THE IMPORTANCE OF ORAL PRAXIS IN THE DEVELOPMENT OF SPEECH SOUNDS IN PRESCHOOL

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Abstract: *Articulation refers to the correct pronunciation of the sounds of the native language. The production of intelligible speech requires fine coordination and precision of oral muscle movements. Given that the efficient activity of the orofacial muscles is crucial for proper articulation, the aim of this study was to determine the correlation between the inability to perform certain motor patterns and the incorrect pronunciation of sounds. The sample consisted of 63 children of both genders, aged 4 to 6 years. Oral Praxis Test and the Global Articulation Test were used. The research was conducted at the "Čika Jova Zmaj" kindergarten in Foča during November 2023. The results of the study show a significant correlation between the inability to perform the motor pattern of "chattering" and the pronunciation of the sound Š (Cramér's V = 0.009), the sound Ž (Cramér's V = 0.049), the sound DŽ (Cramér's V = 0.014), the sound Ć (Cramér's V = 0.017), and the sound C (Cramér's V = 0.008), as well as between the inability to perform the motor pattern of tongue fluttering and the incorrect pronunciation of the sound R (Cramér's V = 0.047). It was also found that an alarmingly high percentage (68.3%) of preschool children have articulation disorders.*

Key words: *articulation, oral praxis, preschool children.*

INTRODUCTION

The term "articulation" refers to the correct pronunciation of the sounds of one's native language, and the most common speech disorders in preschool children are articulation disorders. According to the International Classification of Diseases (WHO, 2008), an articulation disorder is a specific developmental disorder where a child's pronunciation of speech sounds is below the expected level for their age, while their language abilities are intact. In the newer classification, ICD-11, a specific articulation disorder is described as an atypical sound realization that does not align with age expectations and cannot be explained by any obvious cause, while language development remains unimpaired (WHO, 2020).

Many preschool children experience speech and language disorders as well as poor communication development (Brodin & Renblad, 2020). Among speech disorders in preschool children, articulation disorders are the most prevalent. Numerous studies report high prevalence rates of articulation disorders (Ćalasan, Dragičević & Dobrota, 2015; Ćalasan et al., 2016; Golubović&Čolić, 2009; Junuzović-Žunić et al., 2007; Umićević & Ljubić, 2015). Recent studies indicate a higher prevalence of articulation disorders compared to older research findings, which is particularly concerning. Newer research also highlights that speech disorders create various barriers in later literacy acquisition (Ayupova, 2022), and for preschool children, the development of effective communication skills forms the foundation for future academic success and social integration (Sobirovich & Sodiqjonovna, 2024).

Articulation disorders arise from an improper flow of air during the articulation of specific sounds, rooted in altered articulator functions (e.g., incorrect tongue, lip, palate functions, jaw angle position) and undifferentiated phonemic hearing (Dobrota, 2010). The position of the speech organs during articulation determines the physiology of sounds. Each sound has physiological distinctiveness that must be understood to achieve precise and clear articulation, or pronunciation, of that sound (Šipka, 2006). Producing intelligible speech requires fine coordination and precision of oral musculature movements (Mei et al., 2020), and efficient muscle activity in the orofacial region is key to proper articulation (Dobrota, 2010). Good articulation is directly related to oral praxis (Dobrota & Ćalasan, 2018). Oral praxis is the ability to

voluntarily perform specific movements of the orofacial muscles, controlled by certain cranial nerves (V, VII, IX, and XII), with impairments in any of these nerves resulting in functional issues in the orofacial region that manifest as pathological articulation (Dobrota, 2016).

During an orofacial assessment, a speech therapist analyzes the position, appearance, and function of articulators to identify potential structural or functional causes of articulation disorders (Salihović et al., 2009). Diagnosing articulation disorders includes assessing the mobility of speech organs, which involves examining the static position of articulators, dynamic movement, and the fluency of movement during transitions between articulatory positions (Junuzović-Žunić, Banović &Ibrahimagić, 2015,Ristić, Jolović & Čolić, 2023). Often, the assessment involves imitative tasks of speech organ movements demonstrated by the examiner, which the child then repeats. A mandatory step in speech therapy diagnostics is checking the correct pronunciation of all native language sounds, using articulation assessment tests. The types of articulation errors encountered by speech therapists include omissions, substitutions, and distortions (Dobrota&Ćalasan, 2018). Omissions are missing sounds in words, which can be considered a passing phase in early development but only for sounds that require complex motor patterns for accurate articulation (Dobrota, 2010). Substitution involves replacing one sound with another, typically in a systematic way based on sound voicing or place and manner of production. Distortions refer to incorrect pronunciations of sounds, which may affect intelligibility less than substitutions and omissions since the sound exists but is distorted. Articulation disorders should be corrected at an early age, so the child acquires proper pronunciation of all native language sounds before starting school. If there is incorrect pronunciation of specific sounds, an early assessment of the type, degree, and cause of the articulation disorder is conducted to organize appropriate speech therapy (Dobrota&Ćalasan, 2018). For children around five years old, incorrect articulation of certain sounds is still tolerated, but only for those sounds whose pronunciation requires complex motor patterns. After the age of five, incorrect pronunciation of sounds is defined as a pathological condition (Dobrota, 2010). Since efficient muscle activity in the orofacial region is crucial for proper articulation, this paper aims to determine the correlation between the inability to perform specific motor patterns and incorrect pronunciation of sounds.

