

MONIKA ŁUSZCZUK

Maria Curie-Skłodowska University in Lublin
Department of Logopedics and Applied Linguistics

ORCID ID: <https://orcid.org/0000-0001-6555-3317>

Research Report: The influence of myofunctional and occlusal disorders on articulation in children aged 5 to 7

ABSTRACT

This paper presents the results of studies to determine the influence of biological factors on speech development. The studies conducted among children aged 5 to 7 concern the correlation between the myofunctional and occlusal disorders and articulation. The presented studies confirm that there is a relationship between the occurrence of myofunctional and occlusal disorders and abnormal articulation, particularly its distorted realizations. This correlation is the strongest in complex oral (orofacial) motor disorders. Moreover, it is demonstrated that in the majority of children with malocclusion abnormal articulation can be observed.

Key words: articulation, speech development, malfunction, malocclusion

INTRODUCTION

This paper presents the results of studies on children ages 5–7. The studies focused on assessing the realization of selected phonemes and selected biological factors: myofunctional (occlusion) and oral motor ones (breathing, swallowing, and motor efficiency of selected articulatory organs). The goal of the studies underlying the present paper is therefore to show a correlation between the quality of articulation and the quality of myofunctional and occlusal conditions.

Speech development is determined by other functions that are realized in the same area because, without having a separate organ for the speaking function, humans have adapted the existing structures for the purpose: the oral cavity (mouth)

– a part of the alimentary system, and the respiratory system (Demel, 1998; Juzwa and Pawlowski, 1981; Mackiewicz, 2001; Łada, 2012; Pluta-Wojciechowska, 2012; Wędrychowska-Szulc, 2008). The orofacial complex¹ is the area in which, in addition to articulation (a secondary function), other functions are also realized, i.e. primary functions², which are an oral motor matrix for articulation (Pluta-Wojciechowska, 2013). The regular muscle tone during the realization of these functions and normal tongue position determine the maintenance of functional balance in this area and its normal growth (Dominik, 1999; Juzwa and Pawlowski, 1981, Pisulska-Otremba, 1995).

Changes in the tone and the abnormal work of muscles produce other, disordered articulatory motor patterns (Kawala, Babijczuk, Czekańska, 2003; Konopska, 2001, Konopska, 2007, Mackiewicz, 1992; Mackiewicz, 2001; Nurzyńska-Januszko, 1990; Pluta-Wojciechowska, 2013; Pluta-Wojciechowska, 2009), and they mold hard tissues in a different, irregular way, which may contribute to the rise of anatomical abnormalities (Bielawska, 1998; Dera, Bojda 2007; Kahl-Nieke, 1999; Kierkowska-Wasilewska, 1984; Konopska, 2007; Kus-trzycka, Jaworska, 1997; Łabiszewska-Jaruzelska, 1995; Pluta-Wojciechowska, 2009, Raftowicz-Wójcik, Matthews-Brzozowska, 2005; Raftowicz-Wójcik, Matthews-Brzozowska 2006; Styczek, 1981; Śmiech-Słomkowska, 1994).

L. Konopska stresses that “each of element of the oral-maxillofacial complex dynamically molds the environment of the masticatory organ and peripheral speech apparatus” (Konopska, 200), whiel D. Pluta-Wojciechowska adds that “the outcome of speech development both in healthy and ill children is an unusual accumulation and combination of diverse factors”, which “produce a new quality but are not a mere sum total of these factors” (Pluta-Wojciechowska, 2012).³

¹ The orofacial complex (orofacial system, orofacial space) is, in a broad sense, “a set of tissues and organs of the oral cavity and of the facial area and throat (together with the coordination centers of the central nervous system) which mutually cooperate to a different degree and extent during different functions such as taking food and drinking, breathing, and facial expressions, maintaining the position of the head, orofacial self-plays, articulation and others associated with this area” (Pluta-Wojciechowska, 2013, 307).

² Primary functions are physiological functions realized in the area of the orofacial complex, “in particular, breathing and taking food and drinking, which develop based on primary oral motor skills, but also nonverbal functions of the orofacial complex, related to the former to a different extent, such as for example orofacial sensory functions, the way of positioning the head while lying, physiological functions like yawning, coughing, etc., self-examination, self-experimenting and orofacial self-plays, which form, with the nervous system, the motor basis of speech in the prenatal and postnatal period” (Pluta-Wojciechowska, 2013, 307).

³ The development of the function of speaking and primary functions takes place with the development of the central nervous system and progressive anatomical changes modified also by external factors (Bielawska-Victorini H et al., 2008; Karłowska, 2008; Mackiewicz, 2001; Pluta-Wojciechowska, 2010; Proffit et al., 2001). The impact of the central nervous system on the devel-

RESEARCH

The study was participated in by 132 children aged 5 to 7, going to standard public kindergartens in a large city. None of the children, subjects of the study, had distinct features of acquired or congenital abnormalities of organ structures (e.g. cleft lip or palate, LFS, post-traumatic deformities, and others), none of them was certified as disabled, or certified by a psychological-pedagogical outpatient clinic as needing additional support in education. None of the children had also used logopedic help earlier. Information on the subject was obtained in the preliminary interview as well as from parents and/or teachers; in doubtful cases, the child was disqualified from participation in the study. According to the adopted procedures it should be assumed that the children qualified for the study had similar capabilities of developing speech and were within the intellectual development norm appropriate for their age range. The sex of the subjects was not a significant factor in the study.

The study focused on assessing the realization of the phonemes: [r], [š], [ž], [č], [ž], [s], [z], [c], [z], [š], [ž], [č], [ž], [t], [d], [n] and [l]. The patient's articulation was assessed in an auditory and visual way in accordance with the principles of logopedic diagnosis. A preliminary, approximate assessment of articulation was conducted during a child's free utterances, while a thorough study of articulation was carried out using the *Articulation Examination Chart* [*Karta badania artykulacji*], based on the *Picture Questionnaire* [*Kwestionariusz obrazkowy*] (Demel, 1998). Both the store of sounds and the manner of their realization (substitution, distortion, elision) were determined. The author adopts A. Sołtys-Chmielowicz's concept that a substitution occurs when two phonemes of the general system have the same realization in the patient's pronunciation, while a distortion is a realization where a standard realization is replaced by an abnormal realization, untypical of a given phonetic system, being outside of the area of realization of other phonemes (Sołtys-Chmielowicz, 2002). The study material was analyzed first of all from the angle of the way of sound realization.

