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Laryngological and Audiological Determinants of the Well-being of Children with Desonorization*

SUMMARY

The paper presents the results of the author's research on desonorization in dyslalia concerning the laryngological determinants of the well-being of children with impaired realization of voicing of obstruent phonemes. The research material comes from 30 subjects with desonorization between 4.7 and 17.8 years of age. On the basis of laryngological examinations it was found that the majority of children with desonorization require specialist medical care due to anomalies within the Waldeyer tonsillar ring that imply otological and audiological problems. The conducted studies show that a necessary condition for diagnostic-therapeutic management in cases of desonorization disorders is laryngological examination and specialist treatment.

Keywords: pharyngeal tonsil, palatine tonsils, speech disorders, desonorization, children

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INTRODUCTION

The term ‘desonorization’ (Lat. *sonorus* – resonant) has been adopted to apply to distortions, not determined by the neutralization of voicing opposition of distortions, of sound realizations of voiced phonemes in the form of their voiceless instead of voiced realizations. In earlier logopedic studies these types of abnormalities were termed “voiceless speech/articulation” (Kania 1975). The author’s recent studies into desonorization in dyslalia were oriented towards analyzing and describing the observed logopedic phenomena at the articulatory, acoustic and auditory levels (Konopska 2015). The findings made during these studies show that children with desonorization realize with defects not only voiced but also voiceless obstruent phonemes that make up the unmarked element of the voicing opposition, on the basis of which the marked element of the opposition is acquired in the ontogeny of the language. Furthermore, in almost all the subjects (97%), faulty realizations of voiceless obstruent phonemes co-occur with faulty realizations of sonorant phonemes (Konopska 2015). For logopedic theory and practice this means inter alia that in children with desonorization in obstruent phonemes, what should be done in the first place is to improve the sound realizations of voiceless phonemes (Konopska 2015, 2018).

A continuation of the cited studies is now the inquiries into the causes of disorders in the realization of the voicing of obstruent phonemes, in which the answer is sought to the question: *What are the determinants of desonorization in dyslalia*? The obtained and published data on the pre-, peri- and early postnatal determinants of the well-being[1] of children with desonorization shows that the majority of the subjects (75%) were born from high-risk pregnancy; consequently, the overwhelming portion of this group consists of high-risk group children. Furthermore, it was found that in the majority of children of this group (75%) during the pre- and/or peri- and/or early postnatal period there are single factors or groups of factors endangering their well-being, including the normal development of speech (Konopska 2017).

The results of studies on the otological and audiological determinants of the well-being of children with desonorization were published in the earlier report (Konopska 2018). They demonstrate that in 80 percent of the studied children with desonorization there are abnormalities within the tympanic membrane with regard to its color, light reflex, position and translucency. In 53 percent of subjects, impedance audiometry provided data indicating secretory otitis media and/or dysfunction of the auditory tube; and also bilateral or unilateral conduc-

[1] The WHO definition of health reads: “A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (Domaradzki 2013).

tive hearing loss was found by tonal audiometry in 53 percent of subjects (Konopska 2018).

The goal of the present paper is to present the results of the author's studies on the following detailed research problem: *What are the laryngological determinants of the well-being of children with desonorization?*

1. MATERIAL AND METHODS

The collected research material comes from 30 subjects with desonorization aged between 4.7 and 17.8 years, of whom: 21 males (70% of the subjects) and 9 females (30% of subjects). The mean age is 7 years and 6 months. The presented research results are related to selected medical diagnoses[2], as well as the results of specialist treatment. During the otolaryngological examination, the following were assessed in accordance with the binding standards:

1. the nasal cavity: nasal patency, the state of the nasal mucosa, the presence and nature of secretions in the cavities of the nose, the size of the nasal conchae, and the state of the nasal septum,
2. the nasopharyngeal cavity: patency of the choanae, the size, shape and position of the pharyngeal tonsil
3. the throat: the size of palatine tonsils, the mobility and tone of the soft palate, the respiratory and phonatory position of the palatine arches
4. auricles and retroauricular regions,
5. the external acoustic duct and the tympanic membrane (otoscopic examination),
6. physical hearing assessed by pure tone audiometry and impedance audiometry (tympanometry)

The paper discusses the results of laryngological examinations obtained during the first medical appointment and after specialist treatment applied.

