

Lambdacism, Rhotacism and Sigmatism in Preschool Children: Frequency and Distribution

Tatjana Georgievska-Jancheska*

Center for Rehabilitation of Hearing, Speech and Voice, Faculty of Medicine, University Ss. Cyril and Methodius of Skopje, Skopje, Republic of Macedonia

Abstract

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***Correspondence:** Tatjana Georgievska-Jancheska. Center for rehabilitation of hearing, speech and voice Skopje, Faculty of Medicine Skopje, University Ss. Cyril and Methodius of Skopje, Skopje, Republic of Macedonia. E-mail: tatjana_georgievska@yahoo.co.uk

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BACKGROUND: Speech sound appears first in the child's speech development and is the primary means of expression. Articulation disorders can hinder the comprehensibility of children's speech. The speech, in turn, can limit the child's inclusion in the social and educational environment.

AIM: To establish frequency and distribution of lambdacism, rhotacism and sigmatism or their combination in preschool children and the frequency and distribution of these articulation disorders among boys and girls.

MATERIAL AND METHODS: A retrospective analysis of data from preventive examination for early diagnosis of impairments of hearing, speech and sounds in preschool children has been carried out. In the selected sample, only the data for children diagnosed with lambdacism, rhotacism, sigmatism or their combination are analysed. The data is statistically examined, represented in tables and figures and analysed descriptively.

RESULTS: In the analysed sample, the greater presence of lambdacism was observed before rhotacism and sigmatism. Most commonly, these three types of articulation disorder appear alone, as isolated cases, instead of a combination of two out of the three impairments. They are more common in boys than in girls.

CONCLUSION: Timely diagnosis and rehabilitation of lambdacism, rhotacism and sigmatism or their combination in preschool children will enable easier and faster integration of the children in the social and educational environment without leaving lasting consequences.

Introduction

While most children are ready for verbal communication at preschool age, some lack speech and linguistic abilities equal to their peers [1]. Such abilities can limit the children's inclusion in the social and educational environment [2]. Due to this, speech and linguistic abilities play an important role in human society and are crucial for establishing verbal communication.

Speech is formed and developed as a need for realising the language system, while language forms and develops as a result of speech [3]. The basic elements of speech are the sound, word and sentence. The sound takes a primary position since it appears first in the child's speech development and is the primary means of expression. Children should be encouraged and trained for proper articulation of

sounds, which lays the foundation for speech.

Speech production is a complex motor skill where movements of organs involved in the articulation are precisely coordinated in time and space [4]. To produce a highly structured and limited flow of acoustic energy, over 50 muscles must quickly change the shape and position of the speech organs in the vocal tract [5]. Deviation or disturbed function of these organs can lead to impaired speech. Articulation disorders are difficulties with the way sounds are formed and strung together, usually characterised by substituting one sound for another, omitting a sound, or distorting a sound [6]. The speech is primarily unintelligible and difficult to understand. Various causes such as impaired hearing, orthodontic anomalies, auditory perception disorders and imitation, motor dyspraxia and lazy tongue can lead to late or impaired development of normal articulation.

Depending on which sound or group of sounds the child has difficulty with, the following types of articulation disorders can be differentiated: sigmatism (inability or difficulty in pronouncing the sounds: /S/, /Z/, /Sh/, /Zh/, /Ch/, /Dzh/, /C/, /Dz/, /Kj/, /Gj/), kapacism (inability or difficulty in pronouncing the sound /K/), gammacism (inability or difficulty in pronouncing the sound /G/), lambdacism (inability or difficulty in pronouncing the sounds /L/ and /Lj/), rhotacism (inability or difficulty in pronouncing the sound /R/ sound), tetacism (inability or difficulty in pronouncing the sound /T/ sound), deltacism (inability or difficulty in pronouncing the sound /D/), etacism (inability or difficulty in pronouncing the sound /E/) and tetism (replacement of sounds /S/, /C/, /Sh/, /Ch/, /Kj/ and /K/ with sound /T/ and replacement of sounds /Z/, /Zh/, /Dzh/ and /Gj/ with /D/).

