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The importance of endoscopic evaluation of adenotonsillar hypertrophy and its influence on nasal resonance and articulation in children

ABSTRACT

Adenotonsillar hypertrophy is very common in childhood. Obstruction of the nasopharyngeal airway may cause obligatory oral breathing, chronic open-mouth posture, incorrect inferior or anterior-inferior position of the tongue, disordered swallowing and impaired facial growth. Facial growth disorders frequently result in onset of the specific types of malocclusion and specific speech disorders. Obstruction of the pharynx during sleep by adenotonsillar hypertrophy remains the main cause of sleep apnea syndrome in children. Obstruction of the upper airway by the enlarged adenoid and/or hypertrophic tonsils may lead to hyponasality of the voice and/or cul-de-sac resonance. Malocclusions, in turn, in association with the incorrect tongue positioning in the oral cavity give rise to the disordered articulation of anterior consonants.

Key words: adenotonsillar hypertrophy, upper airway obstruction, nasendoscopy, swallowing, malocclusion, resonance, articulation

The overgrowth of the adenoidal tissue, so often found in childhood, is related to the acquisition of immunity by a child. Both the adenoid and the tonsils play an active role in combating infections in children and often constitute the first immune barrier in the way of spreading the infection (Van Cauwenberge

et al. 1995). However, their overgrowth often affects negatively the patency of the upper airway and thereby causes a whole range of secondary complications. These include primarily a change in the physiological mode of breathing through the nose for non-physiological mouth-breathing with a flat abnormal positioning the tongue in the mouth, dysphagia, tongue thrust and subsequent disorders of the growth of the facial part of the skull with formation of malocclusion. A hyperplastic adenoid often hinders also the access of breathing air to the Eustachian tubes, causing thus an insufficient aeration of the middle ear, being a common cause of conductive hearing loss in children. Adenoidal or adenotonsillar hypertrophy can trigger as well many other pathologies including sleep apnea, in whose etiology in children it plays a leading role.

Blockage of the respiratory airway through the nose by an oversized adenoid may also interfere with normal nasal resonance in speech, causing hyponasalityof varying degrees of severity. On the other hand, enlarged tonsils may interfere with the transmission of sound into the mouth, causing disturbances of resonance, known in English literature as a "cul-de-sac resonance" or "potato in the mouth speech" and, in Polish sources, as "noodle-in-the-mouth speech". In turn, occlusal disorders and abnormal positioning of the tongue in speech and at rest are the cause of abnormal articulation of anterior sounds.

The aim of the study is to demonstrate the role of endoscopic techniques, both in the correct clinical assessment of the hypertrophy of the adenoidal tissue, as well as in a proper assessment of interrelations between the degree and nature of the adenoidal and/or tonsillar overgrowth and the resulting type and severity of disordered breathing, swallowing, occlusion and speech.Resonance voice disorders and articulation defects are the last element in the sequence of disorders resulting from adenoid and/or tonsillar hypertrophy, that is hypertrophy of the so-called Waldeyer ring.

Speech, a secondary function characteristic of only man, develops on the basis of the correctly functioning primitive functions such as breathing and swallowing (Stecko, Hortis-Dzierzbicka and Kulewicz 2005). The correct physiological breathing mechanism through the nose allows a good aeration of the maxillary sinuses that develop in early childhood and, thus, the normal development of the maxilla. The process of breathing also allows the correct formation and position of the mandible with respect to the maxilla (Linder-Aronson 1979; Cheng et al. 1988; Hultcrantz et al. 1991; Woodside et al. 1991; Mackiewicz 1992). Proper spatial relations in the craniofacial and oral cavity in turn determine the proper course of the swallowing act. In the oral phase of the swallowing act, in order to push a food bite towards the isthmus of the throat, the tongue should momentarily assume a location close to the palate. When blocking the nasopharynx and postnasal airway by an hypersized adenoid and the substitute oral respiratory tract, the

child breathes through half-closed lips, with a falling lower jaw and the tongue lying flat on the bottom of the mouth or, sometimes, placed on the teeth. In addition, in individuals with a narrow wrongly aeratedupper jaw, the palate is often arched high, creating the so-called Gothic palate. Thus, the abnormal swallowing mechanism is maintained and there are no good conditions for the formation of proper occlusion. In consequence, secondary to the disorders of the upper airway patency a variety of bite disorders can develop, especially of the type of overbites and open bites.