1.1. Evaluation of the pharyngeal tonsil

The pharyngeal tonsil (Lat. *tonsilla pharyngea*) is situated in the nasal part of the throat, at the transition of the ceiling of the throat into the posterior wall, directly opposite the choanae and proximate to the pharyngeal opening of the auditory tube, and, together with the palatine tonsils, tubal tonsils, and lingual

[2] All otorhinolaryngological, audiological and phoniatric examinations were performed by one physician – Elżbieta Teresińska, MD, PhD (Individual Specialist Medical Care, Szczecin) specialist grade I in otorhinolaryngology, specialist grade II in phoniatrics and audiology, and with completed post-graduate (post-MA) studies in logopedics. A total of 110 diagnostic-treatment audiological-laryngological-phoniatric visits were conducted, in which the author took part every time.

tonsil, as well as with single lymphatic follicles dispersed in the pharyngeal mucosa and with lateral cords of lymphatic tissue located in the posterior part of throat, it forms the Waldeyer tonsillar ring, also called the lymphoid ring. The Waldeyer ring is a significant and integral element of the immune system of the human organism, and owing to its location at the crossing of the respiratory tract and the alimentary tract, it functions as a "guard" of the respiratory tract (Zając, Jakubowska 2001).

Tonsillar buds are formed very early, i.e. in the 3rd and 4th month of fetal life, and the tonsils are already partly developed in the newborns but are very small. The successive growth of tonsils (because of contact with antigens) begins from the age of six months, when the child begins to develop his/her own mechanisms of immunological response, and loses passive immunity passed on by the mother. The systematic enlargement of the pharyngeal tonsil lasts until the age of three, its largest size being achieved between the age of three to seven years[3]. After the age of seven or eight years, the pharyngeal tonsil begins to gradually atrophy, and in persons aged 17 to 20, only its trace remnants are found. One can distinguish physiological hypertrophy of the tonsil, which evidences the active defense mechanism against environmental antigens, and pathological hypertrophy, which occurs when the enlarged pharyngeal tonsil impairs nasal patency. The rate of growth of the tonsils can be influenced by, inter alia, recurrent infections of the upper airways, allergic and dietary factors[4], and hereditary predispositions (Zając, Jakubowska 2001, Gryczyńska 2008).

The currently recognized "gold standard" in diagnosing the hypertrophy of the pharyngeal tonsil in children is nasofibroscopy (Kubba, Bingham 2001, Broda et al. 2009, Kopala, Rudzki 2012). This examination is performed through the nasal entry by means of an endoscope with a mobile camera and light source combined with the visual tract. The digital recording of the examination enables its play-back and evaluation. Nasofibroscopic examination requires the patient's cooperation, among others, calm behavior while the endoscope is being inserted into the nasal cavities, maintaining of the motionless position of the head, and repetition of syllables in order to enable an exact evaluation of the position of the soft palate. In the examinations in question, nasofibroscopic examination was attempted in each child, however, in some cases nasofibroscopy was made difficult, inter alia because of the lively reactions by a child, or swelling of the nasal conchae. In such cases the evaluation of the nasopharynx was attempted after the treatment of the nose, and through the middle throat (posterior rhinoscopy using a rigid endoscope or by means of a mirror). The final solution, when attempts to use the abovementioned methods failed, was the palpable evaluation of the tonsil.

[3] Similarly, the physiological enlargement between the age of 3 and 7.

[4] The location of adenoids within the Waldeyer ring exposes them to contact with inhalation allergens.

The size of the pharyngeal tonsil in nasofibroscopic examination was assessed with regard to the surface area of the choanae based on the digitally recorded or posterior rhinoscopy. The tonsil was defined as small when it covered up to 30 percent of the choanal space (the adenoid tissue reaches 1/3 of the choanae), medium – if it occupied > 30% to 50 cent of the choanae (the adenoid tissue reaches up to 1/2 of the choanae), large – if it occupied > 60% to 80 percent of the choanal space (the adenoid tissue reaches up to 2/3 of the choanae) and very large – if the tonsil covered > 80 percent of the choanal space (the adenoid reaches up to more than 2/3 of the surface area of the choanae) (Broda et al. 2009, Caylakli et al. 2009, Gromek, Krzeski 2010, Feres et al. 2013). In laryngological examinations the Xion video otoscope was used with the application of soft optics – a pediatric nasopharyngoscope[5] with the diameter of the working part: Ø 2.8 mm along the whole length, and rigid optics – with the diameter of the working part at Ø 10 mm.

