

The Influence of Oral Motor Disorders on the Quality of Articulation in Children Aged 5 to 7 Years. Preliminary Research Reports

Monika Łuszczuk*

Department of Logopedics and Applied Linguistics Maria Curie-Skłodowska University (UMCS), Poland

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ABSTRACT

This paper presents the preliminary results of studies which are part of a larger project to determine the scope of influence of biological factors on speech development. The studies presented herein concern the correlation between the quality of oral motricity and articulation. The presented studies confirm that there is a relationship between the occurrence of motor disorders and abnormal articulation, particularly distorted realizations. Furthermore, it was demonstrated that complex motor disorders are a higher risk factor for articulation problems to occur than simple motor disorders.

Introduction:

The article presents research results concerning the correlation between articulation and motor skills. Articulation is a coordinated function that consists in time-dependent alterations of the shape, position and relations between individual articulatory organs, which takes place during pronunciation of sounds. In the course odontogenic development, the development of motor skills of the articulators is parallel to speech development [1-3]; it is also integrated with physiological processes because the humans, not having a separate speech organ, adjusted the existing system for the purpose: the oral cavity – a part of the alimentary system, as well as the respiratory system [1,4-11]. The orofacial complex is the area in which, apart from articulation, other, more primal physiological functions are therefore realized: primary functions as the motor matrix for articulation, which is a secondary function [9,12]. The evolution of the speech function and primary functions is parallel to the development of the central nervous system, stimulated by the gradual anatomical development and by external stimuli [4,6]. Speech development is an unusual accumulation and interaction of different factors, which produce a new quality rather than a simple sum of these factors [13-16].

The article presents preliminary results of studies, which are part of a larger project whose objective is to define biological determinants of speech development in children. The results presented below thus refer only to some factors that influence speech development. The study focused on assessing the realization of the following phonemes: /r/, /ʃ, ʒ, č, ʒ/, /s, z, c, ʒ/, /ś, ź, ć, ź/, /t, d, n/ and /l/ as well as on biological motor factors. The ways of

Correspondence:

Monika Łuszczuk,
Department of Logopedics and
Applied Linguistics Maria Curie-
Skłodowska University (UMCS),
Poland, Email:
monika.luszczuk@poczta.umcs.lublin.pl

realization of the other phonemes were not taken into account in the presented results.

Materials and Methods

122 children who went to a standard public kindergarten in the city took part in the studies. None of the children had any prior record of logopedic treatment; none was certified as disabled, or was given a testimonial from a psychological-pedagogical counseling center indicating the need to additionally support the child's education. Information on the subject was obtained from parents and teachers; in cases of doubt the children were not qualified to participate in the study. The goal of this procedure was to select a uniform group in terms of development abilities and the rate of speech acquisition. In accordance with the adopted procedure for selecting the study group, it should be assumed that the intellectual development of the qualified children was normal in terms of their age range. The youngest subject was 5 years 3 months old, the oldest – 6 years and 9 months. The sex of the patients was irrelevant for the study.

This article presents the results of the study on the correlation between articulatory and motor skills. The assessment of motor skills focused on the execution of primary functions (breathing, swallowing) and the performance of selected articulators (lips, tongue, mandible, and palate). The assessment of articulation skills was carried out in accordance with the principles of logopedic diagnosis. A preliminary, approximate assessment of articulation was conducted during the child's free utterances. A detailed assessment of articulation was conducted using the Karta articulation research (Articulation Evaluation Form) [1], containing appropriately selected sets of pictures, whose names enabled investigating the articulation of the foregoing consonants in each of the three sound positions in a word and in specific phonetic neighborhood. Both the set of sounds and the manner of their realization (substitution, distortion) [14-15,17] was defined. A patient's articulation was assessed in auditory and visual terms. I assume that a substitution is a sound (here consonant) that is substituted for by another realization but

characteristic of a given language; in general, substitutions differ from substituted-for sounds by a small number of features; differences usually refer to the place of articulation, less often to the degree of closeness of speech organs. A distortion should be understood as a realization in which a standard realization is replaced by a non-standard realization, a distorted form of a sound, a consonant untypical of a given phonetic system, outside of the field of realization of other phonemes.