The assessment of oral motor skills took into account the course of primary physiological functions (breathing, swallowing) and the efficiency of selected articulatory organs (lips, tongue, mandible and soft palate). The basis for determining the respiratory pattern was the observation of the subject and assessment of breathing using a two-sided mirror. The course of swallowing was assessed when this function was performed; observation covered the work of the lips and tongue (when the lips were parted with fingers) and the masseters and larynx; the

opment of the masticatory organ is described inter alia by Dominik (1999, 60). S. Grabias also emphasizes that speech development is a process determined both biologically and socially (Grabias, 2001, 18–20).

investigation was also complemented with the palpation of the muscle tone of the masseters and the position of the larynx. The motor activity of the articulatory organs was assessed by observing their work during realization of speech; the work of the lips, tongue and the mandible was investigated in the direct functional assessment through sight, while the work of the soft palate was assessed indirectly, through hearing, paying attention to nasal resonance. When assessing the tongue activity, its position at rest was also taken into consideration. An oral motor disorder (or myofunctional or orofacial motor disorder) was termed as simple if it concerned the reduced efficiency or irregular work of only one of the articulatory organs studied (e.g. only the lips), and as complex when it concerned the irregular work of at least two articulatory organs (e.g. the lips and mandible at the same time) or the abnormal course of activities (e.g. swallowing or breathing).

The investigation of the occlusal conditions⁴ assessed in relation to three spatial planes focused on extraoral investigation and on intraoral assessment of the occlusion of dental arches. Extraoral investigation comprises the inspection of the facial symmetry and facial proportions *en face* and the proportion between the arrangement of the lips and the chin in assessing the facial profile. Intraoral assessment took into account the size of the overjet and overbite, the position and inclination of the teeth, Baume's classification or Angle's classification. The assessment of morphological conditions took into account the biological norm appropriate for the age of the studied children.

PRESENTATION AND ANALYSIS OF RESEARCH RESULTS

In the studied group consisting of 132 children, correct articulation was reported in 50 children, which accounts for 37.88% of the total number, and abnormal realizations⁵ in 83 children (62.12%). Oral motor disorders were recorded in

⁴ When assessing morphological conditions, that which was taken into account was not only the interrelation between dental arches (occlusion) but also the positioning and inclination of the teeth in the arches, or the shape and size of the arches. Extraoral conditions reflect intraoral ones, thus being an additional clue for their assessment.

⁵ Many logopedic practitioners and some scholars assume that substitutions prior to six years of age are developmental. Abnormal realizations in children aged 5 to 7 may be also associated with the natural process of sound acquisition in a specific order, consequently, not all abnormal realizations in children of preschool age should be treated as abnormal. However, not all the so-called "children's articulations" change into normal articulations in the course of speech development, which is also confirmed by logopedic practitioners and scholars. It should be emphasized that not every substitution is developmental because it is difficult to establish whether a given substitution will turn into a regular sound in the future; therefore, a reliable description of every abnormal phoneme realization in phonetic terms is necessary in the case of every sound regardless of the child's age (Pluta-Wojciechowska, 2005; Pluta-Wojciechowska, 2010), Pluta-Wojciechowska, 2012).

36 children (27.27%), and occlusal abnormalities in 27 children (20.45%). It was reported that abnormal realizations concern first of all the /r/ phoneme and dentalized phonemes, mainly postalveolar (rustling), and then hissing ones.⁶

In the group of 50 children with normal articulation, malocclusions were reported in 4 children, oral motor disorders in 1, and in 2 – both malocclusions and oral motor disorders. 43 children (86%) had no abnormalities. These data are illustrated in Chart 1. In the group of 83 children with abnormal realizations, malocclusions were reported in 8, in 20 – oral motor disorders, and in 13 children both malocclusions and oral motor disorders were found. In 42 children no abnormalities in oral motricity or in occlusion were reported. The foregoing data are illustrated in Chart 2.

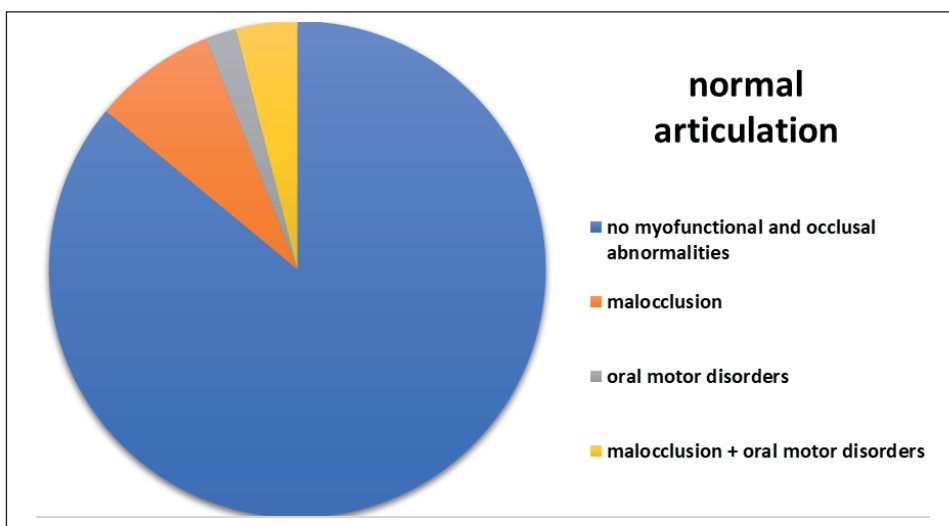


Chart 1. The number of children with normal articulation in the context of myofunctional and occlusal disorders

In the group of 27 children with malocclusions, accompanying abnormalities in articulation were reported in 21 children, of which: in 8 – distortion realizations only, in 8 - substitutions only, and in 5 – realizations of both types. These data are illustrated in Chart 3. In the studied group of children with malocclusions,

In the research presented in this article, it was first of all essential to seek a connection between myofunctional-occlusal conditions and the efficiency of oral motricity, which, it should be stressed, is improved with the child's age.

⁶ In the present article it was essential first of all to seek and present the relationship between oral motricity plus occlusal conditions and realization efficiency. Detailed analysis of articulation quality is beyond the capacity of this paper and is the subject of another report on the speech of preschool-age children.