1.2. Evaluation of the palatine tonsils

The palatine tonsils (Lat. *tonsillae palatinae*) are located on both sides in the so-called tonsillar sinus between the palatoglossal and palatopharyngeal arches. The lateral surface of each tonsil touché son the muscular coat of the throat and the buccopharyngeal part of the upper pharyngeal sphincter muscle, and the posterior part meets the palatopharyngeal arch. The regular shape of the palatine tonsils is oval, and their size (if they are not pathologically enlarged) is that of sweet cherry. The palatine tonsils achieve the largest size at the fifth or sixth year of age, whereas they undergo involution in later years (Zając, Jakubowska 2001, Łasiński 1993, 94–96). When evaluating the size of the palatine tonsils during breathing at rest, the following are taken into account: the shape of the pharyngeal cavity, placement of the tonsils in the tonsillar niche, and the width of the intertonsillar space. The size of the tonsils is usually evaluated in relation to the transverse diameter of the middle throat, but account is also taken of the possibility of their hypertrophy in the anteroposterior diameter and in the height dimension. To assess the size of the palatine tonsils, the five-grade Pirquet scale was applied:

- grade I – tonsils at rest – invisible,
- grade II – tonsils do not reach the palatopharyngeal arch
- grade III – tonsils fill the niche without protruding beyond the palatine arches,

[5] The reported studies used a pediatric nasopharyngoscope purchased from the funds of the implemented research project no. N N104 084639, and a Xion video otoscope, part of the equipment of the phoniatric room of the Individual Specialist Medical Care provided by E. Teresińska, MD, PhD (Szczecin).

– grade IV – tonsils protrude beyond the palatine arches, sometimes more strongly causing the bulging of the palatoglossal arch,
– grade V – tonsils protrude from the arches as tuberous formations, almost touching on the midline (Kuczkowski 2014, 167–175).

In the case of the asymmetric enlargement of the palatine tonsils, the point of reference was one that was more enlarged. Examinations were first conducted without an endoscope because its introduction sometimes provoked a reflex of pushing out the tonsils, and their bulging beyond the palatoglossal arches, thereby falsely impacting the evaluation of the tonsil size. The evaluation also covered the symmetry at rest and phonatory symmetry of the palatine arches as well as the soft palate with the uvula, including the possibility of the medial flow of the stream of articulation air. The subject of the evaluation was the maintenance of symmetry or its absence. If the palatine arches and the soft palate were symmetrically set and the unilaterally enlarged tonsil blocked the airflow almost entirely or entirely, in such cases the arrangement was assessed as asymmetrical. The examinations were conducted independently by a laryngologist and by the author of the present study during logopedic examinations. A comparative analysis of the examination results for the breathing position of the palatine arches and the soft palate showed an 86% compatibility, and for the phonatory position - 93%. As these examinations were conducted at different times (logopedic ones before medical examinations), Table 1 presents the results of medical examinations regarding laryngological evaluation. This paper presents the results of the evaluation of the pharyngeal tonsil before and after treatment, and the evaluation of the palatine tonsils before treatment[6].

1. Results and Discussion

1.1. Pharyngeal tonsil

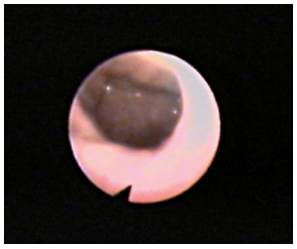
Table 1 contains the results of laryngological examinations concerning the evaluation of the patency of the nasopharynx and the size of the pharyngeal tonsil

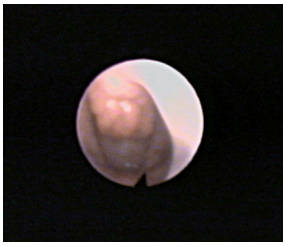
[6] In some cases a slight reduction in the size of the palatine tonsils was observed after the treatment of the pharyngeal tonsil but, since the specificity of treating the hypertrophy of the palatine tonsils differs from that of the pharyngeal tonsil, the study presents the results of evaluation of the palatine tonsils only from the first laryngological visit. The treatment of the hypertrophy of the palatine tonsils may consist in *tonsillotomy* or in *tonsillectomy*. The total excision of the palatine tonsils (tonsillectomy) is seldom performed in children and for other indications than their size only. The procedures of their partial reduction (tonsillotomy) are performed more often, however, in comparison with the procedures on the pharyngeal tonsil, the two interventions are performed far less frequently in children. Absolute indications include obstructive sleep apnea syndrome, recurrent hemorrhagic tonsillitis, or peritonsillar abscess (Zając, Jakubowska 2001).