Determination of a patient's respiratory pattern was based on observation of his/her behavior and appearance; direct sensory assessment and a double-sided mirror test were also taken into account. Swallowing was assessed during the execution of this function by observing the working of the lips, and the masseteric and laryngeal muscles; the investigation was also complemented with the palpation of the masseteric muscles and position of the larynx. [18]. The performance of the articulators was assessed during the realization of the speech function; the work of the lips, tongue and mandible was directly assessed by sight while the work of the soft palate was assessed indirectly, by evaluating nasal resonance through hearing. When assessing the skills of the tongue, its position at rest observed during free breathing was also taken into consideration.

Results & Discussion

Correct articulation was reported in 45 children in the study group, which accounts for 37.70% of the total number. Nonstandard realizations were recorded in 76 children, i.e. 62.29%, and motor disorders in 35 children, or 28.68%.

It was found that abnormal realizations affected first of all the /r/ phoneme and dentalized phonemes. Altogether, 44 non-standard realizations of the /r/ phoneme and 45 non-standard realizations of the /š, ž, č, ʒ/ phonemes, 30 non standard realizations of the /s, z, c, ʒ/, phonemes, 15 nonstandard realizations of the /ś, ź, ć, ʒ/ phonemes, 6 nonstandard realizations of the /t, d, n/ phonemes, and 5 nonstandard realizations of the /l/ phoneme were observed (Table 1).

Table 1: The breakdown of non-standard realizations of particular phoneme groups by age.

	/r/	/š, ž, č, ž/	/s, z, c, ž/	/š, ž, č, ž/	/t, d, n/	/l/
6-7 year-olds	13	9	6	3	0	1
5-6 year-olds	31	36	24	12	6	4
Total	44	45	30	15	6	5

Table 2: The breakdown of non-standard realizations of phoneme groups by distortion and substitution realizations.

	Substitutions	Distortions	Total
/r/	37	7	44
/š, ž, č, ž/	32	13	45
/s, z, c, ž/	5	25	30
/š, ž, č, ž/	5	10	15
/t, d, n/	0	6	6
/l/	1	4	5

Table 3: The breakdown of the observed motor disorders.

	Swallowing	Breathing	Tongue motor skills	Lips motor skills	Motricity of the soft palate	Mandibular motricity
6-7 year-olds	1	4	8	1	1	0
5-6 year-olds	8	10	9	5	0	3
Total	9	14	17	6	1	3

Table 4: The breakdown of the number of children in the context of the number of motor disorders.

	Complex motor disorder	Simple motor disorder	Total
6-7 year-olds	6	5	11
5-6 year-olds	18	6	24
Total	24	11	35

Table 5: The breakdown of the observed abnormalities in particular age groups

	6-7 year-olds	5-6 year-olds	Total
distortions only	3	7	10
substitutions only	11	20	31
distortions+substitutions	0	3	3
simple motor disorder	3	0	3
distortions+ simple motor disorder	1	2	3
substitutions+ simple motor disorder	0	2	2
distortions+substitutions + simple motor disorders	1	2	3
complex motor disorder	0	0	0
distortions+ complex motor disorder	2	8	10
substitutions+ complex motor disorder	1	3	4
distortions+substitutions + complex motor disorders	3	7	10

Table 6: The breakdown of figures illustrating standard/nonstandard realizations, including the type of realization and co-occurrence/absence of motor disorders.

	simple motor disorder	complex motor disorder	without motor disorders
distortions	3	10	10
substitutions	2	4	31
distortions +substitutions	3	10	3
correct articulation	3	0	43

More nonstandard realizations (abnormalities) were reported in the group of younger children (5-6 years old) than in the group of older children (6-7 years old). Detailed figures showing the distribution of realizations of particular phonemic groups, including the division into the age groups, are presented in the table below (Table 1). Table 2 (Table 2) shows the breakdown of the observed non-standard realizations of the studied phoneme groups, divided into substitutions and distortions. The largest number of non-standard realizations was found in the group of phonemes whose realizations are the last to appear in speech development: /r/ (44) and the phonemes /š, ž, č, ž/ (45), with substitution realizations prevailing in both cases: (37) and (32) respectively. Most distortion realizations were found in the phoneme group of /s, z, c, ʒ/ (25), this being the main type of realization in the group. Among the dentalized phonemes, the fewest nonstandard realizations were found in the phonemic group of /ś, ź, ć, ź/. Non-standard realizations of /t,d,n/ and /l/ phonemes were found less often, with only distortion realizations being reported in the /t,d,n/ group. A graphic representation of the data is illustrated in the charts below (Chart 1 and 2). The detailed figures presenting the distribution of realizations of particular phoneme groups by substitution and distortion realizations are shown in the table below (Table 2).

