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About Popular Though Disputable Tongue Exercises in the Case of Peripheral Disorders of Articulation

SUMMARY

The authors present the physiology of articulation of selected speech sounds in Polish. They also revise the usefulness of popular tongue exercises such as teeth counting, "cat's back", tongue rolling, touching the nose with the tip of the tongue, pushing the cheeks, etc. – from articulation therapy requirements. The knowledge concerning primary and secondary tongue movements as well as basic facts about tongue anatomy and physiology have also been introduced and organized in the article.

Key words: peripheral articulation disorders, primary functions, oral motor exercises, physiology of articulation

INTRODUCTION

The aim of this publication is to, first, present the physiology of articulation of selected Polish speech sounds. Using this knowledge, we will then verify the usefulness of popular tongue exercises (e.g., teeth counting, "cat's back", tongue rolling, etc.) in terms of anatomical analyses. The presented considerations refer only to the treatment of peripheral articulatory disorders (i.e. "dyslalia" in Polish terminology) of anatomical or functional etiology.

In this article, we will sort out information concerning various tongue functions; we will also reconsider some basic concepts about tongue structure and physiology. This analysis will create a basis for predicting how selected speech

sounds are produced in Polish. In the next part of the study, we will review universally used tongue exercises that have been popularized and copied for years in many sources. Such tongue exercises include: the counting of teeth, "cat's back",[1] tip tensioning, tongue rolling, touching the nose with the tip of the tongue, pushing cheeks, etc. (see, e.g.: Michalak-Widera, 2011; Szłapa, 2005; Morkowska, Żmuda-Trzebiatowska, 2008). While discussing the above-mentioned exercises, we will try to answer the question whether and to what extent such practices correspond with the motor requirements of essential primary functions (the tongue rest posture and swallowing) and articulation.

We are consciously omitting conditions such as physiological, phonemic and phonetic aspects of hearing as well as phonemic awareness for the creation of speech sounds due to the narrowness of the topic. In this publication, we emphasize the motor aspect of creating speech sounds, based on the considerations of Rocławski's (2001) phonemic and phonetic system, the findings of Mackiewicz (2001, 2002), Ostapiuk (2013a, 2013b), Konopska (2006), as well as the authors' own research (Pluta-Wojciechowska, Sambor, 2017; Pluta-Wojciechowska, 2011, 2013; Sambor, 2016, 2017). We presuppose that the orofacial-pharyngeal space is, in fact, an unusual mechanism: it is a device that produces speech sounds but primarily processes different substances, such as air, liquids, and foods (Pluta-Wojciechowska, 2013, 2015, 2017; Sambor, 2014/2015, 2017).

If the previous claims are true, we have to take into account the basic physiological conditions of the entire oral cavity in order to analyze the mechanics of primary and secondary (articulatory) tongue movements. This analysis of primary and secondary movements will be used to revise popular tongue exercises.

THE STRUCTURE OF TONGUE MUSCLES AND THE PHYSIOLOGY OF PRIMARY FUNCTIONS AND ARTICULATION

If we consider the tongue as an element of machinery that performs tasks related to various functions, then we have to analyze both the structure and the type of tasks which it performs. The tongue's positions and movements are determined by the intrinsic and extrinsic muscles of the tongue. The intrinsic muscles determine the shape of the tongue (the superior longitudinal, inferior longitudinal, transverse and vertical muscle) and the extrinsic muscles position the tongue within the oropharyngeal space (genioglossus, styloglossus, hyoglossus, and palatoglossus).

[1] This is a popular Polish term for an exercise that relies on the bulging of a narrowed tongue, with the tip propped behind the lower incisors. It is supposed to prepare the tongue for eliciting palatal sounds; however, it promotes an adverse tongue posture instead (dorsal posture, dorsality – Sambor, 2014).

The condition of the lingual frenulum plays a vital role in the mobility of the tongue – one has to consider not only its length but also its structure, the location of its insertions, and the structure and position concerning the anterior-posterior plane (Pluta-Wojciechowska, Sambor, 2016; see also: Ostapiuk, 2005, 2013a, 2013b). Apparently, apart from the lingual frenulum also other factors may influence the mobility of the tongue, e.g., the position of the hyoid bone, head posture, suprahyoids tension, etc.