A large number of sounds are similar in different languages, some even identical, but the words are not, so languages differ in words (among other things) and can be learnt. Still, the terms for articulation disorders of certain sounds or group of sounds are universal, i.e., internationalised. However, that does not necessarily mean that impairment of a certain sound in one language will be considered impairment in another. This is so because every language has its phonology. For example, rhotacism, i.e., the pronunciation of the French /R/ is not preferred in the Macedonian language, but it is the norm in the French language.

Some research shows that the most common types of articulation disorders include sigmatism, lambdacism and rhotacism, either alone or in combination [7], [8], i.e. the most common error sounds are [S] [L] and [R] [6].

Considering that speech development in children begins with the first word and ends between the ages of 6 and 8, [9] this research aims to examine the condition of articulation of sounds from the Macedonian language in preschool children. At the same time, the frequency and distribution of irregular articulation of sounds from the type of lambdacism, rhotacism and sigmatism, either alone or in combination, will be determined, as well as the frequency and distribution of the same among the males and females.

Material and Methods

To carry out the research, a retrospective analysis was performed of the data collected through previously conducted preventive examinations by a team of experts (a specialist doctor orthodontist and clinical speech therapist) from the Center for rehabilitation of hearing, speech and voice-Skopje. The data is based on the assessment of speech of

preschool children made by the team of experts during spontaneous speech and model speech. By model speech, test words and sentences are first examined where there is a common presence of a certain sound or sounds, which are suspected of their pathology and, naturally, of the isolated sound itself. In words, the sound is in different positions (initial, medial and final). The observation of the visible organs participating in articulation established the presence of visible deviations and quality of the oral system. The preventive examinations were conducted for each child individually during a period of 9 months (March 2018 – November 2018). Namely, examinations are carried out by the Center for rehabilitation of hearing, speech and voice-Skopje with the aim of early diagnosis of impairments in the development of hearing, speech and voice in children aged 4 to 6.

For the research, a random sample of data (n = 738) was selected from the data obtained through the preventive examinations which the Center for rehabilitation of hearing, speech and voice-Skopje has at its disposal. The sample consisted equally of data from males (n = 369) and females (m = 369). The children are with normal intellectual development, without mental retardation or impaired hearing. The data comes from five preschools in five municipalities on the territory of the city of Skopje, Republic of Macedonia. The data from the selected sample was analysed in detail only for children diagnosed with lambdacism, sigmatism and rhotacism or their combination (n = 289).

By means of a descriptive method, the following parameters were analyzed: age, gender, type of articulation disorder, i.e., deviation in the pronunciation of sounds in the Macedonian language /R/, /L/ and /Lj/, /S/, /Z/, /Sh/, /Zh/, /Ch/, /Dzh/, /C/, /Dz/, /Kj/, /Gj/.

Statistical analysis

The obtained data are statistically examined, represented in tables and graphs and analysed descriptively. The categorical (attributive) variables are represented with absolute and relative numbers. The numerical (quantitative) variables are represented with the mean, minimum values, maximum values and standard deviation.

The statistical analysis of the data obtained through the research was done in the programs Statistica for Windows 7.0 and SPSS 17.0. To compare the analysed variables between the male and female respondents, non-parametric (Pearson Chi-square test) and parametric tests (Student's t-test) were used. The statistical significance was defined at level $p < 0.05$.

Results

With the aim of obtaining a clearer picture for the research, the results of the analysed data are divided into two groups: results of the total sample ($n = 738$) and results of the sample with articulation disorders ($n = 289$).