Most distortion realizations (25) were found in the phoneme group of /s, z, c, ʒ/, which accounts for 38.46% of all distortion realizations; fewer (13) were reported in the phoneme group of /š, ž, č, ž/ (20%) and then (10) in the phoneme group of /ś, ź, ć, ź/ (15.38%). To sum up: distortion realizations are mostly found in dentalized phonemes (73.84%). This data is illustrated in the charts below (Charts 1 and 2), (Table 2).

Most substitution realizations (37) were found in the realization of the /r/ phoneme, which accounts for 46.25% of all distortion realizations; fewer realizations (32) were found in the phoneme group /š, ž, č, ž/ (40%). Substitution realizations of all the other phonemes investigated account for 13.75%. This data is

represented in the charts below (Chart 1 and 2), (Table 2).

Substitutions prevail in the realizations of the /r/ phoneme and in the realizations of the /š, ž, č, ž/ phonemes. In contrast, distortions prevail in the realizations of the /s, z, c, ʒ/ and /l/ phonemes. Only distortions were found in the realizations of the phoneme group /t,d,n/. The data is illustrated in the charts below (Chart 1 and 2), (Table 2).

The table below (Table 3) contains the breakdown of the observed motor disorders. The abnormal motor skills of the tongue were the most frequently found disorder (17 cases). In 14 children, respiratory pattern disorders were observed and swallowing disorders in 9. Abnormalities of lips motor skills were recorded 6 times and abnormalities in the work of the mandible – 3 times. The incorrect motricity of the soft palate was found only in one case. These figures are illustrated in Chart 3 below. In general, motor disorders were found more often in the group of younger than in the group of older children (Chart 3), (Table 3).

The motor disorders investigated in the study were found in a total of 35 children, i.e. 28.68% of all the studied children. Complex disorders (disorders in the realization of the swallowing and/or breathing functions, and /or the abnormal motor skills of more than one articulator) were found more frequently (68.57%) than simple disorders in the performance of one of the articulators (the lips, tongue, palate or mandible). Motor disorders were also reported more often (65.71%) in the group of younger children than in the group of older children. This data is also presented in the table below (Table 4).

Among the children in whom nonstandard realizations were reported, by far the most frequent cases (31) were those of patients with isolated articulatory abnormalities of the substitution type. Realizations of exclusively the substitution type were found in 6 children, 2 cases being simple motor disorders, and 4 cases of complex motor disorders. Realizations of exclusively the distortion type, accompanied by motor disorders, were found in 13 children, 3 cases being simple motor disorders, and 10 complex motor disorders. In 13 children, concurrent

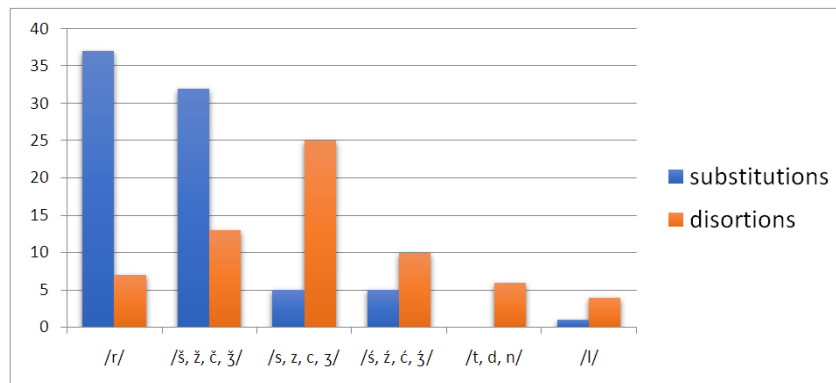


Chart 1: Comparison of nonstandard realizations of phoneme groups per distortion and substitution realizations.