The tongue is an extraordinary organ. Its movements take place in three planes and are associated with contacting or approaching different zones of the oral or pharyngeal cavity. These movements require a three-dimensional modification of the tongue. From the point of view of anatomy and physiology, every movement and modification of the shape of the tongue is caused by an underlying strictly defined action of a particular muscle group. These muscles are not directly visible during a typical SLT diagnosis and often are not adequately considered. Nevertheless, one should not forget that tongue muscles are the originators of the necessary configuration for the articulation of the majority of speech sounds (e.g., [sh], [r], the vowels, etc.). The volume of the tongue is constant regardless of its formation in three-dimensional space. This fact indicates that the activity of individual muscles affects the entire tongue mobility and shape. It also means that "in the case of limiting the tongue movement in one direction the entire organ will work in a different compensatory way. The final course of a function related to the tongue activity in orofacial space depends on coordinated and uninterrupted action of all the lingual muscles" (Pluta-Wojciechowska, Sambor, 2016, p. 152).

To illustrate such coordinated action of the tongue muscles during primary functions and articulation, we will use several examples. And so the tension of genioglossus muscle protects the respiratory tract from aspiration of the tongue during inhalation; it is also the only muscle that protrudes the tongue; its left and right sections are activated alternately during chewing. Excessive activity of the posterior genioglossus muscle was recorded during a so-called tongue-thrust (and probably also in other improper patterns of the oral phase of swallowing). The same muscle (or rather its particular parts) is important while maintaining the high position of the tongue when creating Polish palatal phonemes or while flattening the dorsal part in the production of alveolar sibilants.

Let us emphasize that the activity of this largest lingual muscle should not be excessive, because in such a case one can observe a frontal tongue posture (in extreme situations out of the oral cavity, e.g., in interdental realizations). The proper activity of intrinsic tongue muscles is also necessary for the correct course of primary functions and efficient tongue formation. These muscles make the tip of the tongue lifted or descended, and in the case of cooperating with the particular genioglossus muscle parts, they form a concave, flat or convex shape of the tongue.

When writing about primary functions, we want to bring up the semantic content of this concept. This term has become very popular in recent years; however, it is not always precisely defined or used correctly by different authors. According to Pluta-Wojciechowska's intention, the primary functions are a system of mutually dependent interrelated activities in the orofacial and oropharyngeal space and concern breathing and food and liquid intake (formed on the basis of primary motor skills). However, the orofacial complex also is involved with the development of other non-verbal tasks, such as facial expressions, auto-examination, auto-experimenting, and orofacial auto-playing, sensory sensations coming from the oral cavity. The orofacial complex, along with the central and peripheral nervous system, constitute the base of speech in the prenatal period and the postnatal period (Pluta-Wojciechowska, 2011, p. 125). Thus, the term "primary functions" is not only an ornament of scientific texts, but it is a concept that takes into account various connections and dependencies between developmental paths of various non-verbal activities taking place in the orofacial and oropharyngeal space. The development of these functions creates a biomechanical base of articulation (Pluta-Wojciechowska, 2011, 2013, 2015, 2017; see: Mackiewicz, 2001, 2002; Hiiemae, Palmer, 2003; Serrurier et al. 2012; Sambor, 2014/2015, 2016a, 2016b, 2017b). The main primary functions of the orofacial system are breathing, swallowing and food processing.

It can be further assumed that the most crucial tongue functions are:

- the position of the organs during breathing (it lasts for 24 hours, the time during which the tongue is in the V-H position can be estimated at around 20–22 h. during the day);
- its positions and movements during eating;
- its positions and movements while creating speech sounds;
- Inter-Speech Posture, which results from the features of the phonetic system and phonological of a given language (Gick et al. 2004; Pluta-Wojciechowska, Sambor, 2017).

The analysis of the resting position of the tongue, swallowing and the articulation structure of Polish speech sounds show that there are similarities with these activities in positioning and shaping the tongue – both in the norm and in pathology (see: Mackiewicz, 2001, 2002; Pluta-Wojciechowska, 2011, 2013; Psaume et al. 1986; Sambor, 2014/2015, 2017).