METHOD

SAMPLE, TIME, AND PLACE OF RESEARCH
The sample in this study consisted of 63 children of both genders, aged 4 to 6 years. The research was conducted at the "Čika Jova Zmaj" kindergarten in Foča in November 2023.

RESEARCH INSTRUMENTS
Two tests were used in the study: the Test of Oral Praxis - TOP (Radičević&Stevanković, 1992) and the Global Articulation Test - GAT (Vladisavljević&Kostić, 1983).
The Test of Oral Praxis (TOP) consists of 21 motor patterns and is used to precisely assess the state of the orofacial region. This test is administered through imitation, where the examiner performs a motor pattern and asks the child to replicate it. The test starts with simple motor patterns (e.g., breathing through the nose and mouth, blowing out a match, sticking out the tongue) and gradually progresses to more complex ones (e.g., lip trembling, tongue trembling, palatolingual groove formation). A correctly executed movement by the participant is marked with (+), a partially executed movement with (±), and an inability to perform the movement with (−).
For articulation assessment, the Global Articulation Test (GAT) was used. This test evaluates the pronunciation of all sounds in the Serbian language. In the test, sounds are grouped based on the airflow during their production (vowels, plosives, affricates, fricatives, laterals, nasals, semivowels, and vibrants). The test is administered by having the examiner say a word containing the target sound in the initial position, which the participant must repeat. Pronunciation of sounds is scored as follows: (+) for correctly pronounced sounds, (+/−) for distorted pronunciation, and (−) for substituted or omitted sounds. If a sound is substituted, the test's last column records the sound used as a substitution. If a sound is distorted, the type of distortion is specified.

RESEARCH PROCEDURES
Before starting the research, written consent was obtained from the parentsof all children participating in the study, ensuring the confidentiality of their data.Each child was individually tested by the researcher using both tests in a separate room in the kindergarten (the speech therapy office).

STATISTICAL DATA ANALYSIS

Data analysis was conducted using the SPSS 24.0 statistical software package. Basic descriptive statistics were calculated for all variables. To examine the correlation between the inability to perform motor patterns on the TOP and the pronunciation of certain native language sounds on the GAT, Cramer's V test was used. Data were presented in tables and graphs.

RESULTS

Table 1 shows the distribution of participants based on the presence of articulation disorders. From Table 1, it is evident that a concerning percentage of preschool children, 43 (68.3%), have articulation disorders, while 20 (31.7%) children do not.

Table 1. Distribution of Participants Based on the Presence of Articulation Disorders

Articulation disorder	Total	
	N	%
YES	43	68.3%
NO	20	31.7%
Total	63	100%

Table 2. shows the distribution of the most common types of articulation disorders (percentage of omissions, substitutions, and distortions). It is evident that the most common type of articulation disorder among preschool children is substitutions, with 34 (53.97%), followed by distortions at 29 (46.03%), while omissions are the least common, accounting for 6 (9.52%). It is also important to note that, in a certain number of our participants, two different types of articulation disorders were present simultaneously (omissions and substitutions; omissions and distortions; substitutions and distortions).

