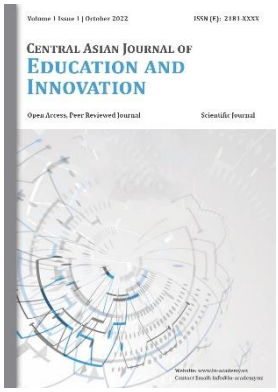

THE INFLUENCE OF JAW DEVELOPMENT ON THE FORMATION OF ORTHODONTIC ANOMALIES IN CHILDREN

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ABSTRACT

Insufficient or excessive jaw development directly leads to orthodontic abnormalities. If the bones grow slowly, there isn't enough space for the teeth, causing crowding. Uneven growth disrupts the bite, and the early loss of baby teeth slows jawbone development, exacerbating deformities. Orthodontic pathologies in children are caused by several interrelated factors, each of which disrupts the harmonious development of the jaws. The aim of this study was to investigate the developmental characteristics of the upper and lower jaws in children before the end of their growth period and to assess their impact on the development of orthodontic anomalies. The results of examination and treatment of 150 children aged 5 to 14 years observed at the Dentero Family clinic were analyzed. It was found that 70.0% of the examined patients had various jaw deformities, the most common of which was underdevelopment of the upper jaw. The use of Mark Ross orthodontic appliances, face masks (Face Mask), and subsequent treatment with braces contributed to the improvement of the morphofunctional parameters of the maxillofacial region.

Introduction. The rudiments of primary teeth are formed between 6 and 7 weeks of fetal development. The rudiments of permanent teeth appear in the fifth month of pregnancy. By birth, a child's jaws already contain the rudiments of most of the teeth that will erupt over the next 12 years. The first primary teeth erupt at 6 to 8 months. By 2.5 to 3 years, a child has all 20 primary teeth. From 6 to 12 years of age, the period of mixed dentition occurs, when primary teeth are gradually replaced by permanent ones. The final formation of the primary dentition is completed by 14 to 16 years of age with the eruption of the second molars. Wisdom teeth appear later, between 17 and 25 years, and do not contribute to the formation of the primary dentition [1-2].

Dentists distinguish five periods of bite development. Each requires its own approach to diagnosis and treatment. Understanding these periods helps parents determine when to consult a specialist. Each period has its own windows of opportunity for correction. For example, widening a narrow upper jaw is easiest between the ages of 7 and 10, before the median palatal suture closes. After age 14, such widening requires surgical intervention. This is one of the reasons why orthodontists work with children long before all permanent teeth appear.

Disturbances in the growth of the upper and lower jaws during the period of active development of the body lead to the development of various orthodontic anomalies that have a negative impact on the function of chewing, breathing, speech and aesthetic perception of the face [1-4].

According to various studies, the incidence of malocclusion and dental deformities reaches 50–75%. Growth disturbances of the upper and lower jaws are of particular importance during the period of active child development [5].

The growth of the maxilla is primarily due to facial skeletal sutures and bone remodeling processes, while the development of the mandible is closely linked to the activity of the condylar cartilage and the growth of the skull base. Disruption of these processes leads to the development of skeletal malocclusions, facial asymmetries, and functional disorders [6].

The problem is particularly relevant due to the fact that early diagnosis and timely orthodontic correction make it possible to utilize the child's natural growth potential and prevent the need for complex orthognathic treatment in adulthood [7].

Purpose of the study. To study the developmental characteristics of the upper and lower jaws in children aged 5 to 14 years and determine their influence on the formation of orthodontic anomalies, as well as evaluate the effectiveness of two-stage orthodontic treatment.

Materials and methods. The study was conducted at the Dentero Family dental clinic in Fergana for the period 2024-2025. The study included 150 children aged 5 to 14 years who sought preventive consultation or orthodontic treatment. All patients were divided into age groups: 42 children (28.0%) were aged 5 to 7 years, 54 children (36.0%) were aged 8 to 10 years, and 54 children (36.0%) were aged 11 to 14 years.

Each child underwent a comprehensive clinical and instrumental examination, including anamnesis, complaint assessment, facial examination, facial symmetry analysis, and examination of the dental arches and occlusal relationships. To determine the growth patterns of the upper and lower jaws, anthropometric measurements of the dental arches, analysis of diagnostic jaw models, photometric facial analysis, orthopantomography, and lateral head teleradiography, followed by cephalometric analysis, were performed.

Particular attention was paid to assessing the size of the maxilla, the width of the dental arches, the position of the mandible relative to the base of the skull, and identifying signs of skeletal and dentoalveolar anomalies. Additionally, nasal breathing and the presence of harmful habits that could affect the development of the maxillofacial region were examined.

Patients were treated in stages. During the first stage, children with insufficient maxillary development and signs of skeletal Class III were prescribed Mark Ross orthopedic appliances and Face Masks, aimed at stimulating maxillary growth and correcting intermaxillary

relationships. The duration of this stage ranged from 8 to 14 months, depending on the child's age and the severity of the pathology.

After achieving positive changes in maxillary growth, the second stage of treatment was performed using fixed orthodontic devices—brackets. This stage was aimed at final alignment of the teeth, elimination of crowding, correction of occlusion, and stabilization of the achieved results.