Table 1. The Results of laryngological examinations – nasopharynx: the evaluation of the palatine tonsil

Evaluation of the pharyngeal tonsil (N = 30)						
Condition after prior adenoidectomy	Small up to 30%	Medium enlarged > 30% to 50%	Largely enlarged > 60% to 80%	Very largely enlarged > 80%	In need of treatment	
					Yes	No
2 7%	9 30%	4 13%	7 23%	8 27%	17 57%	11 37%

In the group of 30 children with desonorization, a prior adenoidectomy of the pharyngeal tonsil was reported in the case of two subjects. The non-enlarged pharyngeal tonsil was found in 9 children (to 30%), a medium enlargement of the pharyngeal tonsil was found in 4 children (> 30% do 50%), the pharyngeal tonsil was largely enlarged in 7 subjects (> 60% to 80%), and very largely enlarged in 8 (> 80%). The different conditions of adenoids found during laryngological examinations in the subjects with desonorization are illustrated in Fig. 1.

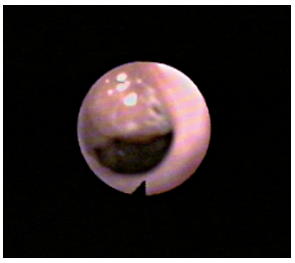


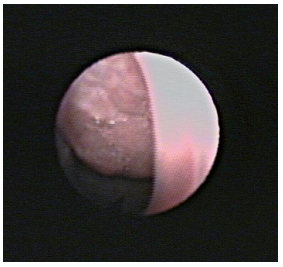


1.a.) the picture of the ceiling of the posterior pharyngeal wall during fibroscopic examination

1.b.) the picture of the ceiling of the posterior pharyngeal wall during posterior endoscopy

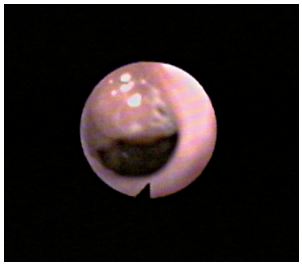
Atrophied adenoids (up to 30%). Female, 13.7 years



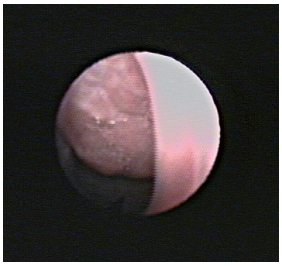


1.c.) medium-sized adenoids (> 30% to 50%), male 8.7 years

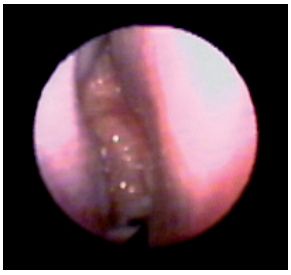
1.d.) medium-sized adenoids (> 30% to 50%), female 5.9 years



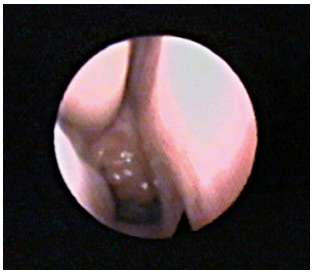
1.e large adenoids
(> 60% to 80%), male 5.3 years



1.f.) large adenoids
(> 60% to 80%), male 8.4 years



1.g.) very large adenoids (> 80%). The floor of the nasopharyngeal cavity covered by mucopurulent secretion, female 6.3 years



1.h.) very large adenoids
(> 80%), male 6.6 years

Fig. 1. Fibroscopy pictures of the choanae and pharyngeal tonsil

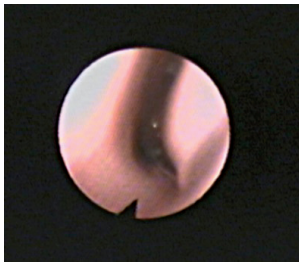
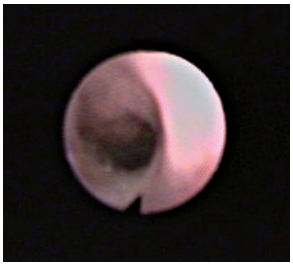
Treatment of the hypertrophied pharyngeal tonsil was started in 17 children (57 percent of the subjects), and it was conservative treatment in the case of 16 children. The main criterion for starting treatment was the data obtained from audiological and tympanometric examinations (conductive hearing loss, dysfunction of the auditory tube, secretory otitis media) and the data obtained from medical histories (inter alia chronic breathing through the mouth, snoring while sleeping, recurrent infections of the upper airways). Conservative treatment was administered to all children with the III^0 and IV^0-grade enlarged pharyngeal tonsil and in two children with the II^0–grade enlarged tonsil. In all the cases, a significant improvement was achieved; however, in the case one child, with the diagnosed hypertrophied tonsil IV^0, and after treatment - with III^0, a decision was made to refer the child to adenoidectomy (which was performed) because there was a per-

sistent impatency of the auditory tube and difficulties in nasal breathing. In the case of two children with the same results as in the child described above, further observation and monitoring was recommended (Table 2.).