Table 2. Type of Articulation Disorder

Type of Articulation Disorder	Total number of children with different types of articulation disorders	
	N	%
Omision	6	9,52%
Substitution	34	53.97%
Distortions	29	46.03%

Note: Some children have two types of articulation disorders simultaneously

Figure 1 shows the five sounds most commonly mispronounced by preschool children (either omitted, substituted, or distorted). These sounds are: Č, DŽ, R, Ž, and C.
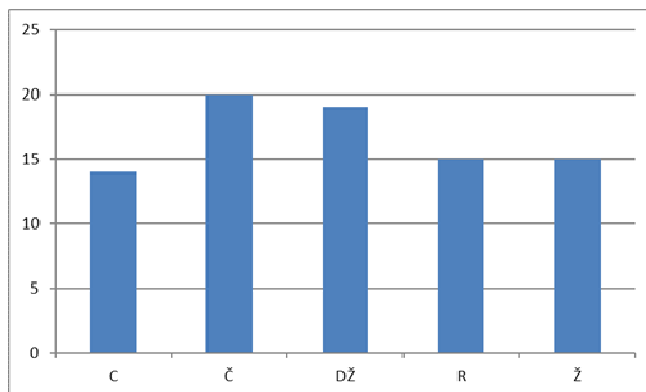

Figure 1. The five most common sounds mispronounced

Figure 2 shows the classification of sounds in the native language (based on their place of articulation), specifically the percentage distribution of incorrectly pronounced sound groups. From the chart, we can observe that preschool children most commonly mispronounce sounds from the alveolar group – Š, Ž, Č, DŽ, R (46%), followed by the dental group – D, T, N, L, S, Z, C (26%), the postdental group – Ć, Đ (13%), the palatal group – J, NJ, LJ (6%), the velar group – K, G, H (4%), the labiodental group – V, F (3%), and the bilabial group – P, B, M (2%).
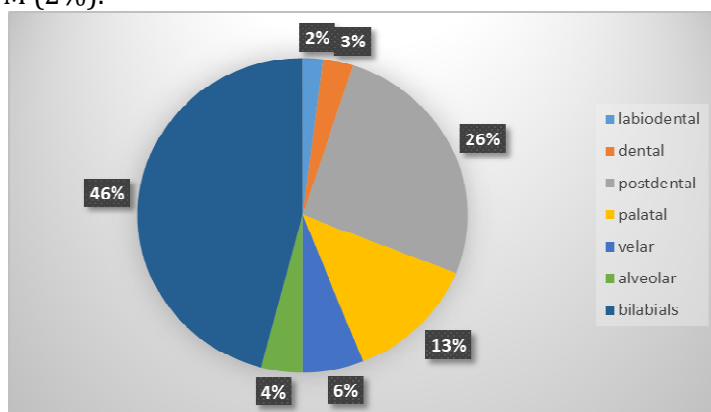

Figure 2. The prevalenceof incorrectly pronounced spunds grouped by place of articulation

In Figure 3, a representation of the groups of sounds in the native language (classification of sounds based on the airflow) is provided, specifically the percentage of incorrectly pronounced sound clusters. By examining the chart, we can observe that preschool children most commonly mispronounce sounds from the group of affricates - C, Ć, Č, Đ, DŽ (41%), followed by fricatives - V, F, S, Z, Š, Ž, H (34%), the vibrant R (10%), laterals - L, LJ (9%), plosives - P, B, K, G, T, D (5%), and nasals - M, N, NJ (1%).
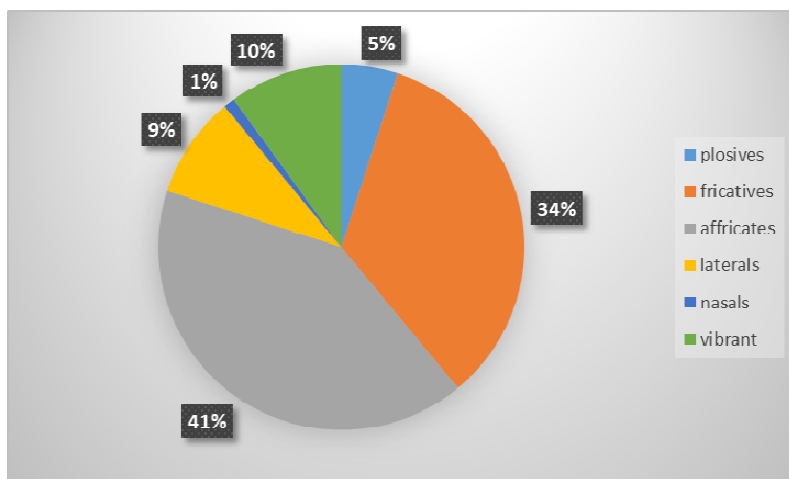

Figure 3. Most commonly mispronounced sound groups according to airflow type

To examine the relationship between the inability to perform motor patterns on the TOP and the pronunciation of certain native language sounds on the GAT, we used Cramer's V test, specifically a series of these tests, since we applied the same statistical technique multiple times across different variable combinations (Table 3).