Impaired nasal breathing changes the conditions of resonance because the nose, together with the large air spaces of the paranasal sinuses that communicate with the nasal cavities, constitutes a very important resonator cavity. When a child has the blocked nasal airway, his or her speech acquires the characteristic quality of the "rhinolalia clausa". In turn, a flat position of the tongue in the oral cavity and disorders of occlusion cause secondary multiple disorders of articulation of the anterior plosives, bilabial [p, b, m], labial-dental [f, v], apico-dental [t, d, n] and disordered articulation of the dentalized sibilants [s, z, c, dz; ś, ź, ć, dź; š, ž, č, dż]. A detailed description of disorders of articulation of the anterior consonants in different types of malocclusions is presented, among other sources, in the papers of Woodside et al. (1991), Vallino and Tompson (1993), Konopska (2002) Raftowicz-Wójcik and Matthews-Brzozowska (2005), Stecko and Hortis-Dzierzbicka (2005).

For the formation of the correct articulation patterns in childhood, a correct functioning of the hearing apparatus is essential. A hyperplastic adenoid, located in nasopharyngeal cavity, often blocks the access of breathing air from the nose, obturating the posterior nasal apertures, but also directly blocking the pharyngeal ostia of the Eustachian tubes located in nasopharyngeal cavity on its lateral walls, hindering a proper ventilation of the middle ears.

A strategic location of the adenoid in the nasopharyngeal cavity in childhood is also of paramount importance in relation to the three-dimensional activity of the palato-pharyngeal sphincter, of which, unfortunately, the ENT doctors are not aware when they qualify children for adenoid surgery. Open nasalization, suddenly appearing in the speech of the child after adenoidectomy (removal of the adenoids), is a matter of immediate concern of the operating surgeon, but more often than not this concern is belated. As a complication of adenoidectomy, hypernasality is unfortunately only a well-known event among clinicians dealing with the narrow issue of palatopharyngeal insufficiency (Witzel 1986; Finkenstein 1996; Hortis-Dzierzbicka 2004; Hortis-Dzierzbicka 2010/2011).

It should be emphasized at this point that the participation of the nasopharyngeal adenoidal tissue in a proper function and performance of the palatopharyngeal sphincter during speech has been noted and its importance recognized

no sooner than diagnostic imaging methods had been introduced to assess the functioning of the vocal tract in craniofacial anomalies. These techniques include nasofiberoscopy and videofluoroscopy. It was recognized just owing to their use that in the majority of children the palato-pharyngeal closure is essentially a palato-adenoidal closure (Gereau and Shprintzen 1988). Hence the sudden appearance of a hyper nasality in the speech of children with unrecognized submucosal cleft palate, the so-called deep throat and so-called palatal dysplasias. Special care also is required when making the decision about adenoidectomy in children with operated cleft palate, where the adenoidal tissue in the nasopharynx often acts as a sort of prosthesis, allowing a full palatopharyngeal closure (Hortis-Dzierzbicka 2004; Hortis-Dzierzbicka 2010/2011).

Due to the high location of the adenoid in the nasopharyngeal cavity, the adenoid is not directly visible at the basic clinical examination of the patient through the mouth or the nose. For this reason, before entering these modern imaging methods, the basic method of assessing the adenoidal presence and size remained very unpleasant for the child and not very reliable palpation through the mouth and/or later on the basic X-ray examination.

In the authors' opinion, by far the best, least invasive and most reliable method of assessment in respect of the adenoid is the endoscopic examination because videofluoroscopy as an X-ray examination is only a shadow technique. It also requires a close collaboration with a radiologist. Nasofiberoscopy assessment (examination through the nose using the endoscopic flexible optics) can not only directly visualize both the adenoid itself, its size and shape, but also allows to assess the degree of blockage by it of the postnasal upper airway. In doubtful cases of the operated cleft palate patients or suspected velopharyngeal insufficiency of a different origin, it also helps to assess the adenoidal participation in the palato-pharyngeal closure, protecting against performing a risky adenoidectomy procedure.

As far as tonsils are concerned, the aim of full evaluation in terms of both their appearance and size, as well as the degree of any possible blockage of the pharyngeal airway is both the clinical oral examination and endoscopic assessment (Kummer 1993; Finkenstein, Hortis-Dzierzbicka 2004).