Table 2. Results of laryngological examinations – nasopharynx: the evaluation of the pharyngeal tonsil before and after treatment[7]

The size of the pharyngeal tonsil before treatment (30 subjects) and after treatment (15 subjects)					
The size of the pharyngeal tonsil	Before treatment		After treatment		Total
	N = 30	%	N = 15	%	
Small up to 30% (I^0)	9	30.0%	0	0.0%	9
Medium-enlarged > 30% to 50% (II^0)	4	13.3%	11	73.3%	15
Largely enlarged > 60% to 80% (III^0)	7	23.3%	3	20.0%	10
Very largely enlarged > 80% (IV^0)	8	26.7%	0	0.0%	8
The condition after prior adenoidectomy	2	6.7%	0	0.0%	2
Adenoidectomy intervention	0	0.0%	1	6.7%	1
Total	30		15		45
Pearson Chi ^2	22.35		df = 5		p = **0.00045**
Spearman R rang	-0.09		t = -.6044		p = 0.54873

Selected fibroscopy pictures of the pharyngeal tonsil before and after conservative treatment are illustrated in Fig. 2.

The picture of the pharyngeal tonsil during fibroscopy examination before treatment	The picture of pharyngeal tonsil during fibroscopy examination after treatment
	
2.a.) very large adenoids (> 80%) with purulent secretion	2.b.) medium-sized adenoids (> 30% to 50%)

[7] The data in Table 2 relate to 15 patients because in two cases their mothers did not report with them to follow-up examinations.

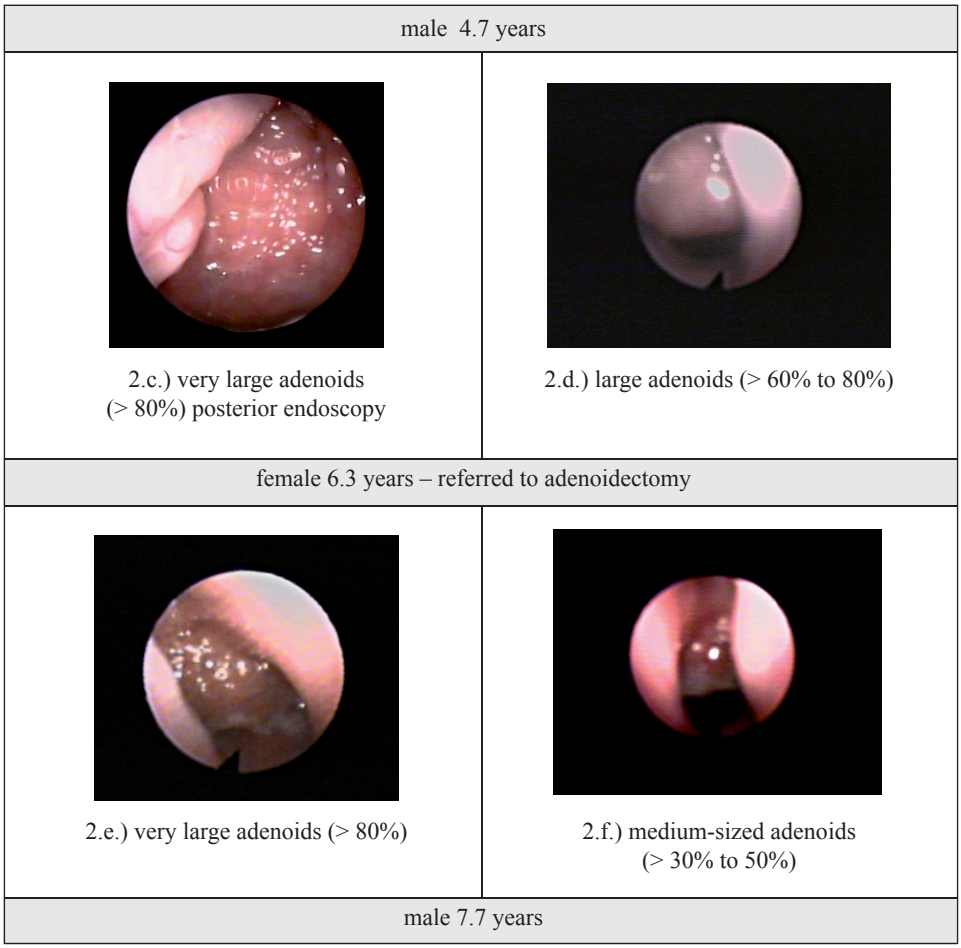


Fig. 2. Fibroscopy pictures of the pharyngeal tonsil before and after conservative treatment