Table 3 shows the most commonly mispronounced sounds and the motor patterns associated with their incorrect pronunciation. The application of the aforementioned test revealed a statistically significant association between the inability to perform the tongue-clicking motor pattern and the pronunciation of the sounds Š (Cramér's V = 0.009), Ž (Cramér's V = 0.049), DŽ (Cramér's V = 0.014), Ć (Cramér's V = 0.017), and C (Cramér's V = 0.008), indicating a moderate association between these two variables. Additionally, a statistically significant association was found between the inability to

perform the tongue-trilling motor pattern and the inability to pronounce the sound R (Cramér's V = 0.047).

Table 3. Association Between the Inability to Perform Certain Motor Patterns and the Pronunciation of Specific Sounds

Motor pattern	Sounds							
	Š	Ž	Č	DŽ	Ć	Đ	C	R
tongue-clicking	.328**	.275*	.088	.316*	.310*	.273	.330**	.233
smacking	.243	.236	.282	.136	.100	.206	.154	.296
Palatolingual groove	.245	.179	.173	.265	.248	.277	.213	
Mouth fluttering								.256
tongue-trilling								.301*

DISCUSSION

The results of our research show an alarmingly high prevalence of articulation disorders among preschool children. Specifically, as much as 68.3% of the children in our sample have articulation disorders. These findings are consistent with previous studies indicating a high prevalence of speech disorders in children of this age (Čolić et al., 2024; Ćalasan, Dragičević, Dobrota, 2015; Ćalasan et al., 2016; Golubović&Čolić, 2009; Grigorova et al., 2020; Junuzović-Žunić et al., 2007; Tasić et al., 2019; Umićević&Ljubić, 2015). Grigorova et al. (2020), in their study involving 550 preschool children, reported an articulation disorder prevalence of 52.7%, which is closest to our percentage. The results of these studies reflect a general trend of increasing articulation disorders among preschool children, which becomes evident when comparing the results of recent studies (Čolić et al., 2024; Ćalasan, Dragičević, Dobrota, 2015; Ćalasan et al., 2016; Grigorova et al., 2020; Tasić et al., 2019; Umićević&Ljubić, 2015) with older studies (Golubović&Čolić, 2009; Junuzović-Žunić et al., 2007). One possible explanation is that the percentage of articulation disorders varies among authors due to different diagnostic standards. Additionally, the higher prevalence of articulation disorders in our

study may be attributed to the impact of the COVID-19 pandemic, which affected our participants during the peak period of speech and language development. During the pandemic, children had reduced interaction with peers and adults outside their homes. Durkin et al. (2020) emphasize that social interactions are crucial for speech and language development. Furthermore, the increased screen time (phones, tablets, computers) observed during the pandemic negatively impacted children's speech and language development (Madigan et al., 2019). Studies also highlight the negative effects of preschool closures and the lack of direct contact with speech therapists, leading to delays in identifying and treating speech disorders (McLeod &Searl, 2020). All of this could have contributed to the alarmingly high percentage of articulation disorders among preschool children observed in our study results.

The analysis of types of articulation disorders showed that substitutions are the most common type (53.97%), followed by distortions (46.03%), while omissions were recorded in the lowest percentage (9.52%). Regarding omissions, our results align with previous research findings, which also show omissions as the least represented type of articulation disorder among children of this age (Alić et al., 2015; Dodd, 2000; Golubović et al., 2019; OmayaAmr Rey et al., 2022). These results are expected, as omissions typically occur during the early developmental period of sounds and are considered a transient phase, particularly for sounds that require complex logomotor patterns for correct articulation (Dobrota, 2010). In terms of the relationship between substitutions and distortions, previous studies report findings that differ from ours. Specifically, our results showed that substitution is the most common type of articulation disorder among preschool children, while other studies report distortions as the most prevalent (Alić et al., 2015; Golubović et al., 2019; OmayaAmr Rey et al., 2022). This discrepancy may be explained by the fact that some children in our sample displayed simultaneous occurrences of omissions, substitutions, and distortions, or various combinations thereof, indicating the complexity of the articulation disorders present. Alić et al. (2015) note that in combinations of two types of articulation disorders, distortions and substitutions predominate.

