Type of praxis	Responden t's gender	N	AS	SD	SG	t-test	df	p
Facial musculature practice	Male	26	11,50	4,77	0,844	-0,48	28,41	0,8996
	Female	19	14,20	6,72	0,956			
Ideomotor practice	Male	26	28,62	8,71	1,752	0,07	27,35	0,9748
	Female	19	27,24	11,91	1,968			

Analysis of the research results revealed that boys and girls have equally developed facial muscle praxis and ideomotor praxis.

Table 3. Differences in the level of development of facial muscle praxis and ideomotor praxis in children in relation to age

Relationship	r, χ^2	df	M	F	p
Ideomotor practice	21,11	1	21,11	58,265	,003
Facial musculature practice	28,45	1	28,45	59,789	,002

Using Pearson's correlation coefficient, it was examined whether there is a connection between the type of praxis (ideomotor praxis and facial musculature praxis) in relation to age. A positive correlation ($p < 0.005$) was obtained between the type of praxis and age. Older children had better results on the praxis assessment subtests compared to younger children. Namely, with the growth and general development of children, the ability to perform movements also develops and vice versa.

Discussion

The results of the research showed that there is no statistically significant difference between boys and girls in achievements on tests of facial musculature practice and ideomotor practice. This finding is consistent with previous research that indicates that gender is not a significant factor in the development of orofacial and ideomotor abilities, but that individual differences within each gender are significantly greater than gender differences (Marinelli et al., 2017; Cermak & Larkin, 2002). This indicates that in practice, more attention should be paid to the individual motor profile of the child, and not to gender stereotypes in the assessment of motor or speech maturity.

On the other hand, the results indicate a significant relationship between age and the development of facial musculature practice and ideomotor practice. Namely, older children achieve better results in tasks that examine voluntary and imitative control of facial movements, as well as in tasks that require planning and execution of symbolic actions. This finding is consistent with the expected developmental trend of motor planning, where the maturity of the central nervous system and increased motor experience lead to greater coordination and precision of movements (Klein et al., 2019; Hill, 2001).

The development of these abilities is especially important in the preschool period, because it is the basis for the successful development of articulation, phonological awareness and verbal expression, which are skills that directly affect academic success in the school period (Catts et al., 2002; Lewis et al., 2011). The improvement of facial musculature practice and ideomotor coordination with age can be interpreted as an indicator of general cognitive-motor maturation, which has important pedagogical implications.

These findings point to the need to encourage activities that improve fine and gross motor coordination, orofacial movements and imitative abilities within preschool programs, because they indirectly support speech and cognitive development. Early stimulation of motor functions, through speech therapy, music, drama and movement activities, can contribute to a better preparation of the child for the school environment and reduce the risk of later learning difficulties.

Conclusion

The results of the conducted research showed that there is no statistically significant relationship between gender and the level of development of facial musculature practice and ideomotor practice in preschool children, which indicates that these abilities have a similar developmental course in boys and girls. In contrast, a significant relationship was established between age and achievement on tests of facial musculature practice and ideomotor practice - older children show better organization, coordination and movement control compared to younger children. These findings confirm that orofacial and ideomotor abilities gradually develop in accordance with general motor and cognitive maturation.

The development of facial musculature practice and ideomotor coordination is an important prerequisite for proper articulation, clear speech production and the development of phonological awareness, which is the basis for the later acquisition of reading and writing skills. From a pedagogical point of view, these results indicate the need for systematic encouragement of motor and speech-language development in the preschool period. Activities that encourage fine motor skills, movement coordination, imitation and motor planning can play a significant role in improving the prerequisites for academic success.

In addition, the findings of this research can serve as guidelines for experts in the field of speech therapy, pedagogy and preschool education in the early recognition and support of children with difficulties in the motor organization of speech. Early assessment of the practice of facial musculature and ideomotor abilities can have preventive value - not only for speech-language development, but also for the child's general readiness for school.

Although the findings are in line with previous research, it is necessary to conduct additional studies with larger and more diverse samples, as well as with the application of instrumental methods of assessment of motor functions, in order to gain a deeper understanding of the neuropsychological basis of the relationship between motor, speech and academic competencies.

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