1.2. Palatine tonsils, palatine arches, and soft palate

As shown by the data in Table 3., in the studied group the most frequent is the presence of the fourth-grade enlargement of the palatine tonsils (43%), in which the tonsils protrude beyond the palatine arches, sometimes more strongly causing the bulging of the palatoglossal arch; the next in order is grade III (23%), in which the tonsils fill the niche in which they are located without protruding beyond the palatine arches; less frequent is grade II (17%), in which the tonsils do not touch the palatoglossal arch, while grade I (tonsils at rest - invisible) and grade V - all according to the Pirquet scale - (the tonsils protrude from the arches as tuberous formations, almost touching on the midline) are the least frequent (10% and 7% respectively).

Table 3. Results of otorhinolaryngological examinations – the size of the palatine tonsils and the breathing and phonatory position of the palatine arches in children with desonorization

Evaluation of the palatine tonsils and the breathing and phonatory position of the soft palate with uvula (N = 30)								
The size of palatine tonsils					Soft palate			
					in breathing position		during phonation	
I^0	II^0	III^0	IV^0	V^0	symmetrical	asymmetrical	symmetrical	asymmetrical
3 10%	5 17%	7 23%	13 43%	2 7%	18 60%	12 40%	16 53%	14 47%

During breathing at rest, the symmetrical position of the palatine arches was reported in 60 percent of the subjects, while asymmetry was found in 40%. The asymmetrical position of the palatine arches during phonation (in height and in width) combined with or without deviation of the uvula was also found in 53 percent of the subjects (Table 3). The obtained data show that the occurrence of the asymmetrical positioning of the palatine arches (in height and in width) in the breathing position increases with their size. In the breathing position and in the process of phonation a significant risk factor for the occurrence of the asymmetrical position of the palatine arches and soft palate with the uvula in the studied group is grades IV^0 and V^0 of hypertrophy of the palatine tonsils (Tables 4–5).

Table 4. The breathing position of the palatine arches and the soft palate with uvula versus the size of the palatine tonsils

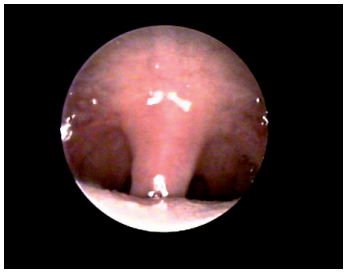
Palatine arches, soft palate in breathing position	The size of the palatine tonsils				
	I^0	II^0	III^0	IV^0	V^0
	N=3	N=5	N=7	N=13	N=2
symmetrical N = 18	2	5	6	5	0
	67%	100%	86%	38%	0%
asymmetrical N = 12	1	0	1	8	2
	33%	0%	14%	62%	100%

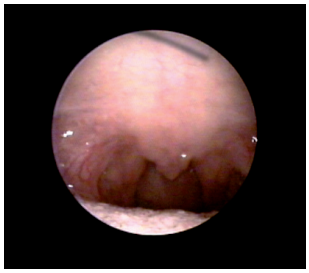
Table 5. The position of the palatine arches and the soft palate with uvula during phonation and the size of the palatine tonsils

Palatine arches, soft palate during phonation	The size of the palatine tonsils				
	I^0	II^0	III^0	IV^0	V^0
	N=3	N=5	N=7	N=13	N=2
symmetrical N = 16	2	5	5	4	0
	67%	100%	71%	31%	0.0%
asymmetrical N = 14	1	0	2	9	2
	33%	0%	29%	69%	100%

Figure 3 illustrates selected pictures of the palatine arches and the soft palate with the uvula during breathing at rest and during phonation in relation to the size of the palatine tonsils (results of laryngological and logopedic examinations)[8].

The size of the palatine tonsils: grade II – the tonsils do not touch the palatopharyngeal arch



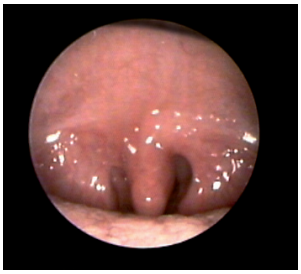


3.a.) breathing position without asymmetry 3.b.) phonation without asymmetry

female, 6.0 years

[8] The pictures of the palatine tonsils (in Fig. 3), obtained using an endoscope, penetrate the oral and pharyngeal cavity far deeper than during essential evaluation. For the purposes of the study such views were selected as are the most accordant with the evaluation of symmetry/asymmetry of the palatine arches and the soft palate with the uvula.