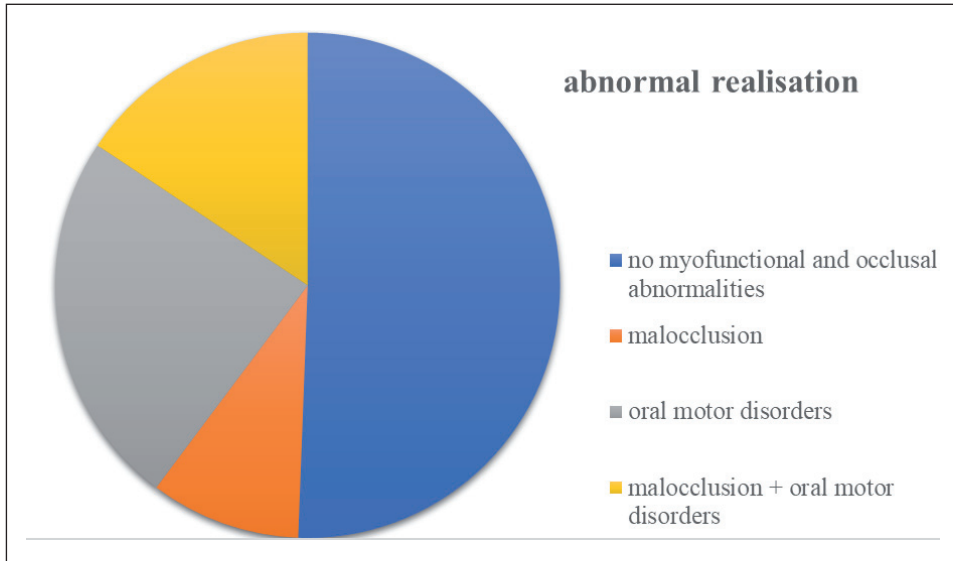


Chart 2. The number of children in whom abnormal realizations were reported in the context of myofunctional and occlusal disorders

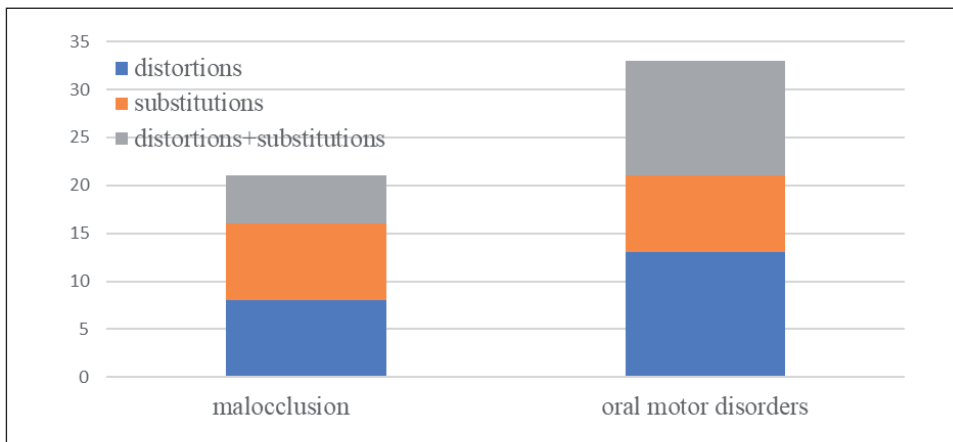


Chart 3. Specification of the ways of abnormal realizations of phonemes in the context of malocclusion and oral motor disorders

accompanying orofacial (=oral) motor abnormalities were observed in 15 subjects, of which: in 3, they were simple disorders, and complex disorders in 12 children. The data are illustrated in Chart 4. Among the children with malocclusions, no other abnormalities were found, in 2 – accompanying oral motor disorders were reported, in 8 – abnormal realizations of phonemes, and in 13 – oral motor

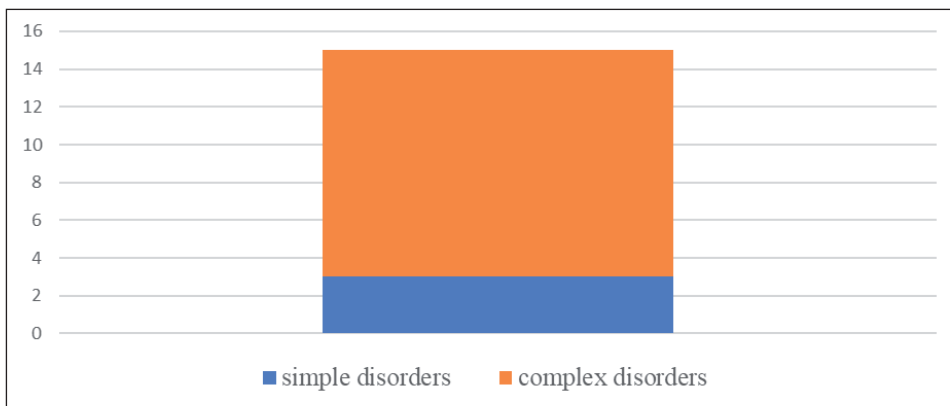


Chart 4. The number of children with malocclusion in the context of accompanying myofunctional disorders

disorders and abnormal realizations of phonemes at the same time (11 of 13 cases being complex oral motor disorders).

In the studied group, by far the most frequent malocclusion was class II defects (distocclusion and mandibular retroposition), additional co-occurring abnormalities being sometimes reported: protrusion (1 case) or supraclulsion (2 cases). Class III defects (mesicclusion/inferior prognathism) were reported in 3 children, and cross bite in 6. In vertical defects, 2 cases of open bite and 3 cases of supraclulsion were observed.

In the group of 36 children with oral motor disorders, accompanying malocclusions were found in 15, and in 33 – abnormalities in articulation (including 13 cases of only distortion realizations, 8 – substitution realizations only, and in – 12 realizations of both types). These data are illustrated in Chart 3. Chart 6 shows that in the case of complex oral motor disorders, far more cases of abnormal realizations of phonemes were recorded (24) than in the case of simple disorders (9). In the case of complex oral motor disorders, only distortion realizations were observed in 9 children, in 6 – substitution realizations only, and both types in 9 children. Compare Chart 5.

