Review article / Artykuł przeglądowy

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The interdependence of mouth breathing and facial structure. The adenoidal face and its aesthetic implications

Współzależność oddychania przez usta i budowa twarzoczaszki. Twarz adenoidalna i jej implikacje estetyczne

ABSTRACT

Oral breathing has a significant impact on the development, aesthetics, and structure of the facial skeleton, particularly in terms of the so-called adenoidal face. Prolonged mouth breathing, which often results from chronic inflammation of the upper respiratory tract, e.g., hypertrophy of the pharyngeal and palatine tonsils, is associated with a number of destructive anatomical and functional changes in the face and stomatognathic system.

The study aimed to discuss the interrelationship between mouth breathing and the processes involved in the formation of facial proportions and malocclusion.

Facial skeletal disorders are crucial for health and physical attractiveness. Correct diagnosis of the problem in young children can have a significant impact on improving health and appearance in later life and maintaining self-confidence in adulthood.

Keywords: breathing through the mouth, adenoidal face, malocclusion, facial aesthetics

STRESZCZENIE

Ustny tor oddychania ma istotny wpływ na rozwój, estetykę i budowę twarzoczaszki, w szczególności w aspekcie tzw. twarzy adenoidalnej. Długotrwałe oddychanie przez usta, które często wynika z przewlekłych stanów zapalnych górnych dróg oddechowych, np. przerost migdałków gardłowych i podniebiennych, wiąże się z szeregiem destrukcyjnych zmian anatomicznych i funkcjonalnych w obrębie twarzy i układu stomatognatycznego.

Celem pracy było omówienie współzależności pomiędzy oddychaniem przez usta a procesami zachodzącymi w kształtowaniu proporcji twarzy oraz nieprawidłowościami zgryzu.

Zaburzenia w obrębie twarzoczaszki mają kluczowe znaczenie nie tylko w kontekście zdrowia, ale również w atrakcyjności fizycznej. Prawidłowe rozpoznanie problemu wśród małych dzieci może mieć znaczący wpływ na poprawę zdrowia i wyglądu w późniejszych latach życia oraz podtrzymywanie pewności siebie w dorosłym życiu.

Słowa kluczowe: oddychanie przez usta, twarz adenoidalna, wady zgryzu, estetyka twarzy

INTRODUCTION

Breathing dysfunction and lip insufficiency cause negative changes in facial bone growth patterns, which can lead to skeletal disorders requiring orthodontic intervention and, in advanced cases, combined orthodontic and surgical treatment by a team of specialists in dentistry and surgery, physiotherapy, orthopedics, allergology, and laryngology.

Proper breathing function, i.e., breathing through the nose, slows down the breath itself, activating the nervous

system's sympathetic part, which in turn is responsible for regeneration and metabolic processes. In addition, the nose acts as a natural filter, which is why air entering the nostrils under increased pressure fills the lungs more effectively, purifies the air, and regulates its temperature and humidity. A cascade of chemical reactions is activated, improving gas exchange. In addition to its metabolic function, breathing through the nose also engages the diaphragm, influencing the development of correct posture. Therefore, to prevent the head from protruding forward (which can lead to excessive tension in the shoulder girdle and spine), it is important to ensure proper breathing, which is a key element of a holistic approach to health [1-7].

The shape and profile of the face, apart from individual characteristics, facial expressions, and the thickness of soft tissues and differences in appearance, are primarily determined by bone structures. Disorders that may occur in the structure of the facial skeleton, known as gnathic defects, have a destructive effect on the proportions and features of the face [2]. Chronic mouth breathing is particularly important in the development of vertical disorders (skeletal open bite) and transverse disorders (skeletal crossbite with a Gothic palate). Possible factors causing malocclusion include: past and coexisting diseases, injuries and procedures in the facial skeleton area, dysfunctions and parafunctions, diet, and genetic factors [2-12].

The reduction of these defects is achieved through orthodontics and surgery, constituting an interdisciplinary treatment problem. The main aim of treatment is to improve the function of the entire dental system as well as facial aesthetics [2].

A detailed analysis of the face allows for an effective assessment of aesthetic and functional harmony disorders. A thorough medical history and bite examination are performed to diagnose the problem and help plan effective treatment. The collected data outline both positive and negative features of appearance and allow to assess of the extent to which correction of the malocclusion will reduce the problem [3].

Clinical facial analysis includes an extraoral examination, taking into account proportions, symmetry, tissue volume, and visible aesthetic defects. The examination includes:

- mini-aesthetic analysis (determining the elements of the smile),
- microaesthetic analysis (determining the size and shape of the teeth),
- macroesthetic analysis (measurements of soft facial tissues).