Total sample

To meet the purposes of our research out of the total set of data, children with lambdacism, rhotacism or sigmatism were first identified; these, appearing either alone, i.e., isolated as one articulation disorder or a combination of two out of the three (sigmatism – rhotacism, rhotacism – lambdacism or sigmatism – lambdacism). Out of the analyzed sample ($n = 738$), 39% of the children ($n = 289$) were with the abovementioned disorders, where more common was the presence of an isolated articulation disorder, 29% ($n = 211$), than a combination of two out of the three, 10% ($n = 78$) (Figure 1).

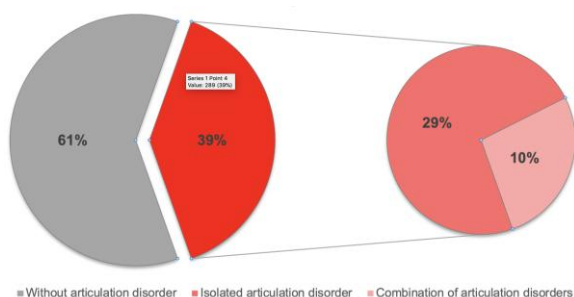


Figure 1: Distribution of articulation disorders and the form in which they appear

According to the type of articulation disorder about the total analysed sample, the most common is lambdacism with 18.2% ($n = 134$). The combination of rhotacism and lambdacism is present in 7.6% ($n = 56$) of the children, while 6.6% ($n = 49$) have rhotacism only. Sigmatism as an articulation disorder is present in 3.8% ($n=28$), while the combination of sigmatism and lambdacism in 2.6% ($n = 19$). The least common combination is sigmatism and rhotacism, only present in 0.4% of the children ($n = 3$) (Figure 2).

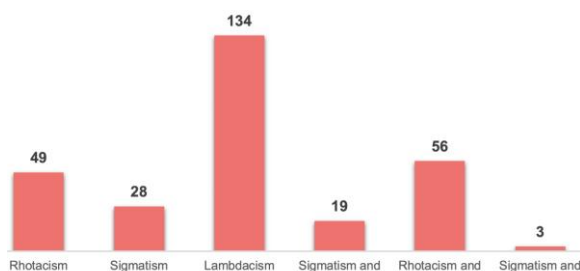


Figure 2: Frequency of the articulation disorders according to the type

For the purposes of cumulative representation of the articulation disorders, when the isolated types of articulation disorder (lambdacism; rhotacism; sigmatism) are supplemented with the data from the respective combinations (sigmatism – rhotacism; rhotacism – lambdacism; sigmatism – lambdacism) where the isolated type of articulation disorder is included, again the most common is lambdacism, followed by rhotacism and sigmatism. More precisely, if the data on rhotacism – lambdacism and sigmatism – lambdacism is added to the data for lambdacism, then the occurrence of lambdacism is 28.4%. Moreover, if the data on sigmatism – rhotacism and rhotacism – lambdacism is added to the data for rhotacism, then the occurrence of rhotacism is 14.6%. Finally, if the data on sigmatism – rhotacism and sigmatism – lambdacism is added to the data for sigmatism, then the occurrence of sigmatism is 6.8%.

About the children's gender, out of the total analysed sample, 43% of the boys had one articulation disorder (lambdacism; rhotacism; sigmatism; sigmatism – rhotacism; rhotacism – lambdacism; sigmatism – lambdacism) and 35% of the girls. The difference in the distribution of children with or without an articulation disorder between the males and females was confirmed as statistically significant ($p=0.019$) (Table 1).

Table 1: Frequency of lambdacism, rhotacism, sigmatism, sigmatism – rhotacism, rhotacism – lambdacism or sigmatism – lambdacism according to the gender

Articulation disorders	Male		Female		p-value
	n	(%)	n	(%)	
With	160	(43)	129	(35)	p = 0.019
Without	209	(57)	240	(65)	

p (Pearson Chi-square test)

Only the data for respondents where articulation disorder is established is taken into consideration for further analysis.