In the group of children with oral motor disorders, there were 11 cases of simple disorders and 25 cases of complex disorders. In the group of children with simple disorders, only accompanying articulation abnormalities were found in 5 children, and in 2 – articulation abnormalities and malocclusions at the same time. In 1 child, only single simple oral motor disorders were observed. In the group of children with complex disorders, only accompanying articulation abnormalities were reported in 13 children while in 11 children – articulation abnormalities and malocclusions. In 1 child – malocclusions and a complex oral motor disorder

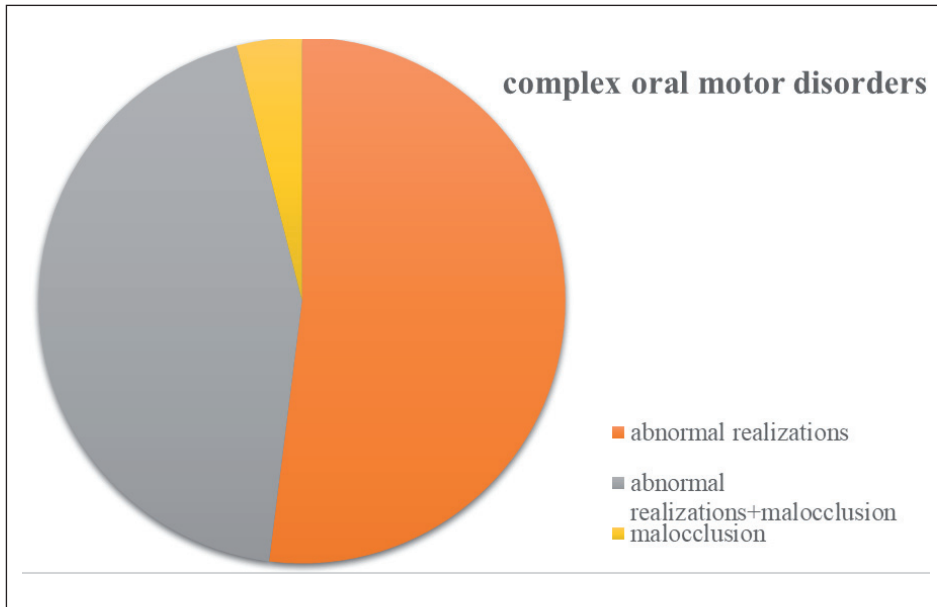


Chart 5. Specification of the number of children with complex oral motor disorders in the context of malocclusion and abnormal phoneme realizations.

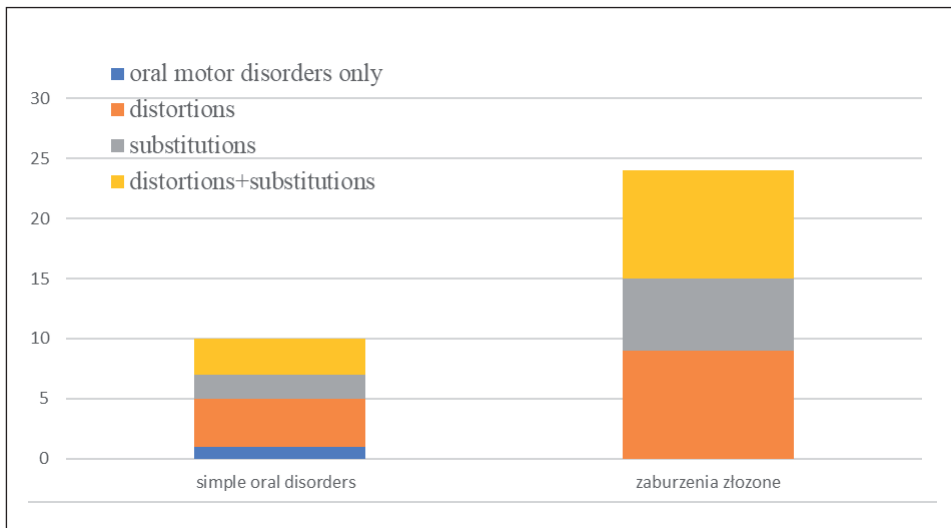


Chart 6. The number of children with oral motor disorders in the contexts of the ways of abnormal realizations

were observed at the same time. No case of an isolated complex oral motor disorder was recorded. These data are illustrated in Chart 7.

In the group of 25 children with complex oral motor disorders, only abnormal realizations of phonemes were observed in 13 children (in 4 – monly distortion realizations, in 4 – only substitution realizations, and in 5 – both types of realizations), while in 11 children: abnormal realizations of phonemes and malocclusions were observed at the same time (5, 2 and 4 cases respectively). In 1 child, a complex oral motor disorder and malocclusion without accompanying articulation abnormalities were reported. The data are illustrated in Chart 7.

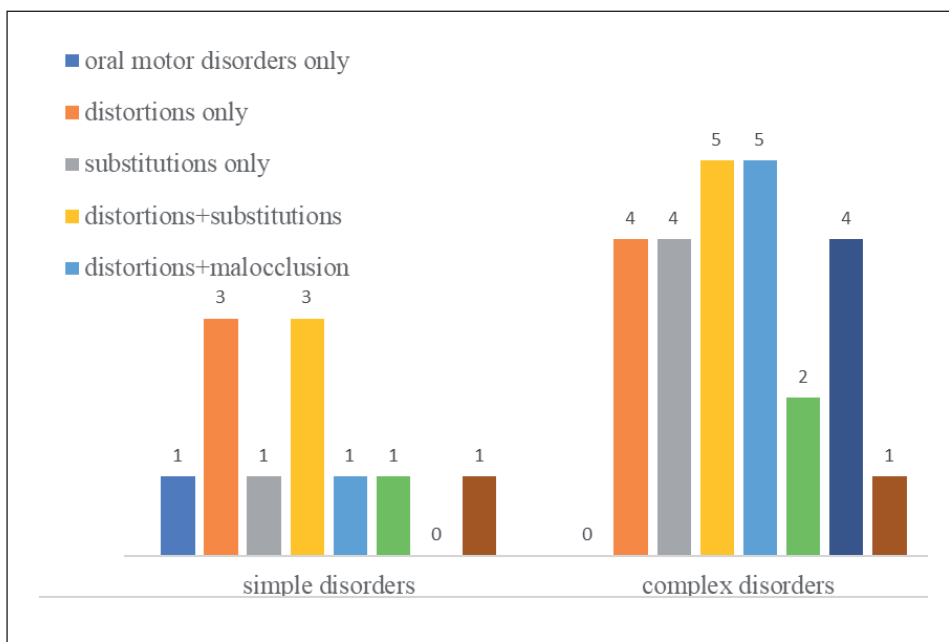


Chart 7. The number of children with oral motor disorders in the context of accompanying abnormalities of articulation and/or occlusion

U 83 children abnormal phoneme realizations were recorded, of which: only distortion realizations in 22 children, in 46 – only substitution realizations, and in 15 – both types of realizations. In the group of children with distortions only, oral motor and/or occlusal disorders were reported in 15 cases, while no other abnormalities were found in 7 children. In the group of children with substitutions only, no other abnormalities were recorded in most of them (33), while they were found in 13 cases. In the group of children in whom both realization types were reported, there were oral motor and/or occlusal disorders in most cases (13) while in 2 children such abnormalities were not reported. These data are illustrated in Chart 8.