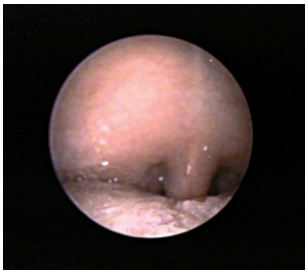
The size of the palatine tonsils: grade II – the tonsils do not touch the palatopharyngeal arch

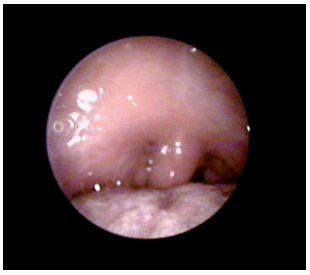


3.c.) breathing position with asymmetry 3.d.) phonation with asymmetry

female, 6.0 years

The size of the palatine tonsils: grade V – the tonsils protrude from the arches as tuberous formations, almost touching on the midline





3.e.) breathing position with asymmetry 3.f.) phonation with asymmetry

female, 6.3 years

3.g.) breathing position with asymmetry 3.h.) phonation with asymmetry

male, 6.1 years

Fig. 3. The position of the palatine arches and the soft palate with the uvula during breathing at rest and during phonation in relation to the size of the palatine tonsils

2. SUMMARY AND CONCLUSIONS

The list of the negative results of the hypertrophied pharyngeal tonsil is not only long but also extensive in terms of the systems and organs affected by these results. They mainly affect the hearing organ, chewing organ, speech organ, respiratory system and the circulatory system. The change of the respiratory pattern from nasal into oral caused by the hypertrophied pharyngeal tonsil and the occurring states of temporary anoxia produce disorders in overall somatic, intellectual and emotional development" (Gryczyńska 2008).

Among children's conditions presented in medical literature and related to the hypertrophy of the pharyngeal tonsil, those most frequently listed are: dysfunction of the auditory tube, chronic secretory otitis media, obliterative otitis media, conductive hearing loss, chronic nasal sinusitis, chronic nasal obstruction, chronic cough syndrome, obstructive sleep apnea and its consequences, malocclusion, and disordered development of the facial skeleton (Gromek, Krzeski 2010, 8–9).

One of the significant problems in logopedic practice, found in children and associated with the pathology of the pharyngeal tonsil, is audiological implications. The enlarged pharyngeal tonsil, because of its location in the nasopharyngeal cavity, usually impairs the patency of the auditory tube (Lat. *tuba auditiva*), whose main task is to equalize pressure between the middle ear and the environment (ventilation function) to drain mucus and secretion from the tympanic cavity (drainage function). The auditory function also performs a protective function: its closed opening prevents the permeation of secretion form the nasopharyngeal cavity into the middle ear space. Since the auditory tube in children is relatively wide, and its position (at an angle of 20^0) is more horizontal than in adults (at an angle of 45^0), such anatomical conditions are conducive to easier penetration by bacteria [9] and to dysfunctions of the auditory tube, and – concomitantly – predispose to recurrent acute otitis media (Lat. *otitis media acuta* – OMA), to the development of secretory otitis media (Lat. *otitis media secretoria* – OMS), which can be an initial stage of OMA or its consequence (in 60–70 percent of children OMS occurs after OMA within 2 weeks, in 40% – after 4 weeks, and in 10–25% – after 3 month), and to chronic suppurative otitis media (Lat. *otitis media suppurativa chronica*,

[9] The nasopharyngeal area in children is copiously colonized by various bacterial strains. These are bacteria that are part of the physiological flora of the upper airways and potentially pathogenic ones. The majority of these bacterial strains form a biofilm on the surface of the tonsil, and within its sulcus, which causes the pharyngeal tonsil to be regarded as a reservoir of pathogenic bacteria responsible for the development of bacterial (chronic and acute) paranasal sinusitis in children as well as acute otitis media, and secretory otitis media with concomitant conductive hearing loss (Gromek, Krzeski 2010).

CSOM)[10]. If the hypertrophied tonsil covers and compresses the openings of auditory tubes or their impatency is caused by a swelling or mucous secretion, then, in the middle ear because of its disturbed ventilation, a fluid accumulates, which leads to poorer sound conduction and impaired hearing, especially within the range of low tones (Radzikowski, Gryczyńska 2004, Obrębowski, Obrębowska 2009). Disorders in the patency of the auditory tube can also be caused by the inflammatory or allergic conditions of the mucous membrane of the auditory tube, hypertrophy of the tubal tonsil, endocrine disorders (e.g. hypothyroidism), and others (Zielnik-Jurkiewicz 2009).