The size of tonsils has usually been, and is still widely assessed through oral examination. It is often unreliable for two main reasons. Namely, if at this examination a spatula is used, it can cause a chocking reflex, as the result of which the tonsils become closer to the midline and the investigator obtains a false picture of their large hypertrophy, while in fact hypertrophy may not be very significant. Another, often overlooked issue at oral examination is the posterior tonsillar hypertrophy, sometimes very large. Hence the importance of endoscopic evaluation, which well visualizes both the posterior hypertrophy and the degree of the

pharyngeal airway obstruction caused by it. The posteriorly and inferiorly hepertrophied tonsils can also drastically impair speech resonance giving it, as mentioned, character of "hot patato voice" (Kummer et al. 1993). Hyponasality and the "hot patato voice" can occur simultaneously, because the hypertrophied tonsils are often accompanied by varying degrees of adenoid hypertrophy, or vice versa. However, in rare cases, the tonsils can also overgrow in the nasopharynx, causing hypernasality in a child that is not affected by the palatolaryngeal insufficiency of a different origin. (Kummer et al. 1993; Shprintzen et al. 1996; Hortis-Dzierzbicka 2004) (Fig. 1).

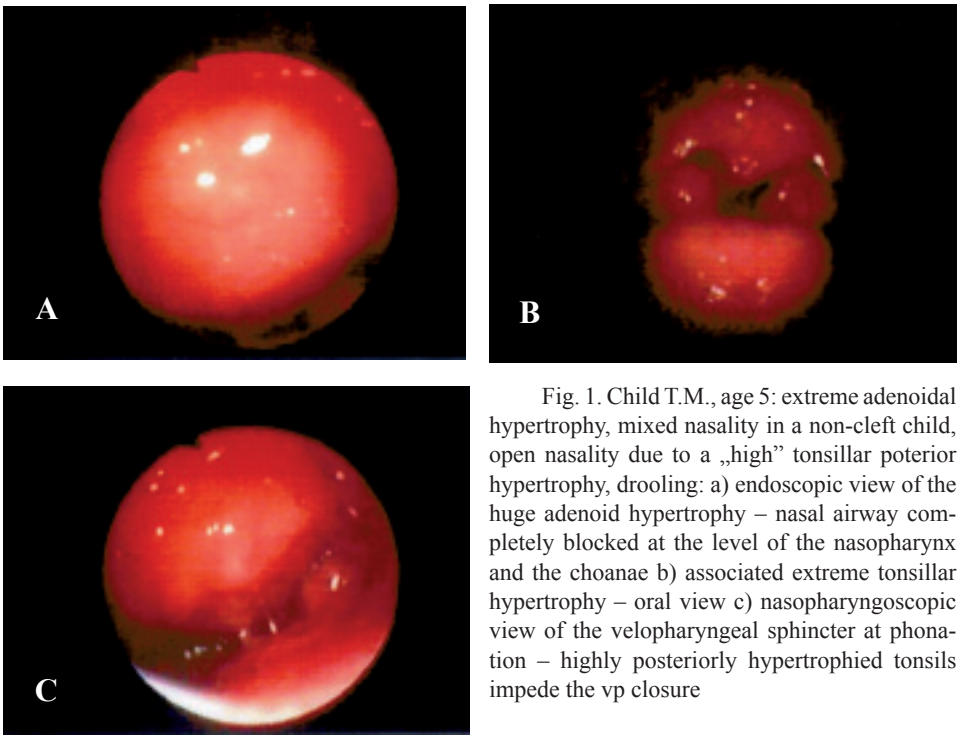

Fig. 1. Child T.M., age 5: extreme adenoidal hypertrophy, mixed nasality in a non-cleft child, open nasality due to a „high" tonsillar poterior hypertrophy, drooling: a) endoscopic view of the huge adenoid hypertrophy – nasal airway completely blocked at the level of the nasopharynx and the choanae b) associated extreme tonsillar hypertrophy – oral view c) nasopharyngoscopic view of the velopharyngeal sphincter at phonation – highly posteriorly hypertrophied tonsils impede the vp closure

Articulatory disorders of the anterior consonants originating from abnormal breathing pattern at the level of the nose and the pharynx are, as mentioned above, variable and dependent on the nature and severity of a sequential tongue dysfunction and bite disorders.