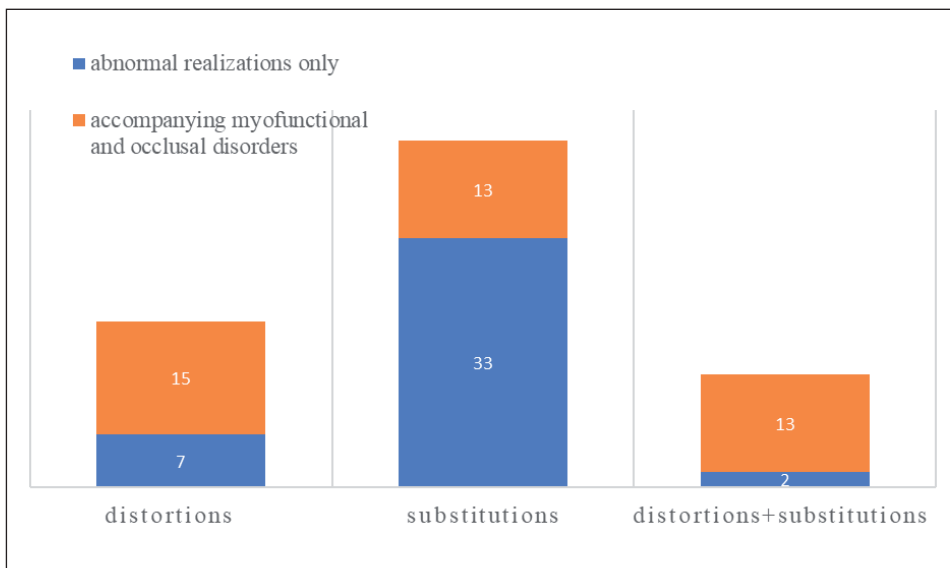


Chart 8. The number of children in whom abnormal realizations of phonemes were reported in the context of accompanying myofunctional and occlusal disorders.

In the group of 22 children, where only distortions were found, 9 subjects did not have oral motor disorders. In 13 children, oral motor disorders were observed (of which: 9 cases of complex oral motor disorders and 4 cases of simple disorders). In the group 46 children with substitutions only, oral motor disorders were not reported in most of them (38), while simple disorders were found in 2 cases, and complex disorders – in 6.

In the group of 15 children with reported both types of realization, oral motor disorders were also observed in most cases (12): in 9 children this was a complex disorder, and a simple one in 3 cases, while no accompanying oral motor disorders were found in 3 children in the group. The data are illustrated by Chart 9 below.

In the group of children (22) in whom abnormal realizations of phonemes as distorted forms only were reported, other myofunctional and/or occlusal abnormalities were also found in 15 of them, of which: in 2 it was a malocclusion only, in 7 – an oral motor disorder, and in 6 – both a malocclusion and an oral motor disorder. In 7 children with distortions accompanied by oral motor disorders only, there were 3 cases of a simple disorder, and 4 cases of a complex one. In 6 children in whom distortions were accompanied by both a malocclusion and an oral motor disorder, there was 1 case of a simple disorder, and 5 cases of a complex one. Compare Charts 10 and 11.

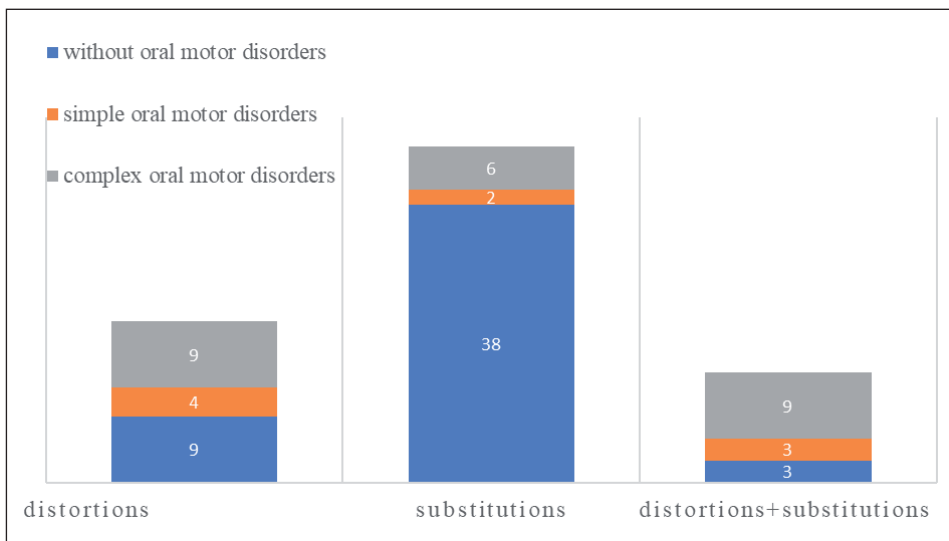


Chart 9. The number of children in whom abnormal realizations of phonemes were reported in the context of oral motor disorders

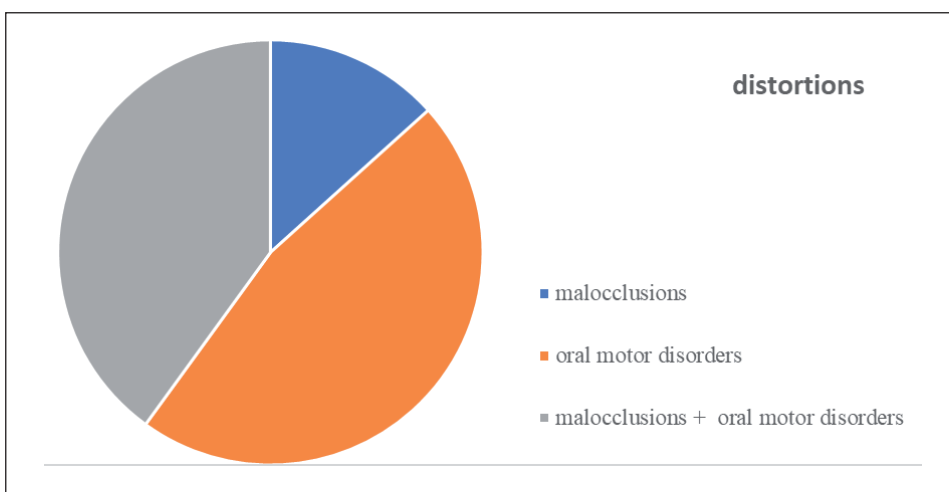


Chart 10. Specification of the number of children in whom only distortions accompanied by myofunctional and occlusal disorders were reported