Statistical processing of the obtained data was performed using SPSS Statistics 23.0. Mean values and standard errors of the mean (M±m), Pearson correlation coefficients (r), and indicators of statistical significance of differences (p) were calculated. Differences were considered statistically significant at a significance level of $p<0.05$.

Results and discussion. The data obtained demonstrate a high prevalence of maxillofacial developmental disorders among school-age children. The most frequently diagnosed disorder was maxillary underdevelopment, which was found in 48.6% of patients with orthodontic pathology. This anomaly was accompanied by a decrease in the size of the upper dental arch, disruption of intermaxillary relationships, and the formation of a mesial bite. Crowding of teeth was observed in 42.0% of children, narrowing of the upper dental arch in 31.3%, mesial bite in 24.7%, and crossbite in 18.0% of the patients examined.

It was found that the frequency and severity of orthodontic disorders increased with the child's age, especially during the transitional dentition. This confirms the importance of early diagnosis and timely initiation of orthodontic treatment.

After completing the first stage of treatment using the Mark Ross device and Face Masks, a significant improvement in the growth parameters of the upper jaw was noted. The average width of the upper jaw increased from 31.8±0.5 mm to 35.7±0.4 mm ($p<0.001$), and the length of the upper dental arch increased from 29.4±0.4 mm to 33.2±0.3 mm ($p<0.001$). At the same time, a decrease in the severity of dental crowding was observed: the crowding index decreased from 5.8±0.3 to 2.1±0.2 points ($p<0.001$).

Positive changes were also noted in the soft tissues of the face. The facial aesthetic index increased from 61.4±1.6 to 78.6±1.4 points ($p<0.001$), indicating an improvement in the facial profile and harmonization of facial proportions. Furthermore, the incidence of nasal breathing problems decreased from 44.7±3.2% to 18.6±2.1% ($p<0.01$), confirming the positive effect of maxillary expansion and advancement on respiratory function.

After completion of the first stage of treatment, a significant increase in the size of the upper jaw and improvement in intermaxillary relationships were noted.

After completing the second stage of treatment with braces, normalization of occlusion was achieved in most patients. Elimination of dental crowding, correction of individual tooth positions, and stabilization of intermaxillary contacts resulted in functionally and aesthetically pleasing results. After the second stage of treatment with braces, correct occlusion was achieved in 89.5% of patients. A strong statistically significant correlation was found between insufficient maxillary growth and the development of skeletal forms of mesial malocclusion (Table 1).

Table 1

Correlation between the characteristics of jaw growth and the development of orthodontic anomalies

Indicator	R	p
Underdevelopment of the upper jaw and mesial bite	0,78	<0,001
Narrowing of the upper jaw and crowding of teeth	0,71	<0,001
Impaired nasal breathing and deformation of the upper jaw	0,63	<0,01
The child's age and the severity of the anomaly	0,48	<0,05
Early initiation of treatment and effectiveness of correction	-0,74	<0,001

As can be seen from Table 1, the correlation analysis revealed a strong positive relationship between underdevelopment of the upper jaw and the formation of mesial bite ($r=0.74$; $p<0.001$), as well as between narrowing of the upper jaw and crowding of teeth ($r=0.69$; $p<0.001$). A moderate correlation was established between impaired nasal breathing and jaw deformations ($r=0.58$; $p<0.01$). A relationship was also found between the child's age and the severity of orthodontic pathology ($r=0.46$; $p<0.05$).

Of particular interest is the negative correlation between treatment effectiveness and the age at which treatment was initiated ($r=-0.71$; $p<0.001$), indicating significantly better orthodontic results with early treatment initiation. These findings support the need for preventive examinations of children beginning in preschool age and the timely application of orthopedic correction methods during the period of active jaw growth.

The data obtained demonstrate a high prevalence of dental anomalies among children examined at the Dentero Family Clinic. The main cause of orthodontic pathology was delayed development of the maxilla, which was observed in almost half of the patients examined. The use of the Mark Ross device and Face Masks during the period of active growth has proven highly effective in stimulating anterior growth of the maxilla. Particularly pronounced results were observed in primary school-aged children, when high bone growth potential remains.

The use of braces in the second stage of treatment eliminated residual dental alveolar defects and achieved stable functional and aesthetic results.

These results are consistent with modern concepts of early orthodontic intervention and confirm the need for preventive examinations for children starting at 5-6 years of age.

Conclusions:

1. Various forms of dentofacial anomalies were detected in 70.0% of examined children aged 5 to 14 years;

2. The most common pathology is underdevelopment of the maxilla, which occurs in 48.6% of patients;

3. Underdevelopment of the maxilla is reliably associated with the development of mesial bite and occlusion disorders;

4. The use of Mark Ross and Face Mask appliances helps stimulate maxillary growth and improve intermaxillary relationships;

5. The use of braces in the second stage of treatment ensures final correction of the dental arches and stable occlusion;

6. Early diagnosis and timely orthodontic treatment significantly increase the effectiveness of correction of maxillofacial deformities in children..

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