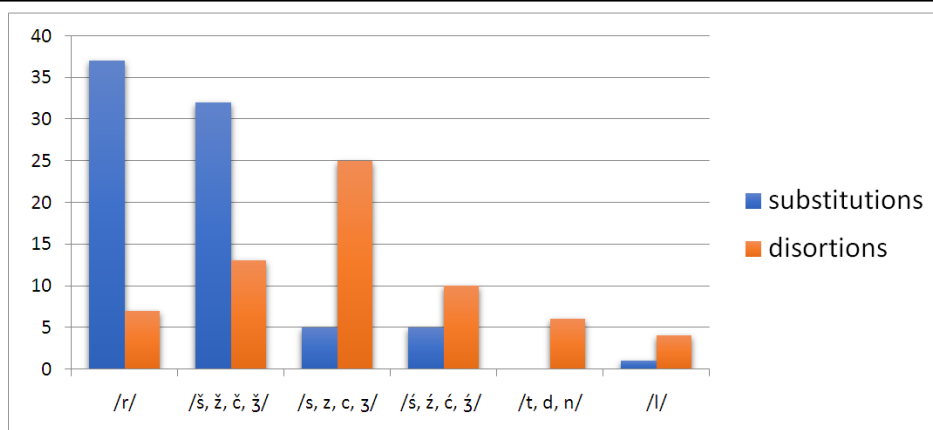


Chart 2: Comparison of nonstandard realizations of phoneme groups per distortion and substitution realizations.

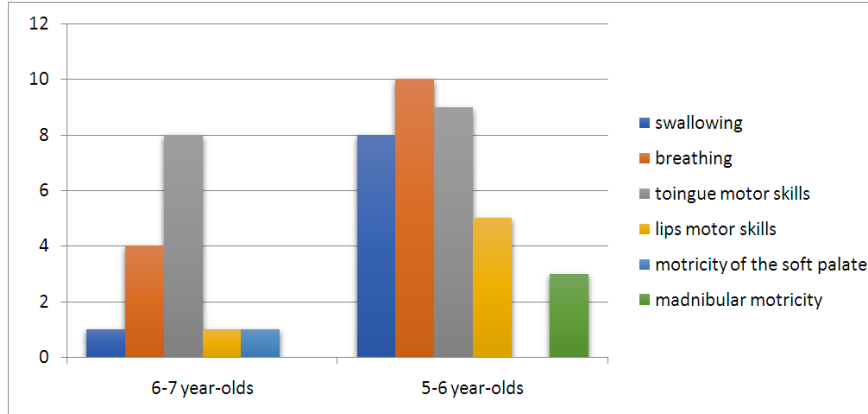


Chart 3: Comparison of the observed motor disorders distributed into age groups.

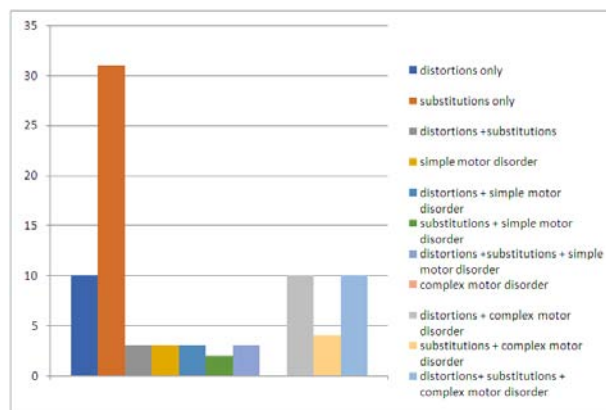


Chart 4: Comparison of the observed abnormalities

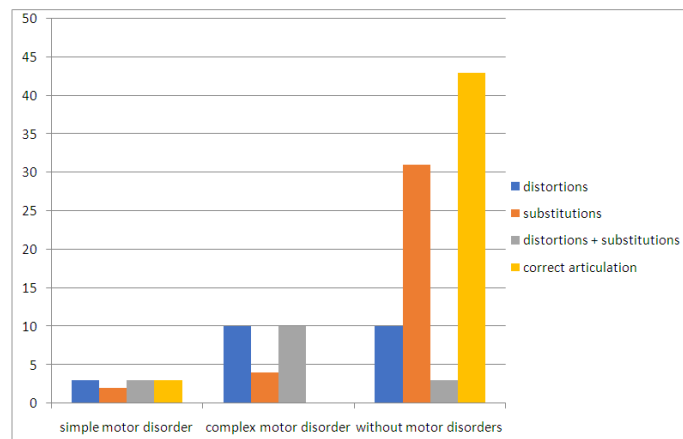


Chart 5: Comparison of data illustrating standard/nonstandard realizations, including the type of realization and co-occurrence/absence of motor disorders.