A proper evaluation of the mentioned clinical factors affects the choice of treatment. When adenoid hypertrophy is the cause, simple surgical procedure such as adenoidectomy (adenoid removal) can restore both nasal the patency, and unblock the auditory tubes and thus affect positively the function of the middle ears,

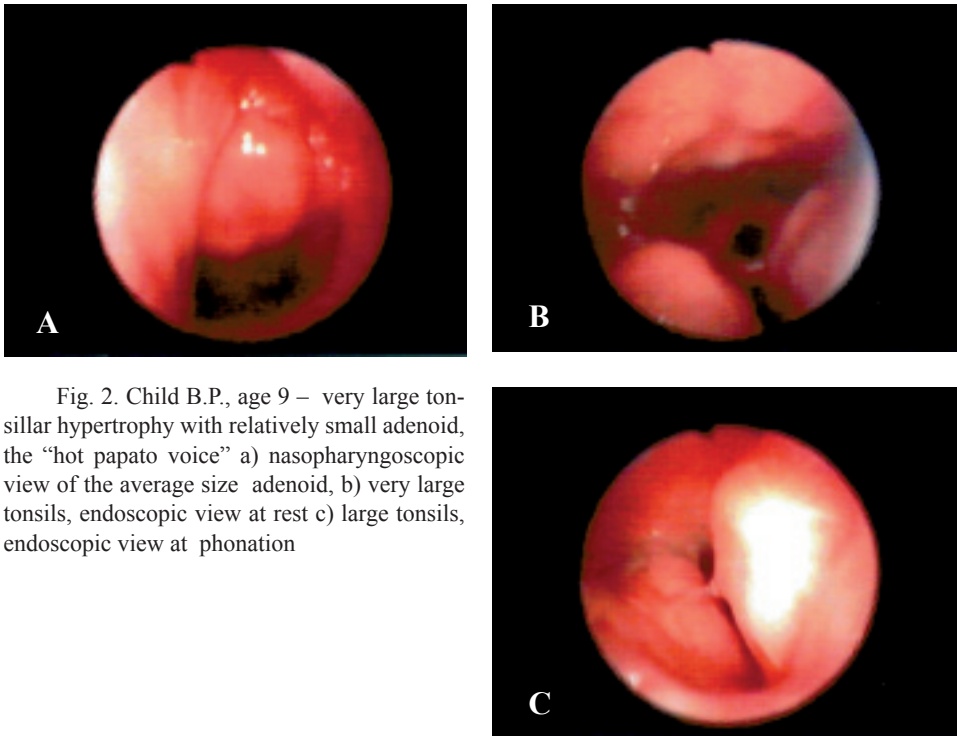

Fig. 2. Child B.P., age 9 – very large tonsillar hypertrophy with relatively small adenoid, the "hot papato voice" a) nasopharyngoscopic view of the average size adenoid, b) very large tonsils, endoscopic view at rest c) large tonsils, endoscopic view at phonation

allowing their proper ventilation. With frequently concurrent tonsillar hypertrophy, the removal of tonsils and the adenoid is performed simultaneously (adenotonsillectomy) (although this is not always the case – see Fig. 2). In our country, tonsillectomy often is replaced by tonsillotomy, when instead of complete removal of tonsils, only their trimming is performed. In many cases, the removal of tonsils and the adenoid is further expanded by simulataneous ventilation tubing of the middle ear on one or both sides.

This paper, being a joint effort of otolaryngologists and speech therapeutists, has also the goal of making clear to the Polish reader the significance of these particular sequential relationship between the disorder of physiological breathing through the nose, consequent oral breathing and impaired tongue stature, as well as craniofacial growth impairment that result in the formation of malocclusions mainly in the form of overbites, open bites and specific articulation disorders. In Polish literature in recent years, this problem seems to be often insufficiently perceived only as a causal relationship between occlusion and articulation disorders (Raftowicz-Wójcik and Matthews-Brzozowska 2005).

Proper causative diagnosis of the primary impairment (nasal breathing difficulties) with the use of the instrumental methods is the key to the elimination of these various secondary disorders. Endoscopic evaluation of the upper airway,

which constitutes also the vocal tract, using flexible optics seems to be the key to a correct diagnosis, and thus allows the proper choice of treatment procedures.

Of paramount importance in the process of treatment and rehabilitation of these children is widely understood cooperation between ENT, possibly foniatrician, audiologist, orthodontist and speech therapeutist. Without the restoration of normal airway through the nose, whose disorder is the most common cause of occlusion and articulation disorders in children, there can be no proper rehabilitation or occlusion or articulation disorders (Stecko and Hortis-Dzierzbicka 2000).

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