Regarding the sounds that preschool children most often mispronounce, our results showed that these are the following sounds: Č, DŽ, R, Ž, and C. Other studies (Ćalasan et al., 2015;

Golubović&Čolić, 2010; Strand, 2020) also indicate that certain sounds from the group of affricates (C, Č, Ć, DŽ), fricatives (S, Z, Š, Ž), and the vibrant R are most commonly mispronounced, which is understandable given that these sounds also have the most challenging logomotor patterns. Furthermore, the literature reveals that preschool children often mispronounce sounds from the group of laterals (L and LJ) (Golubović&Čolić, 2010; Tasić et al., 2019), although the largest percentage of mispronounced sounds belongs to the groups of affricates and fricatives (Mihajlović et al., 2015; Petrović, 2009; Tasić et al., 2015). Strand (2020) notes that the vibrant R, as the only sound requiring tongue vibration, is often challenging for children and that incorrect pronunciation is usually due to reduced tongue mobility. In terms of the articulation of sounds by place of articulation, our results show that children most often mispronounce alveolar sounds (46%), which aligns with studies that point to the complexity of articulating these sounds (Murray et al., 2015). Dental and post-dental sounds were the next most frequently mispronounced in our sample, while children had the fewest difficulties with bilabial sounds, which is to be expected given their visible, simple, and unchallenging articulation (Gozdieska et al., 2017). These findings are important as they indicate the specificity of sounds from different speech groups, requiring particular attention during correction in speech therapy.

The primary aim of our study was to examine the role of oral praxis in sound development among preschool children, focusing on identifying the relationship between the inability to perform certain motor patterns and incorrect sound articulation. Our results showed a significant association between the inability to perform the "tongue-clicking" motor pattern on the oral praxis test and incorrect articulation of the sounds Š, Ž, DŽ, Ć, and C, as well as between the inability to perform the "tongue-trilling" motor pattern and the incorrect articulation of the sound R. In a study also investigating oral praxis in children with articulation disorders (Junuzović-Žunić et al., 2015), significant differences between participants with and without articulation disorders were found in three motor patterns: "horse's trot," "tongue-clicking," and "folding the front part of the tongue upward." Similar study showed that children with incorrect articulation were significantly less successful than their typically developing peers in performing the following tasks: "folding the front part of the tongue downward," "fan," "mouth fluttering," "tongue

fluttering," and "palatolingual groove" (Ječmenica et al., 2020). This study and others report different motor patterns that preschool children most often struggle to perform correctly, it is evident that these are the most challenging to perform and require a certain degree of oral praxis maturity. Čolić et al. (2024) point out that the relationship between the inability to perform certain motor patterns and incorrect articulation does not necessarily imply causation, and that immature oral praxis should not be considered the cause of observed articulation disorders, as it is not the only variable linked to correct articulation. Further research in this area should consider other factors that may negatively impact articulation development, such as immature phonemic hearing or orthodontic anomalies. Environmental factors, such as improper speech modeling or excessive screen exposure, should also not be overlooked.

CONCLUSION

The importance of oral praxis is particularly emphasized during the preschool years, a period of intensive speech development. Therefore, at this age, it is essential to assess oral praxis and, based on identified difficulties in this area, plan appropriate speech therapy intervention. This intervention may include various therapeutic methods focused on improving oral motor skills. Timely identification and intervention for oral praxis difficulties can have long-term positive effects on children's speech and language development.

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ЗНАЧАЈ ОРАЛНЕ ПРАКСИЈЕ У РАЗВОЈУ ГЛАСОВА КОД ДЈЕЦЕ ПРЕДШКОЛСКОГ УЗРАСТА

Резиме: *Под термином* артикулација *подразумијева се правилан изговор гласова матерњег језика. Продукција разумљивог говора захтијева фину координацију и прецизност покрета оралне мускулатуре. С обзиром на то да је ефикасна активност мишића орофацијалне регије кључна за правилну артикулацију, циљ овог рада био је утврђивање повезаности између немогућности извођења одређених моторних образаца и неправилног изговора гласова. Узорак је чинило 63 дјеце оба пола, узраста од 4 до 6 година. Од инструмената у истраживању коришћени су Тест оралне праксије и Глобални артикулациони тест. Истраживање је спроведено у дјечијем вртићу „Чика Јова Змај" у Фочи, током новембра 2023. године. Резултати истраживања показују да постоји значајна повезаност између немогућности извођења моторног обрасца „цокотања" и изговора гласа Ш (Cramér's V = 0.009), гласа Ж (Cramér's V = 0.049), гласа Џ (Cramér's V = 0.014), гласа Ћ (Cramér's V = 0.017) и гласа Ц (Cramér's V = 0.008), као и између немогућности извођења моторног обрасца треперења језика и неправилног изговора гласа Р (Cramér's V = 0.047). Такође је утврђено да забрињавајуће висок проценат (68,3%) дјеце предшколског узраста има поремећаје артикулације.*

Кључне ријечи: *артикулација, орална праксија, дјеца предшколског узраста.*