ADENOID FACE

An adenoid face (*facies adenoidea*) is characterized by an elongated lower face and a reduced transverse dimension of the jaw. Inability to close the lips is accompanied by drooping corners of the mouth and protruding upper incisors. The profile of such a person is often slanted with a receding chin. This facial appearance may be perceived as unattractive, and in terms of health, it is associated with lower self-esteem, a greater predisposition to depression, breathing disorders, as well as problematic and abnormal swallowing or chewing of food [1-3].

Beauty standards change depending on current trends. Over the past few decades, there has been a better understanding of recurring preferences in the assessment of beauty and the recognition of what is attractive. This knowledge is also useful in perceiving certain aspects of beauty as a problem or aesthetic defect [3]. It should be emphasized that an adenoid face may be elongated, but an elongated face is not necessarily an adenoid one. The interchangeable use of these terms is therefore incorrect. For this reason, it is worth bearing in mind the distinction between the two phenomena, because in a more detailed description, an adenoidal face has an elongated lower part of the face, while in an elongated face, genetics plays a major role, i.e., family predisposition in the form of a slender facial skeleton. Furthermore, in an adenoidal face, hypoplasia (underdevelopment) of the jaw, protruding front teeth, or indistinct contours of the nose with narrow nostrils (so-called snub nose) can be observed. In an elongated face, bone growth disorders are observed, including, for example, excessive vertical growth (hyperplasia) and an imbalance in facial muscle and bone development, which may be independent of the type of breathing [4, 8-11].

According to analyses published by Groesz et al. (2002), 40 to 70% of girls in puberty experience dissatisfaction with their appearance. Therefore, the issue of an aesthetic smile is important due to the promoted ideal of female beauty and perfection. Culturally, attractiveness is associated with overall success [4]. White, healthy teeth are a symbol of good health, and the issue of beauty itself is associated with the so-called "genetic quality of an individual". This means that if a person of a given gender chooses their partners from among members of the opposite gender (while possessing certain specific physical characteristics), this preference will become established after a few generations. As it turns out, external attractiveness goes hand in hand with longevity. People considered attractive are more physically fit, have better health and higher levels of sex hormones [5].

EVALUATION OF KEY ANTHROPOMETRIC FEATURES

To better understand the issue of facial analysis, the examination should begin with dividing the face into three vertical zones, taking into account anthropometric points. An important element of the assessment is the visibility of the incisors when the lips are relaxed. The norm is 2-3 mm for men and 4-5 mm for women. If the incisors are correctly exposed at rest but the gums are visible when smiling fully, jaw retraction is not recommended in this case [3].

The next step is to measure the distance between the inner corners of the eyes and analyze the proportions of the eye sockets, zygomatic bones, and piriform aperture. Insufficient protrusion of these structures may be an indication to move the jaw forward. The width of the nasal base is also important, as is the asymmetry of the maxilla and mandible, deviation from the midline, and assessment of signs of aging, such as drooping fat pads or deepening of the nasolabial folds.

In adults with maxillary hypoplasia, orthognathic surgery is considered. Le Fort I osteotomy is an example of a surgical procedure used to treat maxillofacial deformities. It aims to improve facial aesthetics by focusing mainly on restoring harmony between the jaw and other facial structures [3]. It is one of the most commonly performed surgical procedures in the middle craniofacial region, allowing manipulation of the jaw position in three spatial planes. The bone is cut in the axial plane from the piriform aperture to the pterygoid-maxillary junction. It passes through the lateral walls of the nose and the walls of the maxillary sinuses, above the tips of the tooth roots and below the infraorbital foramen. The pterygoid-maxillary junction is completely separated, and the basal plate of the nasal septum is separated from the palate [3].

The size of the lip-chin angle is assessed in the chin area. A sharp angle may indicate a short or protruding chin, while a lack of groove in this area suggests an excessive mandibular ramus or body [3]. The final assessment also includes the soft tissues of the neck. For example, mandibular retrusion can worsen the appearance of the chin skin, while its protrusion often improves the tension and genio-mental angle, which has a positive effect on the aesthetics of the entire face. Currently, for less invasive procedures, cross-linked hyaluronic acid is often used in adult patients to enhance the chin area or shape the angles of the mandible [3]. Orthognathic surgery includes genioplasty or bilateral sagittal split osteotomy (BSSO). It is the most common surgical procedure in this area of the face and skull. Osteotomy cuts are made in the sagittal plane – medially (on the inner surface of the mandibular ramus) above the lingula and laterally (on the outer surface) from the molar region towards the back. Then, both cuts are joined with a horizontal cut and two bone fragments are separated: the anterior fragment containing the teeth, the posterior fragment with the mandibular angle and the condylar process. The clinical examination is supplemented with a detailed analysis of photographs, models of the patient's dentition, and radiological images, including cephalometry.