Respondents with an articulation disorder

The respondents ($n = 289$) where presence of one articulation disorder was established (lambdacism; rhotacism; sigmatism; sigmatism – rhotacism; rhotacism – lambdacism; sigmatism – lambdacism) were of a mean age of 5.39 ± 0.64 years, where the youngest respondent was 4, while the oldest 6. 55% were males, while 45% were females. The mean age of the males was 5.44 ± 0.61 years, while the females 5.33 ± 0.67 . The difference was statistically proven as not significant ($p = 0.15$).

Among the males, articulation disorders more commonly appear alone (68%) than in combination (32%). Among the females, this difference is even more highlighted, i.e., the articulation disorders appear more alone (79%) than in the combination of two out of the three (21%).

Lambdacism as an articulation disorder appears more alone (64%) than in combination with

rhotacism or sigmatism (36%). The distribution of respondents according to gender and about lambdacism (either alone or in combination with rhotacism or sigmatism) reveals that this condition is more noticeable in the males (60.8%) than the females (39.2%) (Table 2).

Table 2: Distribution of respondents with lambdacism (either alone or in combination with rhotacism or sigmatism)

Gender	Lambdacism		Rhotacism - Lambdacism		- Sigmatism - Lambdacism		- Total	
	n	%	n	%	n	%	n	%
Male	77	57.5	35	62.5	15	78.9	127	60.8
Female	57	42.5	21	37.5	4	21.1	82	39.2
Total	134	100	56	100	19	100	209	100

Rhotacism as an articulation disorder appears more often in combination with lambdacism or sigmatism (55%) than alone (45%). The distribution of respondents according to gender and about rhotacism (either alone or in combination with lambdacism or sigmatism) reveals that this condition is equally present in the males and females (Table 3).

Table 3: Distribution of respondents with rhotacism (either alone or in combination with lambdacism or sigmatism)

Gender	Rhotacism		Sigmatism - Rhotacism		Rhotacism - Lambdacism		Total	
	n	%	n	%	n	%	n	%
Male	18	36.7	1	33.3	35	62.5	54	50.0
Female	31	63.3	2	66.7	21	37.5	54	50.0
Total	49	100	3	100	56	100	108	100

Sigmatism as an articulation disorder appears more often alone (56%) than in combination with lambdacism or rhotacism (44%). The distribution of respondents according to gender and about sigmatism (either alone or in combination with lambdacism or rhotacism) reveals that this condition is more noticeable in the males (60%) than the females (40%) (Table 4).

Table 4: Distribution of respondents with sigmatism (either alone or in combination with lambdacism or rhotacism)

Gender	Sigmatism		Sigmatism - Lambdacism		Sigmatism - Rhotacism		Total	
	n	%	n	%	n	%	n	%
Male	14	50.0%	15	78.9%	1	33.3%	30	60.0%
Female	14	50.0%	4	21.1%	2	66.7%	20	40.0%
Total	28	100%	19	100%	3	100%	50	100%

Discussion

Vast research on articulation disorders, i.e., the appearance of lambdacism, rhotacism and sigmatism, either alone or in combination, has been carried out by some authors. Each of them has their approach towards research, analysis and presentation of results. When comparing results for articulation disorders, what is important is the fact that every language has its phonology of sounds, which means that what is considered an articulation disorder of a

certain sound in one language does not necessarily mean a disorder in another. For these reasons, the possibility of making a partial or complete comparison of the obtained results from our research with other similar studies where the same methods and size of the examined sample were used is limited. However, a limited comparison for certain results was still possible. The results of our research are consistent with some other research, though different at times.

In our research, atypical articulation (lambdacism; rhotacism; sigmatism; sigmatism – rhotacism; rhotacism – lambdacism; sigmatism – lambdacism) was established in 39% of the children from the total analysed sample (n = 738). Stanković-Milićević et al., [10] established atypical articulation in 31.96% of the examined children in research conducted on a sample of 316 respondents, all aged 5. The most common type of atypical articulation in their research was lambdacism; then followed by rhotacism and sigmatism, while the least common were tetacism and deltacism. These results also overlap with our research with the only difference that Stanković-Milićević et al., included atypical articulation tetacism and deltacism as well.