Considerations regarding the construction of articulating sounds can be summarized as follows:

- all Polish lingual consonants are characterized by the places of articulation which are formed inside the oral cavity;
- in the case of most phonemes, the tongue adopts a wide shape; no narrowing and tension of the apex may be observed;

- the essence of creating a place of articulation is not only about forming contact resulting in the obstruction in the oral cavity but also about forming a specific three-dimensional formation from the tongue (Pluta-Wojciechowska, 2006, 2010, 2013, 2015, 2017; Sambor, 2017; Ostapiuk, 2013);
- the tongue is not stuck in any fixed articulatory position (the tongue muscles do not remain in isometric contraction), the co-requisite requirements force the agonistic and antagonistic muscles into constant and harmonious cooperation.

The accomplishment of these tasks primarily requires the well-coordinated activation of intrinsic and extrinsic tongue muscles (Sambor, 2017, see also: Styczek, 1979; Reicher et al. 2013; Gick et al. 2013).

WHY DOES THE SPEECH & LANGUAGE THERAPIST NEED TO TRAIN THE TONGUE?

The therapy of articulation disorders focuses on the improvement of the production of speech sounds. Until recently, this procedure was identified as having three-stages, namely: 1. the preparation of speech organs for eliciting the speech sound, 2. eliciting the sound, and then 3. its automatization. Such an approach to the elimination of speech defects has been propagated in Polish speech therapy for several decades and has played an essential role in the constitution of logopedics both as a science and as a practical activity.

The deficiencies or rather "blank sheets" of this style of work were outlined by Pluta-Wojciechowska (2017), who proposed taking the seven stages of therapy into account. It has been described in the form of a Strategic Method for Improving Phoneme Implementation – SMIPI (*ibidem*). Her analyses (2009, 2011, 2013, 2015, 2017) contain considerations regarding the revision of previous tongue exercises; in this document, one can find critical remarks regarding the counting of the teeth exercise, the "cat's back", tongue rolling, etc. (Pluta-Wojciechowska, 2017, see also comments written earlier by Ostapiuk, 2013). Sambor's publications also revise such exercises as: speaking with a wine cork, practicing laterotrusion, protraction and retraction of the mandible, tightening or curling the tip of the tongue (Sambor, 2013, 2015, 2016, 2017).

The topic concerning the usage of the exercises of speech organs, in particular of the tongue, is not new in Polish speech therapy. So let us consider: why does the speech therapist need to train the tongue? The reply is seemingly simple, because SLTs answer "to improve the mobility of the tongue". The critical point is to ask is, rather, what is the purpose of correcting tongue motion? The role of an SLT is to improve the tongue for the articulation requirements

and – if there is a need – for primary functions (mostly for breathing and swallowing). Therefore, it logically follows that the type of exercise should correspond with the tongue movements that are performed during primary functions and articulation. This postulate is implemented by conducting oral-motor exercises during speech therapy. The majority of various studies, guides, sets of color photos and drawings (also published on websites) for several decades have invariably suggested that one needs to raise the tongue to the nose, count the teeth, obtain an arrow-shaped tongue or perform a "cat's back", roll the tongue, push the cheeks with the tensed tongue, etc. It is, nevertheless, worth emphasizing, that neither the authors nor popularizers of these recommendations have presented any research results proving the effectiveness of the proposed exercises.

WHAT FUNCTIONS ARE BEING IMPROVED BY ARBITRARY ORAL EXERCISES?

Table 1 contains an analysis of selected arbitrary tongue exercises. Using this table, one may align some popular oral exercises with the muscles involved in a given tongue movement.

Exercise type	Tongue muscles activation	Similarity with the course of primary functions	Similarity with articulatory gestures	Remarks
lifting the tongue towards the nose	strong activation of posterior genioglossus, transverse, superior longitudinal	licking of the upper lip*, lip cleaning	none	the vast majority of non-normative phonetic features bases on excessive protruded posture of the tongue; the described exercise promotes such posture with an additional narrowing and curling of the apex
sticking the tongue out and down toward the chin	strong activation of posterior genioglossus and suprahyoids	none	none	the vast majority of non-normative phonetic features is based on a protruded tongue posture; the described exercise promotes such a posture
counting of the teeth	strong activation of the transverse muscle, lateral tongue movements	cleaning the interdental spaces	none	tense and tapered apex of the tongue creates huge problems in eliciting of all sibilants and the trill consonant