In the group of children (46), in whom incorrect phoneme realizations as substitutions only were reported, other myofunctional and/or occlusal abnormalities were also found: these being exclusively a malocclusion (5) or an oral motor disorder (5), or both a malocclusion and an oral motor disorder (3). Out of 5 children, in whom substitutions were accompanied by oral motor disorders only, in 1 case it

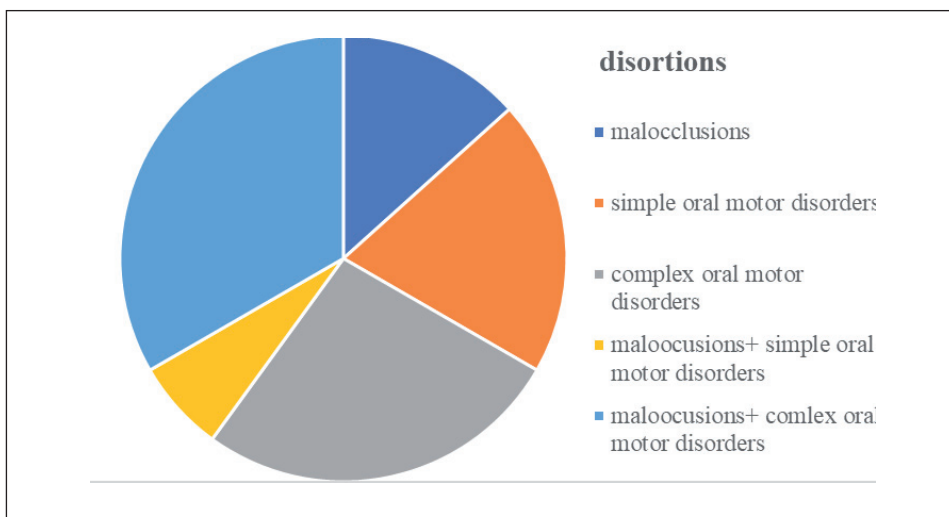


Chart 11. Specification of the number of children, in whom only distortions accompanied by myofunctional and occlusal disorders were reported, taking the division into simple and complex oral complex oral disorders into consideration

was a simple oral motor disorder, and in 4 cases – a complex one. In 3 children, in whom substitutions were accompanied by both a malocclusion and an oral motor disorder, these were: a simple oral motor disorder in 1 case, and a complex oral motor disorder in 2 cases. Compare Charts 12 and 13.

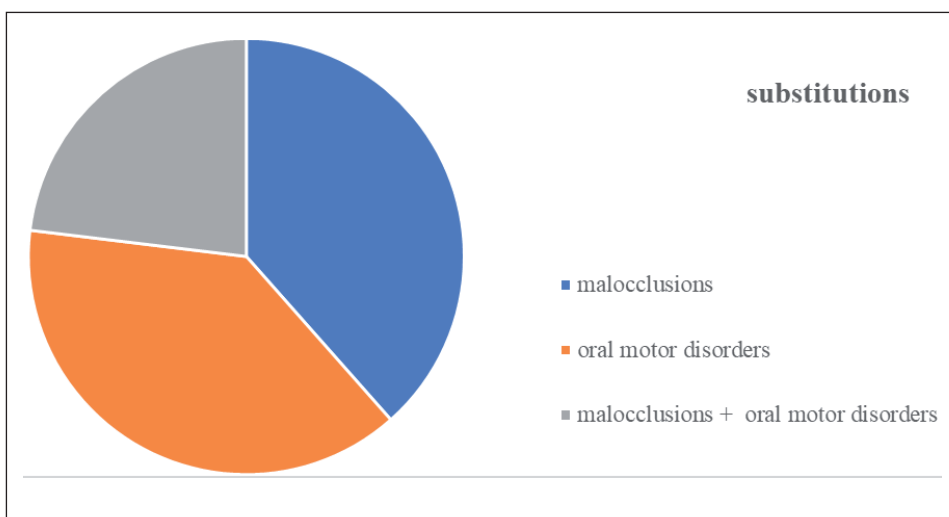


Chart 12. Specification of the number of children in whom only substitutions accompanied by myofunctional and occlusal disorders were reported

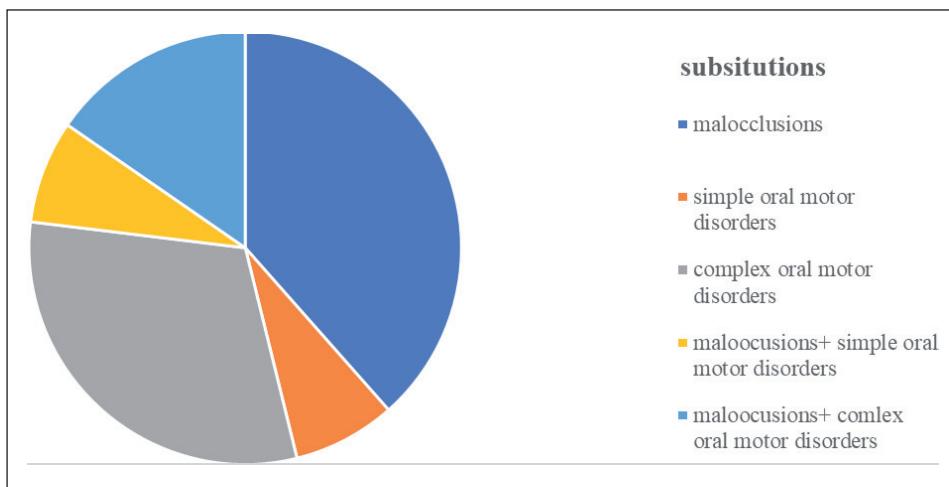


Chart 13. Specification of the number of children, in whom only substitutions accompanied by myofunctional and occlusal disorders were reported, taking the division into simple and motor disorders into consideration

In the group of children (15), in whom both distortion and substitution realizations of phonemes were reported, other myofunctional and/or occlusal abnormalities were also found in 12 cases, of which: – only a malocclusion in 1 child, only an oral motor disorder in 8, and in 4 cases – both a malocclusion and an oral motor disorder. Out of 8 children, in whom abnormal phonemic realizations were accompanied by oral motor disorders only, in 3 children it was a simple oral motor disorder, and a complex one in 5. In 4 children, in whom incorrect phoneme realizations were accompanied by oral motor disorders, both a malocclusion and a oral motor disorder were reported, the oral motor disorder being a complex one only. Compare Charts 14 and 15.

