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PRACA POGLĄDOWA  
REVIEW ARTICLE

## INTERDISCIPLINARY APPROACH TO DIAGNOSTICS OF MALOCCLUSIONS (REVIEW)

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### ABSTRACT

**Introduction:** The main task of modern orthodontics is to create a balanced, morphologically stable occlusion in harmony with facial aesthetics and functional adaptation.

**The aim** of the study is to investigate the relationship between dento-facial anomalies and somatic pathology.

**Materials and methods:** A literary study was conducted using the Medline database and the Google Scholar database.

**Review:** The human body is a biological system consisting of interconnected and subordinate elements. Any abnormalities in the operation of this system may lead to functional impairment in a single organ. This is fully applicable to dento-facial anomalies and deformations; their development is closely related to other diseases.

**Conclusions:** The diagnostics, treatment tactics and prevention of dento-facial anomalies and deformations should be considered in the context of the integrity of the child's unformed organism, the interdependence of the form and functions of its organs and systems.

**KEY WORDS:** diagnostics, dento-facial anomalies, malocclusions

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### INTRODUCTION

The main task of modern orthodontics is to create a balanced, morphologically stable occlusion in harmony with facial aesthetics and functional adaptation [1, 2, 3]. During the last decade, there is a clear tendency in the prevalence of dento-facial anomalies, which, according to the data of modern domestic and foreign scientific literature, reaches 80% [4, 5, 6], and sometimes exceeds this figure. Thus, according to R. E. Villanuela-Arriaga [7], only 8.2% of those examined have a physiological bite which makes orthodontic treatment a problem of social importance. Researchers [8] note a constant and statistically significant correlation between the permanent occlusion pathology and the state of somatic health in adolescence. These include diseases of the respiratory, musculoskeletal, endocrine systems, and the psycho-emotional status of the patient. From the data of modern literature, the interconnection between the presence of anomaly of the bite and posture abnormalities due to the dento-facial system as one of the postural sensors that provide harmony and balance of the human body in space [9, 10, 11]. The most important changes in the structural and functional state of the bone tissue are observed during puberty, the course of which affects the further formation and condition of the bone tissue throughout life [12]. Only taking into account the somatic status and the psycho-emotional state of the patient in orthodontic treatment allows choosing the optimal treatment [13]. Therefore, the interdisciplinary approach is one of the most urgent tasks of modern orthodontics and a constant object of searching for new methods of diagnosis and treatment [14].

### THE AIM

The aim of the study is to investigate the relationship between dento-facial anomalies and somatic pathology.

### MATERIALS AND METHODS

A literary study was conducted using the Medline database and the Google Scholar database. Keywords used in the search were: malocclusions, growth and development, orthodontic diagnostic and treatment.

### REVIEW AND DISCUSSION

The human body is a biological system consisting of interconnected and subordinate elements. The peculiarities of their structure and relations are subordinated to their functioning as part of a single integral mechanism. Therefore, any abnormalities in the operation of this system may lead to functional impairment in a single organ. This is fully applicable to dento-facial anomalies and deformations; their development is closely related to other diseases [15]. Genetic, congenital and acquired factors are commonly identified as the main etiological factors in the development of dento-facial anomalies [16]. Most authors note the existence of a direct interconnection between the general somatic pathology and anomalies of the dento-facial system [16, 17, 18, 19]. When analysing the literature data, several major groups of diseases that have the greatest impact on the development of the dento-facial system are clearly distinguished: diseases of the ENT organs, the gastrointestinal

tract, endocrine and musculoskeletal systems. At present, scientists have substantiated the concept of commonality of factors that shape both dental status and state of somatic health [20, 21, 22, 23, 24]. The morphological basis of the unity of the characteristics of dental and somatic health is the commonality of the embryonic origin of the facial part of the skull, skin, its derivatives, musculoskeletal system, heart valves, and blood vessels [25, 26]. Thus, based on the analysis of the interconnection between parameters of electrocardiogram and electromyography, the intersystem integration of the functional state of the dento-facial and autonomic nervous systems, as well as the cardiovascular and respiratory systems has been proved [27]. An increase in the frequency of dento-facial anomalies and deformations in 1,6-2,3 times is noted in disorder of the musculoskeletal system [28]. In this category of children, deep incisor occlusion, distal occlusion and neutral occlusion with anomalies of individual teeth predominate. It has been revealed that with the increase in the severity of disorders of the musculoskeletal system (from the posture abnormalities to scoliosis II-IV degree of severity) the prevalence of distal occlusion increases [29]. In children with scoliosis, 72.9-84.3% of cases are diagnosed with dento-facial anomalies and deformations [30].