According to our research results for the total examined sample (n = 738) and in relation to the frequency of occurrence of a certain articulation disorder, either alone or in combination, most of the children had lambdacism (28.4%), then rhotacism (14.6%), and the least number of children had sigmatism (6.8%). Junuzović-Žunić and Ibrahimagić [11] researched with 1.600 respondents who speak Bosnian/Croatian/Serbian language, aged 3 to 7, and from both genders. According to their research, sigmatism as an independent disorder, but in combination with lambdacism or rhotacism as well, is the most widespread disorder with a frequency of 17.6% compared to the other articulation disorders. In a sample of 76 children studied by Filić, Kolundžić and Vidović [7], most of the children had sigmatism, lambdacism and rhotacism. Farago et al., [8] suggest that the most common articulation disorders are sigmatism, rhotacism and lambdacism. Jurišić [12], on the other hand, researched phonological-articulation disorders of 31 children, who speak two languages and are aged 6 to 11. Her research revealed that sigmatism and rhotacism were the two most common disorders in the examined sample. Sigmatism is present in 19.35% of the respondents, and if the combined disorders are added to it, then sigmatism is present in 26% of the respondents. Rhotacism is present in 12.9% of the respondents, that is, 16% of the respondents when the rhotacism is supplemented with the combined articulation disorders. According to Filipova, Levenska and Ikadinović-Talevska [9], who studied a sample of 324 respondents, the most common in the speech of preschool children from the municipality of Negotino (Republic of Macedonia) is the articulation disorders. Their results show that the most present are lambdacism, then combined

articulation problems, i.e., speech problems with more sounds. Apart from the research of Filipova, Levenska and Ikadinović-Talevska, the key difference with the other studies is that while in our research the most common articulation disorder is lamdacism that is not the case in the others.

According to our research results and about the total examined sample ($n = 738$), the articulation disorders, lamdacism, rhotacism and sigmatism, more commonly appear alone as isolated articulation disorders than in the combination of two out of the three disorders. The research of Junuzović-Žunić, Banović and Bratovčić [13] conducted on a smaller sample of respondents compared to our research found that respondents, aged 4 to 6, most often had an articulation disorder from a combined type (sigmatism – rhotacism; sigmatism – lamdacism; sigmatism – lamdacism – rhotacism) with a frequency of 34.4%. Alić, Radić and Kantić [14], who analysed a sample of 150 respondents, aged 3-10, have established a different type of articulation disorders. Most of the respondents in their research had a combination of articulation disorders (32.67%). The respondents diagnosed with only one articulation disorder often had sigmatism, lamdacism and rhotacism. These results differ from the results of our research, where more common was the occurrence of isolated articulation disorders with 29% than in combination 10%.

Our research results in relation to the total examined sample ($n = 738$) show that the occurrence of one articulation disorder, either alone or in combination, (lamdacism; rhotacism; sigmatism; sigmatism – rhotacism; rhotacism – lamdacism; sigmatism – lamdacism) is more common between boys (43%) than between girls (35%). According to Vila and Opsenica [15], most studies suggest that delay in speech development; articulation disorders and similar conditions occur more often in males than females. This is consistent with the results of our research, but not with those of Stanković-Miličević et al., [10], who established that the frequency was higher among the girls, totalling at 35%, while 28.84% among the boys.

It is worth pointing out that future research should include a larger number of respondents so that the results obtained can have greater relevance. Then, the frequency of certain types of articulation disorder should be investigated and analysed about the respondents' age, and if and how the respondents' place of residence (urban or rural area) affects articulation disorders.

The results of our and similar research greatly benefit clinical practice. They influence the awareness of the importance of timely diagnosis and rehabilitation of lamdacism, rhotacism, sigmatism or other types of articulation disorder in preschool children, which finally will enable easier and faster integration of the children in the social and

educational environment without leaving lasting consequences.

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