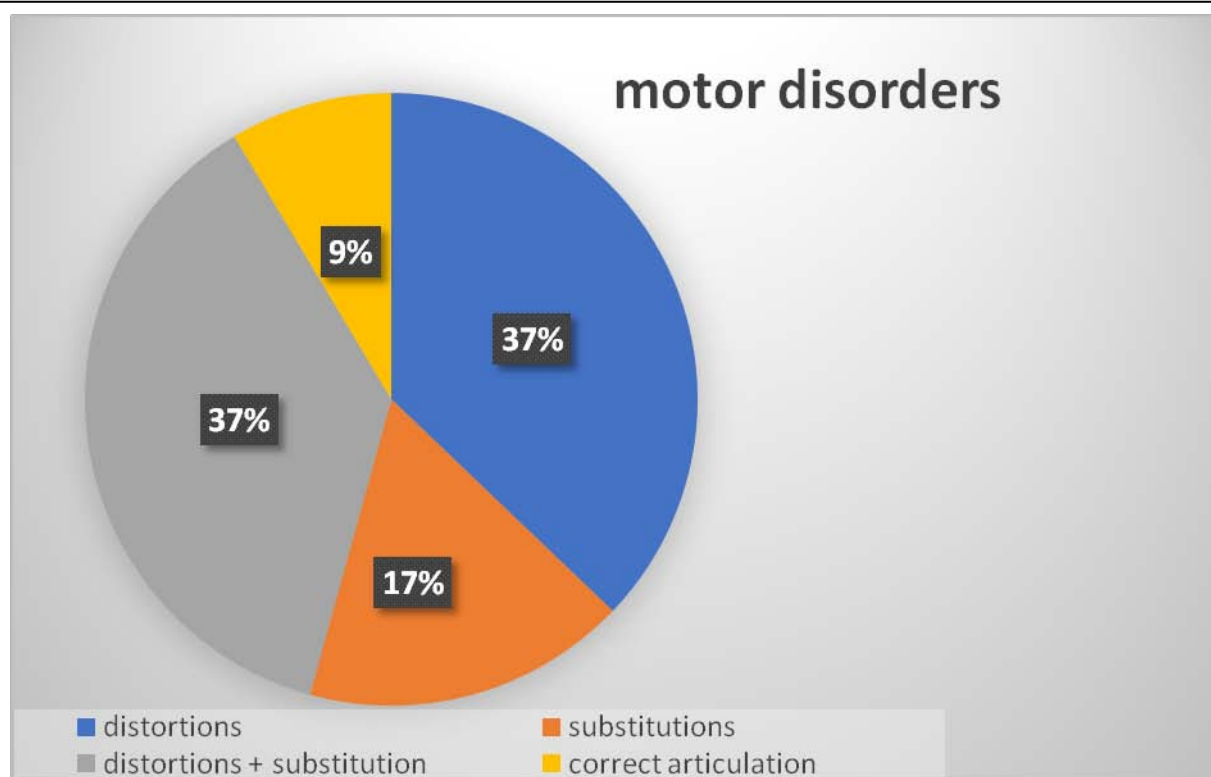


Chart 6: Comparison of data illustrating standard/nonstandard realizations, including the type of realizations co-occurrent with motor disorders.

realizations of the distortion and substitution types were found, accompanied by motor disorders, simple motor disorders being reported in 3 cases, and complex motor disorders in 10 cases. In 10 children, realizations of exclusively the distortion type (without accompanying motor disorders) were found, and in 3 children, concurrent distortions and substitutions (without accompanying motor disorders) were reported. Only a simple motor disorder was found in 3 children. No cases

of complex motor disorders without accompanying articulation disorders were reported. This data, illustrated in the chart below (Chart 4), is also presented in the appended table (Table 5).

When comparing the group of patients with motor disorders and without them, it can be observed that in the group of patients without motor disorders the correct articulation of the studied phonemes occurred far more often than in patients with motor disorders (Chart 5). In

the group of patients without motor disorders, the correct articulation of the studied consonants was observed in 23% of cases whereas in patients with motor disorders correct articulation was reported in 3% of the subjects. In the patients with motor disorders the number of recorded articulation disorders was larger than in patients without motor disorders. By examining particular categories, it can be said that the occurrence of realizations of exclusively the distortion type was observed significantly more often in the patient group with motor disorders than without them: 40% in the patient group with motor disorders and 18% in the patient group without motor disorders, respectively. An even greater difference can be noticed in the group of patients, in whom realizations of the distortion and substitution types were found to occur at the same time; they were observed in 39% of patients with motor disorders and in 5% of those without motor disorders. In contrast, in the group of children without motor disorders, more substitution realizations (54%) were observed than in the group of children with motor disorders (18%).