According to recent studies, the dento-facial system plays an important role in the postural balance of a person, that is, its condition affects the stability of the human body in space. Decrease in the occlusal vertical dimension occurs in such pathological conditions of the dento-facial system as dentition defects, anomalies of bite, dysfunction of the TMJ, pathological abrasion of teeth. It affects the functioning of not only the dento-facial system, but also the human body as a whole [31, 32, 33]. Delaire argued that the position of the upper and lower jaws relative to each other is determined by the ratio of the tone of the posterior group of the neck muscles and the mass of the skull [34]. The position of the jaws has an effect on the spatial orientation of the head, and this in turn affects the position of other structures of the body. When the contact between the occlusal surfaces of the teeth on one or two sides is impaired, the patient's postural status changes, which may lead to pain in the neck or shoulder, changes in the spine, disorders in the body position, and incorrect posture [9]. Some researchers point to the "anterior" position of the head of patients with dysfunction of the temporomandibular joints associated with the shortening of the extensors of the sternocleidomastoid muscles. This confirms the effect of dysfunction of the temporomandibular joints on posture. A high frequency, up to 90%, of dento-facial anomalies in children with allergic pathology has been established [35]. Research showed that in 89,3% of cases, children with bronchial asthma have dento-facial anomalies. The impairment in the activity of the glands of the internal secretion has a negative impact on the formation of the child's organism in general and on the growth and development of the dento-maxillofacial complex, in particular [36, 37, 38, 39]. Adolescence is one of the critical periods of human life, since it is precisely in adolescence that the neuroendocrine system begins to function, and sex hormones which affect the development of many body systems and the formation of reproductive health

are produced. Under the action of steroid hormones, an active development of the musculoskeletal system occurs, which is manifested by the acceleration of total body growth and dento-maxillofacial growth. Insufficient secretion of estrogen leads to impaired bone mineralization and may cause abnormalities in the maxillofacial area [40, 41, 42]. Research results show that sex hormones are one of the key factors that determine the growth and development of the mandible. A delay in the sagittal growth of the mandible, disturbance of its architectonics, and disproportional development of the facial part of the skull were observed with changes in the level of sex hormones [43]. In case of hypogonadism there are anomalies of bite, the deformation of the facial skeleton, changes in the structures of the TMJ. Thus, an examination of one hundred and twenty-two patients suffering from  $\beta$ -thalassemia, which is accompanied by hypogonadism, revealed a disproportional development of the facial part of the skull [44]. Impaired growth and development of the dento-facial system was detected in case of juvenile rheumatoid arthritis [45]. In juvenile idiopathic arthritis, one third of the patients examined were diagnosed with the skeletal pathology of the Angle I class, as well as impaired functional state of the TMJ [46]. Thyroid hormone, thyroxin, stimulates growth in the sphenoid-occipital synchondrosis, nasal cartilage, and the growth of the upper jaw in the area of bone sutures, thereby determining the size and position of the upper jaw. As a result of a decrease in thyroxin level, there is a delay in craniofacial growth, disproportional development, retroposition of the upper jaw, and decrease in the length of the mandible [47]. According to O.T. Supiieva in children living in foci of iodine deficiency, the frequency of dento-facial anomalies is 39.1%, and the frequency of endemic goiter it is 61.1% [48]. In case of pituitary insufficiency associated with a decrease in the secretion of all the hormones produced in the anterior lobe of the pituitary gland, disturbances in the dento-facial system were detected [49]. The study by B. Kawala, T. Mathews-Brzozowska et al. [50] showed that in children with growth hormone deficiency, the difference between chronological, dental and bone age is determined. With insufficiency of the growth hormone, due to the proportional delay in craniofacial growth, there is a decrease in all craniometric and gnathometric linear parameters, with the most pronounced changes in the length of the upper jaw, and the length of the anterior part of the skull base [51, 52]. Hypersecretion leads to gigantism in young people and to acromegaly in adults, which is usually caused by pituitary adenoma. Cephalometric studies with gigantism indicate a large size of the anterior facial height. Growth of the lower jaw occurs gradually and according to research data a cross-bite is often formed. Enlargement of the tongue is noted. An increase in the mandible in case of acromegaly is the result of both appositional growth and hypertrophic changes in the cartilaginous joint. Skeletal anomalies were identified in the experimental study of the role of parathyroid hormones in the maxillofacial development. Accelerated differentiation of chondrocytes and endochondral bone formation in the posterior part of the anterior section of the skull base and in synchondrosis, as well as abnormal bone modelling were observed [53]. Skeletal forms of the Angle Class II anomalies are the dominant pathology in secondary hyperparathyroidism due to chronic renal failure – Sagliker