Table 1

Exercise type	Tongue muscles activation	Similarity with the course of primary functions	Similarity with articulatory gestures	Remarks
arrow-shaped tongue	strong activation of the transverse muscle	none	none	narrowed and tensed tongue creates a problem in eliciting sibilants and trilling
tongue rolling	passive folding of the sides of the tongue by using the orbicularis oris muscle	none	none	negligible opportunity of using this exercise in articulation training due to the lips activity
"cat's back"	strong activation of genioglossus, inferior longitudinal, transverse and suprahyoids	none	none	the exercise corresponds with frequent non-normative phonetic feature: dorsality (undesirable usage of tongue dorsum)

* 1 The licking of the lips can be done with a wide or narrow tongue. Considering the strong activation of the genioglossus, transverse and superior longitudinal muscles during the licking the upper lip, the benefit from obtaining a wide tongue shape seems to be small in comparison with the unnecessary training of the indicated muscles; during the exercise there is also the risk of excessive and unwanted protrusion of the mandible.

Source: Authors' elaboration.

A comparative analysis shows that these very popular arbitrary exercises engage muscle patterns different from those used in the course of articulation, and often profile an adverse position of tongue with a tight apex. This means that there is not only a lack of correspondence between the exercises and the articulation of sound, but also these exercises can even interfere with getting the right speech sound during the elicitation process. Unfortunately, as it has been mentioned above, neither the authors of the described exercises nor their propagators have presented research on the effectiveness of the proposed style of tongue motor skills improvement.

Research on the effectiveness of the SMIPI therapy is presented by Pluta-Wojciechowska (2018, in print). The author presents the results of preliminary

studies regarding the date of eliciting the first proper speech sound during speech therapy. It appears that in almost 66% of patients with peripheral articulation disorders, the first sound is elicited during the first or second visit. The first stage of work (construction of the articulation forefield) involves the therapist and patient practicing the vertical and horizontal (V-H) position of the tongue.[2] V-H posture provides, among other things, the preparation of subsequent functions during therapy, namely learning the correct tongue resting posture and development of a proper swallowing pattern; the V-H position is also useful when learning speech sounds, e.g. [l, r, sz, ż, cz, j, ś, ź, ć, dź, ń, j, s, z, c, dz,[3] n, t, d]. During the therapy, Pluta-Wojciechowska did not use any of the aforementioned exercises, such as: counting the teeth, directing the tongue towards the nose, towards the angle of the mouth, towards the ear, pulling the tongue out on the chin, licking the upper lip, "cat's back", arrowhead, gutters (Pluta-Wojciechowska, 2018 [in print]). Other researchers have also reported about the unsuitability of these types of exercises and strongly criticize them, while underlining the lack of scientific evidence for their effectiveness (Lof, 2003, 2008, 2009, 2011, Forrest, 2002; Powell, 2008; Ruscello, 2008).[4]

Bunton even writes about the different neuronal patterns used in the course of speech and non-speech oral activities. The author, recalling and analyzing the results of a series of objective studies (carried out by various researchers in 1991–2006), notes that the central motor control depends on a specific task; despite the usage of the same peripheral structures as effectors, different neural networks are

[2] "The vertical-horizontal (V-H) position of the tongue is the verticalization of the wide tongue within the oral cavity while the tongue is lifted and the tip of the tongue is touching the area behind the upper incisors (the upper gingiva), with the dorsal part glued to the palate, and the sides of the tongue clinging to the lateral surfaces of the upper dental arch (...) the tongue takes on a wide shape. Let us emphasize that the front part of the tongue assumes a horizontal position, and the tip is directed to the palatal part of the upper teeth" (Pluta-Wojciechowska, 2017, p. 56, see also: 2009, 2011, 2013, 2015).

[3] Consider also Rocławski's remarks regarding the place of articulation of Polish dental fricatives /s, z/. The author's preliminary research indicates that subjects with normative anatomical and functional conditions articulate /s, z/ as when lengthening the dental affricate [c]; the tip of the tongue, although lowered, is not positioned at bottom of the oral cavity. In our understanding, this is a variant of the tongue V-H position. Certainly this problem requires further research.

