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Functional and Morphometric Characteristics of the Maxillary System

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Abstract: This article examines the functional and morphometric characteristics of the maxillary system with a focus on the high prevalence and multifactorial nature of distal occlusion in children. The study emphasizes the role of genetic predisposition, early childhood illnesses, oral habits, and maxillofacial functional disorders as key risk factors. Particular attention is given to the importance of initiating orthodontic treatment during the mixed dentition period to prevent complications such as palatal trauma, temporomandibular joint dysfunction, and psychological impacts during speech development. The paper highlights the significance of skeletal age assessment—especially through cervical vertebrae maturation analysis on lateral teleradiographs—as a reliable predictor of mandibular growth peak. Understanding individual variations in mandibular and facial growth patterns is presented as essential for optimizing treatment timing and outcomes. The authors conclude that facial aesthetics assessment should be integrated into orthodontic diagnostics, as occlusal anomalies strongly influence facial harmony and patient self-esteem.

Key words: distal occlusion, maxillary system, skeletal age, cervical vertebra maturation, mandibular growth.

Introduction.

The high prevalence of dental anomalies in children is an important problem in modern orthodontics. One of the most common anomalies is the distal occlusion of the dentition. In the domestic and foreign literature, many studies are devoted to the study of this issue. Genetic predisposition, early childhood diseases (including upper respiratory tract infections), bad habits, dental pathology (adentia, impaction, microdentia and macrodentia), micrognathia and macrognathia, functional disorders of the maxillofacial region account for a high percentage of "risk factors" that lead to the formation of distal occlusion of the dentition. In each individual patient, distal occlusion, complicated by crowding of teeth, is formed under the influence of a combination of several "risk factors", where breathing disorders, lip closure, swallowing, chewing and speech are in the first place. It is well known today that assessing a patient's potential height is the first step in correcting distal occlusion of the dentition. It is important to carry out treatment during the period of replacement bite in order to avoid injury to the palate by the incisors of the lower jaw in patients with a large sagittal fissure, for the prevention of temporomandibular joint dysfunction, for the psychological rehabilitation of children during speech formation, as well as to improve the prognosis of treatment at an older age. The assessment of growth potential influences the choice of the protocol and the optimal time to start therapy. Assessment of skeletal maturation stage 16 in patients is important in order to avoid complications associated with early treatment of mesial occlusion of the dentition and to obtain high-quality results of correction of distal occlusion using functional devices. Moreover, orthodontic treatment has been found to be most effective in patients whose treatment was initiated at the right time, i.e. during the peak of mandibular growth. The peak of mandibular growth occurs on average at the age of 10-12 years in girls and 12-14 years in boys. Active growth begins about 2 years before the peak of mandibular growth. Although chronological age may serve as some guideline when deciding whether to

start orthodontic treatment, more accurate information is provided by skeletal age assessment methods that better correlate with the growth of the lower jaw. The most popular methods of skeletal age assessment include analysis of the cervical vertebrae on telerentgenograms of the skull in lateral projection and radiographs of the bones of the hand and wrist. Warmeling et al. also believe that although the correlation between the two methods is very high, the popularity of the method using lateral telerentgenograms of the skull has been growing in recent years.

Longitudinal studies based on lateral telerentgenograms revealed wide individual differences in the time of onset and duration of pubertal growth spurt. Therefore, determining the skeletal age of a patient becomes a critical component of orthodontic diagnostics and helps identify children of the same chronological age, but with different degrees of skeletal maturity. Franchi et al. presented a modified method for assessing the skeletal age of patients by assessing the stage of maturation of the cervical 17 vertebrae. The use of this method has a number of advantages: the simplicity of the method and the absence of the need for additional radiation exposure to determine skeletal age. The relationship between skeletal maturity (depending on the stage of maturation of the cervical vertebrae) and the development of dentition is also described in the literature. By assessing the stages of mineralization of specific teeth, a correlation was found between the shape of certain vertebrae and the 2nd lower molar in girls and the lower canine in boys. The mineralization of teeth also correlated with the age of the skeleton. Previously, it was believed that the development of facial structures is a relatively static process, except in pathological cases, and that the treatment of occlusion abnormalities is essentially independent of age, gender, or stage of skeletal growth. This point of view may have been one of the main reasons that, despite the introduction of highly effective orthodontic devices, individual growth variability was not given due attention. As a result of longitudinal X-ray studies, it was recognized that there are significant individual variations in the development of facial structures and inter-jaw relationships. The use of lateral telerentgenograms is undoubtedly of great importance for facilitating the analysis of facial structures and assessing the intensity of skeletal growth. It has been confirmed that the increase in the length of the mandible is mainly due to condyle growth. The anterior border of the chin symphysis remains fairly stable and its thickening occurs through the growth of its posterior surface.

There is also an appositional growth at the lower border of the symphysis, which increases the height of the symphysis. In the area of the lower border of the angle of the mandible, resorption usually occurs, which can be quite pronounced, but in some cases, on the contrary, appositional growth occurs. The combination of resorption and appositional growth characterizes the type of growth and individual formation of the mandible. Condyle growth is often carried out not in the direction of the mandibular branch, as is usually imagined, but slightly forward. There are individual variations in the direction of condyle growth, and depending on this, the directions of condyle growth are distinguished posteriorly, neutrally or anteriorly. Thus, the growth of the mandible is usually characterized by the growth of the condyle upward and forward, the processes of resorption in the area of the lower border of the angle of the mandible and the appositional growth of the lower border of the chin symphysis. Facial aesthetics is an important issue in modern society. Children, teenagers, and parents consider pleasant appearance to be an important factor of psychological well-being, which affects patients' self-esteem. Aesthetic complaints are the most common subjective reason for seeking orthodontic treatment.

Conclusions

This means that an assessment of the appearance of the face should be included in the assessment of the need for orthodontic treatment. The correlation between facial aesthetics and sagittal occlusion ratio has been the subject of research since Engle, who noticed that occlusion anomalies in the sagittal plane cause various disharmonies of facial contours. Patients with distal occlusion have a convex profile, there is a decrease in the height of the lower third of the face, a protrusion of the upper lip and an excessive expression of the chin and nasolabial folds. Orthodontic treatment is aimed at: • achieving functional occlusion; • eruption and alignment of displaced or retinated teeth; 19 • elimination of traumatic factors; • improvement of facial and dental aesthetics; • correction of occlusion anomalies and elimination of functional problems that may contribute to the development of TMJ dysfunction; • normalization of functions of chewing, swallowing, breathing and speech.

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