SUMMATION

On the basis of the analysis of the collected research material, the following can be said:

1. In 86% of the studied children with normal CORRECT articulation, no other accompanying abnormalities in occlusion or oral motor function were observed. In contrast, in 50% children, in whom abnormal realization of phonemes was reported, the co-occurrence of other disorders – myofunctional and/or occlusal – was observed.
2. In the case of children in whom only distortion realizations were observed, other myofunctional and/or occlusal abnormalities were also reported in 68% of cases. However, in children in whom simultaneous

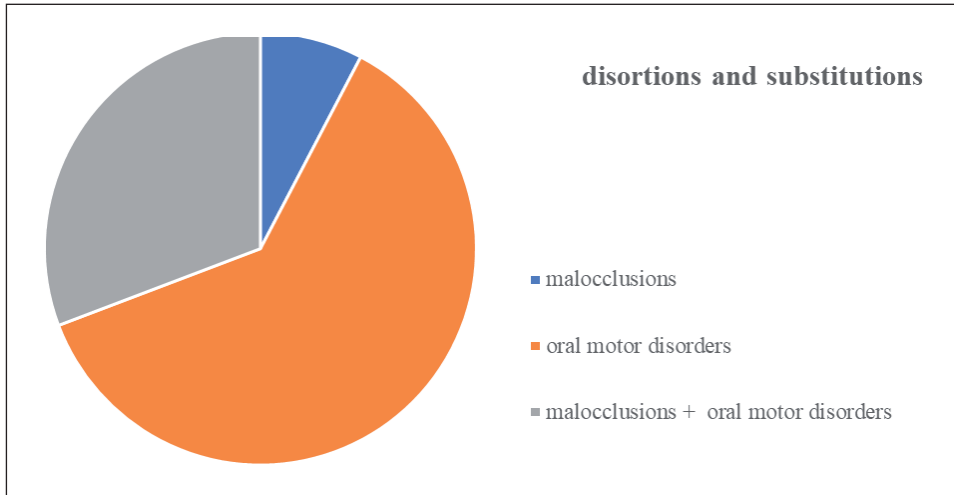


Chart 14. Specification of the number of children with distortions and substitutions at the same time, accompanied by myofunctional and occlusal disorders.

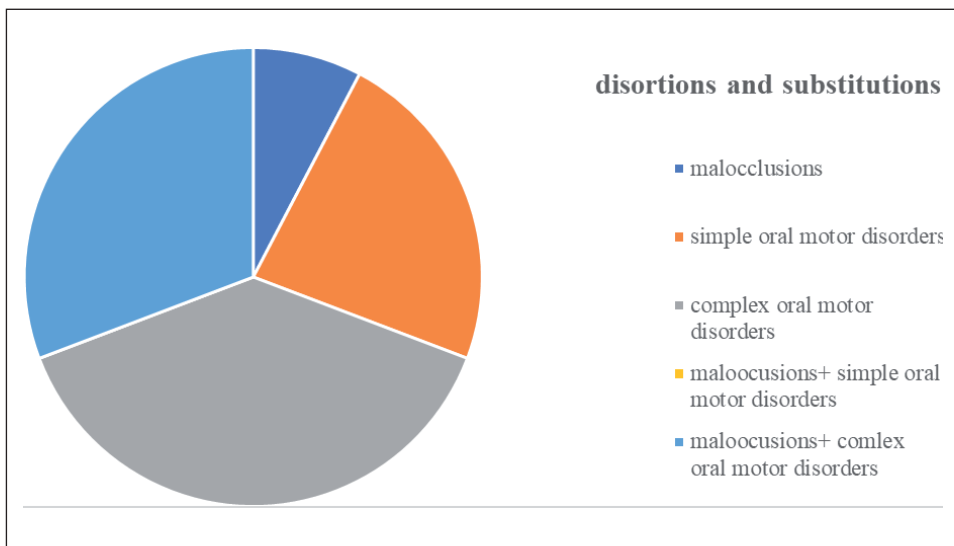


Chart 15. Specification of the number of children with distortions and substitutions at the same time, accompanied by myofunctional and occlusal disorders, taking the division into simple and complex oral motor disorders into consideration

- distortion and substitution realizations were observed, these disorders were reported more often, i.e. in 86% of cases. In children in whom only substitution realizations were reported, myofunctional and occlusal disorders occurred far less often (in 28% of children in this group). In the subjects with malocclusion, more than half of them (55%) had parallel oral motor disorders, complex disorders being found four times as frequently. In the investigated children with oral motor disorders, accompanying malocclusions were found in 41.66%, the most frequent being class II defects.
3. In the studied children with malocclusion, phoneme realization disorders were reported in 77%. In the subjects in whom only distortions were found, 13% of them also had malocclusion while in the subjects in whom substitutions and distortions were reported – 38 (39%) also had malocclusion whereas in the subjects in whom only substitutions were reported, this was the case with barely 8% of cases.
 4. In the studied children with oral motor disorders (36), in 91.66% of cases, articulation disorders were also reported, 75.7% of cases being children with only distortion realizations or children in whom both realization types were found at the same time.
 5. In the group of children with complex disorders, 96% of cases were reported to have accompanying articulation abnormalities or articulation abnormalities and malocclusions at the same time.
 6. In 62.87% of the studied children, abnormal phoneme realization was reported, of which, in children with distortions only, oral motor and/or occlusal disorders were present in 68.2% of cases while in the subjects in whom both types of realizations were recorded, oral motor and/or occlusal disorders were reported in the majority of cases (86.66%). In children with substitutions only, no other abnormalities were reported in the majority of them (71.73%)
 7. The research with its results discussed in the present article should be treated as a pilot study because the numerical strength of the studied group does not allow its generalization. Further inquiries into this area are needed to determine the range of impact of the combination of different biological (myofunctional and occlusal) factors on the development of articulation skills.

CONCLUSIONS

1. In most children aged 5 to 7, the occurrence of abnormal realization is reported.

2. There is a relationship between the occurrence of myofunctional-occlusal disorders and articulation disorders.
3. This correlation applies predominantly to children in whom distortions and substitutions occur at the same time, and somewhat less to those in whom only distortion realizations were reported; it does not however apply to children in whom only substitution realizations were observed.
4. This correlation predominantly applies to complex oral motor disorders, in particular it applies to children in whom only abnormal realizations (only substitutions) are reported, and to children in whom substitution and distortion realizations are observed at the same time.
5. In the majority of children at the age of 5 to 7 with malocclusion, abnormal realizations are reported.