[4] The research on Non-Speech Oral Motor Exercise (NSOME) that we refer to relates to languages where sounds are created inside the mouth – just like in Polish. In the vast majority these sounds are produced with the use of a wide tongue, without the tension of the tip of the tongue. Most of the publications relate to research conducted in English, where the tongue remains wide within the upper dental arch during the implementation of most consonants. In Polish, 18 of 22 lingual consonants require the rise of a wide tongue stretched within the upper arch. In English, 13 of 19 lingual consonants require the usage of a wide tongue. Narrowing of the tongue is found only in one pronunciation variety (so-called dark 'l', allophone of a phoneme /l/ implemented most often in word-final positions e.g. "tall" or "little" – see e.g.: Gick, Allen, 2013).

used for implementation of various motor tasks (Bunton, 2008). This situation seems easy to predict; metaphorically and somewhat colloquially, it can be summarized using a simple dependency – when wanting to dance professionally, one does not attend boxing training. One can assume that during each activity we use the same muscle groups but in a different way.

TOWARDS THE IMPROVEMENT OF TONGUE MOTOR SKILLS

Conducted analyzes of the articulatory requirements of speech organs, as well as major primary functions patterns indicate that tongue activity improvement should be intentional. It means obtaining designated aims, i.e. preparation for performing primary functions and for articulation. It also means the neat selection of exercises, while this selection is directed by the rules of phonetic and physiological origin. Beyond question, there are no lingual-nasal or dorsal-dental consonant phonemes described in the Polish phonetic system. More importantly, due to the known pathomechanisms of peripheral speech disorders, many of the described exercises may be not only ineffective, but also, to a varying extent, harmful. So far, the only research done on the effectiveness of tongue function improvement is related to using the V-H tongue with the exclusion of non-physiological and non-articulatory exercises in the method SMIPI (Pluta-Wojciechowska, 2018). The authors do not exclude the need of using such a treatment mode exceptionally, e.g., in the initial phase of therapy of preschoolers who cannot control the speech organs sufficiently. In this case, exercises such as licking food off a plate, licking the upper lip may be a good start to let the child experience their orofacial space and the movability of the tongue. However, if the child can already perform such activities, the exercise strategy should be changed and the wide tongue inside the oral cavity should be promoted.

Finally, it is worth adding that the **authors do not undermine the necessity the using various, even non-articulatory exercises of the tongue in neurological patients, in patients with obstructive sleep apnea or with those after a hemiglossectomy procedure. In such cases, one often reaches for various methods tailored to the patient's individual needs and capabilities to improve the strength and movement range of the tongue muscles (e.g., for muscle stretching or relaxation, maintaining the elasticity of postoperative scars, reinforcement of pharyngeal sphincters, etc.)**. The selection of exercises for these patients is complex and represents an equally important topic for research and discussion. Returning, however, to the assumptions of this study, it should be emphasized: in the case of common articulation disorders of peripheral

etiology (e.g., tongue-tie, tongue-thrust, malocclusion), non-physiological exercises cannot bring the desired results or may even block the obtainment of correct articulation.

CONCLUSIONS

Followers and popularizers of non-articulatory and coincidental tongue exercises may use at least a few counterarguments, which in their understanding ought to undermine the assumptions of the authors and the theses presented in the article. It will be helpful to quote them to show their groundlessness. The first of them gives the following opinion: "Speech therapists have been practicing these kinds of exercises for years". Meanwhile, as the history of medicine shows, not all popular treatments end up having proven effectiveness. The second counter argument can be summarized in this sentence: "You cannot state that non-speech tongue exercises are harmful while there is no research that can confirm such an assertion". One can respond with a similar objection, namely: asking the interlocutor to recall **a particular scientific study that will confirm the effectiveness of such procedures in the therapy of speech sound disorders**. Note that such a task is infeasible due to the lack of research on this problem.[5] The last counter argument recalled here will be resulting from the previous one: "Research on non-speech oral motor exercises cannot be taken into account because it has been conducted for languages other than Polish". Well, in some areas, you can refer them also to the Polish language, because the foreign studies mentioned in this article concern phonetic systems in where the speech sounds are articulated inside the oral cavity and based on a widely-formed tongue – just like in Polish. Thus, it is possible to compare **general rules** of speech therapy for specific articulation disorders type (here in peripheral disorders of articulation) in terms of:

- principles of tongue exercises due to the introspective place of articulation and behavior the width of the tongue;
- use (or not) of primary functions treatment during speech therapy in peripheral articulation disorders;
- the methodological canvas of tongue exercises in the context of phonetic features vowels, including (or not) developmental and/or therapeutic sequences phonetic therapy in the context of faulty phonetic features, e.g., interdentality, asymmetrical tongue posture, etc.

[5] On a side note, it is difficult to imagine the methodology of this type of research – scientists would have to select a group of subjects who would be deliberately deprived from access to the cause-effect therapy of articulation based on phonetic and anatomic data as well as on reliable and current scientific reports.

In the selecting of therapy methods, the articulatory phonetics along with the anatomy and physiology of orofacial space, taking into account the specificity of the mechanism of disorders, should be the final signpost for the therapist. Certainly, the topic discussed in this publication requires further research and analysis.

REFERENCES

Bunton K., 2008, *Speech versus Nonspeech: Different Tasks*, Different Neural Organization.

Forrest K., 2002, *Are oral-motor exercises useful in treatment of phonological/articulation disorders?*, "Seminars in Speech and Language", 23: 15–25.

Gick B., Wilson I., Koch K., Cook C., 2004, *Language-specific articulatory settings: Evidence from inter-utterance rest position*, "Phonetica", 61: 220–233.

Grossman J., 1997, *Ćwiczenia zabawowe w rehabilitacji dzieci z rozszczepami podniebienia*, „Postępy Rehabilitacji", t. 11, z. 1.

Hiiemae K.M., Palmer J.B., 2003, *Tongue movements in feeding and speech*, "Critical Reviews in Oral Biology & Medicine", 14(6): 413–429.

Lof G., 2003, *Oral motor exercises and treatment outcomes. Perspectives on language*, "Learning and Education", 10(1): 7–12.

Lof G., 2008, *Controversies surrounding nonspeech oral motor exercises for childhood speech disorders*, "Seminars in Speech and Language", 29(4): 253–255.

Lof G., 2009, *The nonspeech-oral motor exercise phenomenon in speech pathology practice*, [in:] *Children's Speech Sound Disorders*, C. Bower (ed.), Wiley-Blackwell, Oxford, 181–184.

Mackiewicz B., 2001, *Odwzorowanie czynności pokarmowych w ruchach artykulacyjnych*, „Logopedia", 29: 91.

Mackiewicz B., 2002, *Dysglosja jako jeden z objawów zespołu oddechowo-połykowego*, UG, Gdańsk.

Michalak-Widera I., 2011, *Śmieszne minki dla chłopczyka i dziewczynki – ćwiczenia usprawniające wymowę*, Katowice.

Morkowska E., Żmuda-Trzebiatowska K., 2008, *Język hop do góry! Ćwiczenia logopedyczne dla dzieci*, Seventh Sea, Warszawa.

Ostapiuk B., 2005, *Logopedyczna ocena ruchomości języka*, [in:] *Logopedia. Teoria i praktyka*, red. M. Młynarska, T. Smereka, Agencja Wydawnicza a linea, Wrocław, 299–306.

Ostapiuk B., 2013a, *Dyslalia. O badaniu jakości wymowy w logopedii*, US, Szczecin.

Ostapiuk B., 2013b, *Dyslalia ankyloglosyjna. O krótkim wędzidełku języka, wadliwej wymowie i skuteczności terapii*, US, Szczecin.

Pluta-Wojciechowska D., 2006, *Zaburzenia mowy u dzieci z rozszczepem wargi i podniebienia. Badania – Teoria – Praktyka*, Ergo-Sum, Bielsko-Biała.

Pluta-Wojciechowska D., 2009, *Połykanie jako jedna z niewerbalnych czynności kompleksu ustno-twarzowego*, „Logopedia", 38: 119–148.

Pluta-Wojciechowska D., 2010, *Podstawy patofonetyki mowy rozszczepowej. Dyslokacje*, Ergo-Sum, Bytom.