The breakdown of figures is presented in the table below (Table 6). They were presented in graphic form in charts (Compare Chart 6 and 7).

Conclusion

1. There is a relationship between the occurrence of motor disorders and reduced articulation skills. In children with motor disorders, a larger group, percentage-wise, of non-standard realizations was reported than in children without observable accompanying motor disorders.
2. This correlation is stronger in the case of complex motor disorders than with simple motor disorders, which means that complex motor disorders can be a higher risk factor for articulation problems to occur than simple motor disorders.
3. The correlation between the occurrence of motor disorders and articulation performance applies to children in whom realizations of exclusively the distortion type were found, or to children with distortions and substitutions co-occurring at the same time. In contrast, no relationship between the occurrence of motor disorders and realizations of exclusively the substitution type was found, which may indicate that the causes of substitution are to be sought outside of motor causes.
4. The number of motor and articulation disorders is higher in younger children.

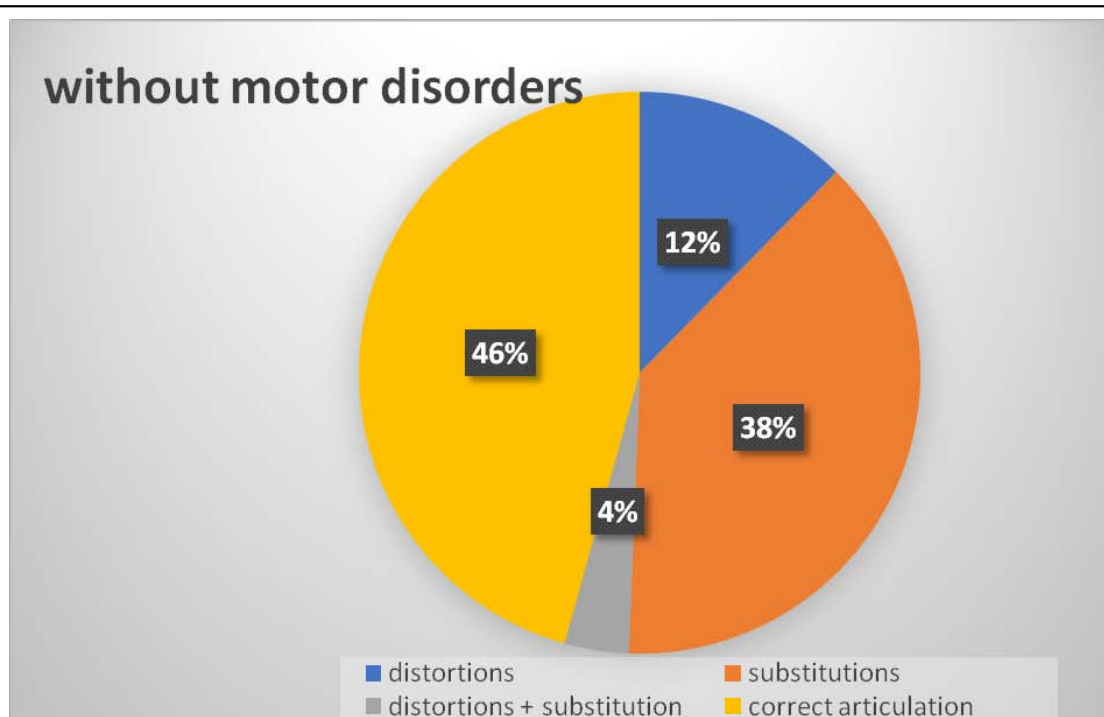


Chart 7: Comparison of data illustrating standard/nonstandard realizations, the type of realizations without accompanying motor disorders.

5. In the presented studies all children were at least five years old, the completed development of articulation having been reported in 46 children, which accounts for 37.70% of all the subjects. This fact should perhaps be considered during the recurrent discussions among speech therapists about the age norm for the complete development of speech [14-17,19].

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