MALOCCLUSION AND ASSOCIATED HEALTH AND AESTHETIC PROBLEMS

The World Health Organization (WHO) defines malocclusion as a condition that limits chewing and breathing and is perceived by the patient as a type of disability and disfigurement. Therefore, the primary aim of orthodontic treatment is mainly to improve the bite, its function, and the overall aesthetics of the face and smile. As it turns out, in medical practice, patients are increasingly turning to orthodontists with a need to improve their appearance, not just their health. For this reason, specialists must pay attention not only to developing the quality of life of patients, but also to a thorough analysis of facial proportions, smile, and proper tooth and gum alignment. It should also be added that the latest progress in conscious orthodontics are leading to new and improved treatment methods, such as fixed appliances, the use of temporary anchorage devices (TADs) and treatment with transparent aligners. Non-invasive diagnostic techniques are also available, such as 3D visualization, treatment effect simulations, and techniques to support orthodontic tooth movement [1-8].

Skeletal defects are characterized by excessive or insufficient bone growth of the facial skeleton in one or more spatial planes.

Open bite

Open bites are characterized by a lack of contact between the upper and lower teeth, which leads to the formation of a visible space called a diastema. This type of defect can cause difficulty in eating and contribute to the elongation of the lower part of the face. Potential causes include prolonged breastfeeding or bottle feeding and protracted use of a pacifier. In some patients, this defect may also cause speech problems, such as lisping. The interaction of these factors can both lead to the development of an open bite and exacerbate its symptoms [6].

Open bite can be divided into:

- partial anterior open bite,
- partial lateral open bite,
- complete open bite – visible separation of both jaw bases.

In complete open bites, the maxillary segment of the face is elongated, the lips may be flaccid, the upper lip is shortened, normal food intake is practically impossible or significantly limited, and speech is impaired [6].

An interdisciplinary approach involving an orthodontist, ENT specialist, speech therapist, and maxillofacial surgeon is recommended for the treatment of open bite and breathing problems. Correction of the defect may include orthodontic appliances, respiratory therapy, and, if necessary, surgical removal of enlarged tonsils [7]. Children with enlarged tonsils often show apathy, concentration disorders, and rapid fatigue. It is precisely this established breathing pattern that may be the cause of a partial anterior open bite. In adults with skeletal open bite, orthognathic surgery is considered. It is worth noting that early diagnosis and intervention can prevent permanent deformities and improve the functionality of the stomatognathic system [7].

Numerous studies presented in a scientific article by Poddębniak and Zielnik-Jurkiewicz on the impact of mouth breathing on facial structure, confirm that one of the causes of open bite is habitual oral breathing resulting, among other

things, from hypertrophy of the pharyngeal tonsil [8]. It is worth noting here that diagnostic and etiological issues are crucial in an interdisciplinary approach to the treatment of open bite, especially in the context of laryngological and orthodontic factors [8].

MOUTH BREATHING – NOT JUST AN AESTHETIC PROBLEM

From a popular science point of view, it is interesting to refer to an experiment described by McKeown. The author cites research conducted in the 1960s by dentist Egil P. Harvold, who noticed that mouth breathing caused by nasal obstruction was common among people seeking orthodontic treatment. To investigate the relationship between mouth breathing and malocclusion more closely, Harvold conducted a series of experiments. The key element of these experiments was to block the nostrils of young monkeys with silicone inserts [9, 14].

The studies showed that the animals adapted to nasal obstruction in various ways. As it turned out, in most cases, the monkeys kept their mouths open. In addition, all of them gradually began to show changes in facial appearance and bite compared to the control group. Monkeys that breathed through their mouths developed malocclusion and other facial deformities, such as a lowered chin and a significant increase in the angle of the mandible and the gonial angle compared to the control group [9, 14].

What is more, Harvold suggested that most human malocclusions could be reconstructed under experimental conditions. He argued that every commonly occurring malocclusion could be artificially reproduced in monkeys with normal occlusion. These findings were confirmed by Dr. Mew, who noted that changes in the position of the tongue and the forces acting on it could lead to serious malocclusions in monkeys [9, 14].

PREVENTION

For the face to develop properly, the following conditions should be taken into account [9, 14]:

- mouth – closed, with lips slightly touching,
- tongue – the tip of the tongue should rest against the front teeth on the upper palate,
- correct breathing (through the nose),
- correct swallowing (elimination of persistent infantile swallowing),
- correct chewing (avoiding mushy food),
- correct posture (straight back and head, pelvis in the correct position),
- avoidance of incorrect habits, such as thumb sucking in children, teeth grinding, nail biting, jaw clenching, snoring, slouching, scoliosis, and lordosis.