BIBLIOGRAPHY

- Bielawska H., 1998, *Rozwój fizyczny u dzieci oddychających przez usta*, „Pediatria Polska”, 73, 1265–1271.
- Bielawska-Victorini H., Doniec-Zawidzka I., Rucińska-Grygiel B., Wedrychowska-Szulc B., 2008, *Rozwój i wzrost twarzy [in:] Zarys współczesnej ortodoncji*, ed. I. Karłowska, PZWL, Warszawa, 18–58.
- Demel G., 1998, *Minimum logopedyczne nauczyciela przedszkola*, WSiP, Warszawa.
- Dera K., Bojda A., 2007, *Występowanie wad zgryzu u pacjentów z wadami wymowy*, „As Stomatologii”, 2, 16–18.
- Dominik K., 1999, *Zarys ortopedii szczękowej*, Wydawnictwo UJ, Kraków, 29, 60, 67, 107–108;
- Grabias S., 2001, *Zaburzenia mowy*, Wydawnictwo UMCS, Lublin, 18–20.
- Juzwa E., Pawłowski Z., 1981, *Czynności fizjologiczne związane z udziałem narządu żucia*, [in:] *Fizjologia narządu żucia*, ed. O. Grosfeldowa, PZWL, Warszawa, 160–186.
- Kahl-Nieke B., 1999, *Wprowadzenie do ortodoncji*, Elsevier Urban & Partner, Wrocław, 79.
- Karłowska I., 2008, *Profilaktyka i oświata zdrowotna*, [in:] *Zarys współczesnej ortodoncji*, ed. I. Karłowska, PZWL, Warszawa, 314–319.
- Kawała B., Babiczuk T., Czeakańska A., 2003, *Występowanie dysfunkcji, parafunkcji i wad narządu żucia u dzieci w wieku przedszkolnym*, “Dental and Medical Problems”, 40, 2, 319–325.
- Kierkowska-Wasilewska H., 1984, *Choroby górnych dróg oddechowych a stan narządu żucia*, “Czasopismo Stomatologiczne”, 4, 269–273.
- Konopska L., 2007, *Wymowa osób z wadą zgryzu*, Wydawnictwo: Uniwersytet Szczeciński, Szczecin, 21–23.
- Kustrzycka K., Jaworska M., 1997, *Wpływ schorzeń górnych dróg oddechowych na wady zgryzu*, “Czasopismo Stomatologiczne” 1, 47–51.
- Łabiszewska-Jaruzelska F., 1995, *Etiologia zaburzeń w obrębie narządu żucia*, [in:] *Ortopedia szczękowa. Zasady i praktyka*, ed. F. Łabiszewska-Jaruzelska, PZWL, Warszawa, 153–194.
- Łada A., 2012, *Czynniki rokownicze rozwoju mowy w okresie prelingwalnym w świetle koncepcji neurorozwojowej*, “Forum logopedyczne”, 20, 56–72.
- Mackiewicz B., 1992, *Współzależność wad zgryzu i wymowy na tle przyczynowym*, “Magazyn stomatologiczny”, 2, 28–30.

- Mackiewicz B., 2001, *Odwzorowywanie czynności pokarmowych w ruchach artykulacyjnych*, „Logopedia”, 29, 87–92.
- Nurzyńska-Januszko K. 1990, *Wpływ niemowlęcego typu połykania na powstawanie wad wymowy*, „Szkoła Specjalna”, 50, 188–192.
- Pisulska-Otremba A., 1995, *Rozwój narządu żucia [in:] Ortopedia szczękowa. Zasady i praktyka*, ed. F. Łabiszewska-Jaruzelska, PZWL, Warszawa, 33–43.
- Pluta-Wojciechowska D., 2005, „*Lowely, jody i safy*”, czyli o tzw. *substytucjach i deformacjach*”, „Śląskie Wiadomości Logopedyczne”, 8, 26–29.
- Pluta-Wojciechowska D., 2009, *Połykanie jako jedna z niewerbalnych czynności kompleksu ustno-twarzowego*, „Logopedia”, 38, 119–148.
- Pluta-Wojciechowska D., 2010, *Dyslalia – mity i rzeczywistość*, [in:] *Nowe podejście w diagnozie i terapii logopedycznej – metoda krakowska*, eds. J. Cieszyńska, Z. Orłowska-Popek, M. Korendo, Collegium Columbinum, Kraków, 65–83.
- Pluta-Wojciechowska D., 2012, *Diagnoza różnicowa- postulat czy utopia? W kierunku budowania modeli rozwoju fonetycznego w przypadku zaburzeń prostych i złożonych*, [in:] *Diagnoza różnicowa zaburzeń komunikacji językowej*, eds. M. Michalik, A. Siudak, Z. Orłowska-Popek, Collegium Columbinum, Kraków, 115–145.
- Pluta-Wojciechowska D., 2013, *Zaburzenia czynności prymarnych i artykulacji*, Wydawnictwo: Ergo-Sum, Bytom, 97–107, 128, 307.
- Proffit W.R., Fields H.W. Jr, 2001, *Ortodoncja współczesna*, Wydawnictwo: Czelej, Lublin, 72–73, 130–132;
- Raftowicz-Wójcik K, Matthews-Brzozowska T, 2005, *Wady zgryzu a wady wymowy – przegląd piśmiennictwa*, „Dental and Medical Problems”, 42(1), 149–154.
- Raftowicz-Wójcik K, Matthews-Brzozowska T, 2006, *Wady zgryzu u dzieci w wieku przedszkolnym z/bez wad wymowy*, „Czasopismo Stomatologiczne” LIX, 5, 361–367.
- Sołtys – Chmielowicz A., 2002, *Wady wymowy i ich korygowanie*, „Logopedia”, 31, 53–93.
- Styczek I., 1981, *Logopedia*, PWN, Warszawa.
- Śmiech-Słomkowska G., 1994, *Znaczenie sposobu oddychania w profilaktyce ortodontycznej*, „Magazyn stomatologiczny”, 11, 27–29.
- Wędrychowska-Szulc B., 2008, *Etiologia wad zgryzu*, [in:] ed. I. Karłowska, *Zarys współczesnej ortodoncji*, PZWL, Warszawa, 59–72.