syndrome. Under the experimental conditions, it was found that corticosteroid hormones have a significant inhibitory effect on the proliferative activity and differentiation of chondrocytes in the temporomandibular joint, and therefore, adversely affect the normal process of endochondral bone formation in the mandible growth zone. The growth of the inhibitory effect of corticosteroids is partially due to a decrease in the reaction of cartilage cells to insulin-like growth factor-1 (IGF-1) [54]. When studying craniofacial morphology in children with obesity, an increase in the length of the mandible, prognathia of the jaws, and a decrease in the anterior height of the face were recorded [55]. However, the analysis of literature data revealed that it is necessary to specify the prevalence of clinical forms of anomalies and deformations of the dento-facial system in children with endocrine pathology. A. Silvestrini-Biavati et al. prove in their study that the pathological condition in one part of the body affects other areas. Skeletal muscles play a crucial role in the coincidence of various disorders, since they have a continuous anatomical and functional “chain” between the skull, lower jaw, spine, limbs and pelvis [56, 57]. Therefore, when a strong muscle tension occurs in one of the links in this chain, it is immediately transmitted to another part of the body. As a result, the body loses its equilibrium state, generating compensatory mechanisms, for example, muscle tension in other antagonistic parts of the body. Thus, dento-facial anomalies with disturbance of the mandibular position are associated with one of the links in the muscle chain, which leads to an excessive contraction of the masticatory muscles [58]. This tension causes the rest of the body to react, creating postural modifications caused by contractions of other muscles of the chain.

Impaired respiratory function has a direct effect on the formation of the dento-facial area. According to A. Y. Gungora [59], the volume of air passing through the nose and nasopharynx is limited by its shape and diameter. Continuous flow induces a constant stimulus for transversal growth of the upper jaw and proper formation of the palate. Maximum morphological differences were observed between patients with and without respiratory tract problems, showing a potential etiological role in the interaction between the respiratory function and the maxillary growth: shortening and narrowing of the upper jaw, increasing the length and thickness of the soft palate, V-shaped dental arch, high palate and protrusion of incisors.

According to L.V. Polma et al. [60, 61, 62], when planning a treatment, it is mandatory to take into account patients' motivation. A.M. Dybov, H.B. Ospanova emphasize the need to take into account the needs and expectations of the patient [63]. The level of aesthetic component, according to I. Grzywacz [64], reflects the subjective need for dental aesthetics and orthodontic treatment. I.N. Minaieva [65] notes that it is the aesthetic component that is essential for the image of success. U. Klages [66] points out that there is an interconnection between physical attractiveness, on the one hand, and social success and high self-esteem, on the other. The author also found that, unlike subjects with higher level of teeth aesthetics, respondents with a low level of aesthetics showed a higher social interest in their own appearance. Thus, taking into account the psycho-emotional state of patients must be necessarily supplemented by clinical diagnostic methods [67].

## CONCLUSIONS

Thus, the interaction of local disorders of the dental-maxillofacial area in children and adolescents with common diseases allows to consider dento-facial anomalies and deformations as a multiorgan, socially significant pathology. Consequently, the diagnostic, treatment tactics and prevention of dento-facial anomalies and deformations should be considered in the context of the integrity of the child's unformed organism, the interdependence of the form and functions of its organs and systems.

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The Authors declare no conflict of interest.

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