Pluta-Wojciechowska D., 2011, *O ćwiczeniach tak zwanej pionizacji języka*, [in:] *Biologiczne uwarunkowania rozwoju mowy i myślenia*, t. 2, red. M. Michalik, Kraków, 209–222.

Pluta-Wojciechowska D., 2011, *Mowa dzieci z rozszczepem wargi i podniebienia*, UP, Kraków.

Pluta-Wojciechowska D., 2013, *Zaburzenia czynności prymarnych i artykulacji. Podstawy postępowania logopedycznego*, Ergo-Sum, Bytom.

Pluta-Wojciechowska D. 2014/2015, *Prototypowe doświadczenia orofacjalne*, „Logopedia" 43/44: 43–62.

Pluta-Wojciechowska D., 2015, *Zaburzenia czynności prymarnych i artykulacji. Podstawy postępowania logopedycznego*, (2nd ed.), Ergo-Sum, Bytom.

Pluta-Wojciechowska D., 2017, *Dyslalia obwodowa. Diagnoza i terapia logopedyczna wybranych form zaburzeń*, Ergo-Sum, Bytom.

Pluta-Wojciechowska D., 2018 (in print), *O „czarach i sztuczkach" podczas wywoływania głosek w przypadku dyslalii obwodowej. Wyniki wstępnych badań efektywności terapii za pomocą SMURF*, „Logopedia".

Pluta-Wojciechowska D., 2019, *Efektywność terapii dyslalii. Logopedyczno-lingwistyczna analiza wyników badań*, UŚ, Katowice.

Pluta-Wojciechowska D., Sambor B., 2016, *O różnych typach wędzidełka języka, ich ocenie i interpretacji wyników badań w logopedii*, „Logopedia", 45: 123–155.

Pluta-Wojciechowska, B. Sambor, 2017, *Pomiędzy słowem, frazą i zdaniem, czyli o śródwymawianiowej pozycji artykulacyjnej zwanej Inter-Speech u osób z i bez dyslalii obwodowej*, Gdańsk, 169–189.

Powell T.W., 2008, *An integrated evaluation of nonspeech oral motor treatments*, "Language, Speech, and Hearing Services in Schools", 39: 422–427.

Psaume J., Malek R., Mousset M.R., Trichet Ch., Martinez H., 1986, *Technique et résultats du traitement total précoce des fentes labio-palatines*, « Folia Phoniat. », 38: 176–220.

Rocławski B., 2001, *Podstawy wiedzy o języku polskim dla glottodydaktyków, pedagogów, psychologów i logopedów*, Gdańsk.

Ruscello D.M., 2008, *Nonspeech oral motor treatment issues in children with developmental speech sound disorders*, "Language, Speech, and Hearing Services in Schools", 39: 380–391.

Sambor B., 2014/2015, *Zaburzone wzorce połykania i pozycji spoczynkowej języka a budowa artykulacyjna głoskowych realizacji fonemów u osób dorosłych*, „Logopedia", 43: 149–188.

Sambor B., 2015, *Mówienie z tzw. szczękościskiem – fakty i mity*, [in:] *Diagnoza i terapia zaburzeń realizacji fonemów*, red. D. Pluta-Wojciechowska, UŚ, Katowice, 157–174.

Sambor B., 2016, *Logopedyczne badanie młodych adeptów sztuki aktorskiej*, [in:] *Logopedia Artystyczna*, red. S. Milewski, B. Kamińska, Harmonia Universalis, Gdańsk, 460–485.

Sambor B., 2017, *Skaza dykcyjna czy wada wymowy? Analiza badań realizacji fonemów spółgłoskowych u młodych adeptów sztuki teatralnej*. Praca doktorska: promotor: dr hab. prof. UŚ, Danuta Pluta-Wojciechowska, Katowice.

Serrurier A., Badin P., Barney A., Boë L.-J., Savariaux C., 2012, C*omparative articulatory modelling of the tongue in speech and feeding*, "Journal of Phonetics", (40)6: 745–763.

Szłapa K., 2005, *Cmokaj, dmuchaj, parskaj, chuchaj*, Harmonia, Gdańsk.