A relationship has been observed between the quality of the airways and malocclusion, as well as a link between mouth breathing and the development of skeletal class III malocclusion [10]. It should be added that lip dysfunction is an important factor in changing the direction of facial growth.

To prevent this, it is important to remember the basic issues, such as controlling closed lips and strengthening the masseter muscles. It should also be mentioned that less water loss is observed while breathing in and out through the nose than through the mouth. This knowledge is used, among others, by sports coaches, who tape their athletes' mouths during training to encourage them to breathe mainly through the nose, even during intense exercise. This translates into better performance and hydration of the body. Learning about the role of proper breathing, leads to the conclusion that breathing itself has a "training" function because during basic breathing exercises, the level of carbon dioxide in the body increases, similar to during physical activity. Therefore, it can be concluded that breathing affects the functioning of the entire body.

One of the factors contributing to mouth breathing, apart from enlarged tonsils, is the relationship between increased facial height and anatomically reduced volume of the nasopharyngeal airways [10-12]. In addition, diseases such as obstructive breathing disorders, bronchial asthma, or, in the case of allergic diseases, rhinitis should also be taken into account. All of the above-mentioned diseases are associated with, among other things, difficulty in breathing. Therefore, untreated conditions can significantly contribute to the onset of a cascade of destructive changes that accompany crowding of teeth, a long or adenoidal face in children, or malocclusion. Untreated inflammation in the body takes its toll on both health and facial aesthetics.

It is also important to consider the relationship between the growth of the tongue and the mandible and the length of the frenulum. With a short frenulum, the tongue may assume a lowered position in the mouth, contributing to the development of a narrow jaw [10-12].

Interestingly, science confirms that a reduction in the size of the tongue during the intensive growth phase may contribute to changes in the development of the facial skeleton and the stomatognathic system. Similar relationships coexist in the face and mandible. They are related to speech, swallowing, chewing, and breathing. Ultimately, integration at the face-mandible level is crucial for maintaining their proper functions [10-12].

According to the literature, 60% of facial development occurs during the first 4 years of life, and 90% before the age of 12 [11]. The development of the mandible (beauty line) itself continues until around the age of 18. For this reason, it is essential to intervene as early as possible in the development of proper nasal breathing technique and correct tongue position. This knowledge makes it possible to rule out later orthodontic or orthognathic treatment. In addition, thanks to the knowledge and experience of Dr. Raymond Silkman, the enormous potential of the tongue is well known. He recognized it as a natural, 24-hour orthodontic appliance that shapes the palate

and the correct angle of the mandible. Without pressure from the tongue on the upper dental arch, jaw development would be significantly impeded. In mouth breathers, the upper jaw will not reach its innate potential without external intervention by an orthodontist or maxillofacial surgeon [9, 12, 13].

SUMMARY

Mouth breathing, often overlooked as an important etiological factor, can significantly affect the development of the craniofacial and stomatognathic systems in children. Among individuals without a genetic predisposition to malocclusion, breathing patterns play a key role. In children with a V-shaped palate, habitual mouth breathing may be suspected, accompanied by a lack of proper stimulation of the palate by the tongue, which often rests on the lower dental arch. Early diagnosis and appropriate treatment focusing on a multidirectional approach are crucial in preventing progressive changes such as tooth crowding, the development of an elongated face with a receding lower jaw, and, as a consequence, serious health problems.

It is also worth noting that there is currently no systematic and standardized monitoring system that would effectively prevent form the consequences of abnormal facial development. In the future, a new and necessary specialization such as orthotropics may develop, which would focus on monitoring the potential of the face during intensive growth in the youngest children and the early diagnosis of developing malocclusion. Therefore, education on the correct positioning of the tongue on the palate and quality and effective breathing, which should be provided by qualified therapists, would be invaluable. The role of parents would be to support the therapeutic process by systematically passing on the acquired knowledge to their children and promoting its practical application in everyday activities. It is worth mentioning that professional treatment of mouth breathing, as discussed in this article, should involve cooperation with doctors from many medical specialties and, if necessary, behavioral therapy [13-15].

A comprehensive approach to this problem requires interdisciplinary cooperation between dentists, orthodontists, maxillofacial surgeons, as well as allergists, speech therapists, and physical therapists. Such multidisciplinary treatment can contribute not only to improving facial function and aesthetics, but also to the overall well-being of the patient. Harmonious facial development, taking into account functional breathing patterns, is therefore not only the key to a beautiful smile, but above all to better health and well-being, in line with the principle that prevention is better than cure.

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