In the discussed group of 30 children with desonorization, in more than half of the subjects (53%) abnormalities within the tympanic membrane, inflammatory conditions of the middle ear, and/or dysfunctions of the auditory tube were found, and subsequently – bilateral or unilateral conductive hearing loss (Konopska 2018). The data presented in Table 6 show that in the group of children with normal physical hearing and in the group of children with hearing loss, the occurrence of particular grades of the hypertrophy of the pharyngeal tonsil is at the level of statistical significance ($p = 0.09927$); however, also noticeable is a tendency for a more frequent occurrence of the higher degree of the hypertrophied pharyngeal tonsil and a less frequent occurrence of the lower degree of the hypertrophied pharyngeal tonsil in the group with hearing loss compared with the group with normal hearing. The data contained in Table 7 explicitly show that the administered treatment of the pharyngeal tonsil has significantly improved physical hearing in the studied group ($p = 0.02672$), which is a condition for effective logopedic therapy in cases of desonorization disorders.

[10] It should be added that the size of the auditory tube and the degree of the closure of the pharyngeal opening in its chondral part change with age. The average length of the auditory tube in the newborn is 17.5 mm, in an 3-months old infant– 21.2 mm, and in an adult – 37 mm on average. In children the pharyngeal opening of the auditory tube is continually not entirely closed until the age of 2 years, which is conducive to inflammatory conditions of the middle ear (Zielnik-Jurkiewicz 2009). Examinations of children aged up to 3 years, with recurrent otitis media with effusion, and with or without hearing loss, show that the level of hearing at the age of 12–18 months is significantly connected with the occurrence of delayed speech development and low language skills at the age of three years. The risk of occurrence -at the age of three- of subclinical (latent) or clinical symptoms of delayed speech development and lower language skills is 2% for children, in whom, at the age of 12–18 months, the mean values of hearing loss were less than 20 dB, and 33% for children, in whom, at the age of 12–18 months, the mean values of hearing loss were more than 20 dB (Shriberg et al. 2000).

Table 6. The size of the pharyngeal tonsil and the condition of physical hearing before treatment

The size of the pharyngeal tonsil	Physical hearing				
	Normal hearing	%	Hearing loss	%	Total
Small 30%	5	36%	4	25%	9
Medium enlarged > 30% do 50%	4	29%	0	0%	4
Largely enlarged > 60%	2	14%	5	31%	7
Very largely enlarged > 80%	3	21%	5	31%	8
Condition after prior adenoidectomy	0	0.0%	2	13%	2
Total	14		16		30
Pearson Chi^2	7.80		df = 4		p = *0.09927*
Spearman R rang	0.31		t = 1.7044		p = *0.09939*

Tab. 7. Treatment of the pharyngeal tonsil and the condition of physical hearing after treatment

Treatment of the pharyngeal tonsil	Physical hearing				
	Normal hearing	%	Hearing loss	%	Total
Yes	8	33%	3	100%	11
No	16	67%	0	0%	16
Total	24		3		27
Pearson Chi^2	4.91		df = 1		**p = 0.0267**2
Spearman R rang	-0.43		t = -2.357		p = 0.02656

Hypertrophy of the palatine tonsils occurs most often with hypertrophy of the pharyngeal tonsil, and this also usually correlates with the degree of its enlargement. The hypertrophied palatine tonsils cause the narrowing of the respiratory tract within the middle throat and are "one of the main causes of the obstructive sleep apnea syndrome" (Zając, Jakubowska 2001, 131). The principal symptom of this syndrome in children is inter alia the oral breathing pattern, snoring, as well as apnea and unnatural positions while sleeping. Hypertrophic changes within the Waldeyer ring also influence the mobility of the soft palate, swallowing dif-

ficulties (especially with solid foods), the low resting position of the tongue, and speech disorders (Eom et al. 2014, Kuczkowski 2014, Borox et al. 2018, Malicka 2018). A syndrome that co-occurs with the enlarged palatine tonsils, observable in the author's logopedic practice, particularly in the case of their asymmetrical hypertrophies, is the deviation of the mandible with the tongue during speaking towards the space with a large flow surface for the expiratory-articulatory air stream.

The results of the author's studies on the determinants of disorders in the realization of voicing with regard to the laryngological determinants of the well-being of children with desonorization permit conclusions that:

1. Most children with desonorization require specialist medical care because of the abnormalities within the Waldeyer ring that imply otological and audiological problems.
2. In the case of desonorization disorders, a necessary condition for the right logopedic diagnostic-therapeutic management is laryngological-audiological examination and specialist treatment.

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