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Clinical Assessment and Treatment of Changes in the Occlusal Surface of the Dentition in Children

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Abstract **Introduction:** Diagnosis, treatment, and prevention of dental and jaw anomalies is one of the urgent tasks in modern orthodontics. As a result of dental and jaw anomalies, functions such as food intake and chewing are disrupted, children may mispronounce words, and cosmetic appearance is affected. Studying the prevalence of dental and jaw anomalies and deformities, as well as the effectiveness of their treatment, is an important issue. Among dental diseases, dental and jaw anomalies rank third in terms of occurrence and prevalence, following dental caries and periodontal diseases. **Methods:** Violations of occlusion of the dentition in children: violation of the central symmetry of the teeth - in 12 children (10%), infraocclusion - in 24 children (20%), supraocclusion - in 18 children (15%), secondary adentia - in 20 children (16.67%). The prevalence of dental caries in children aged 10–18 years averaged 68.7%. The highest rate of physiological growth in facial height in boys and girls was observed between the ages of 14 and 18 years. **Conclusion-** according to the results of the study, it was found that the deformations of the dental rows increase in direct proportion to the age group of children. Occlusal disorders of the dental rows in children - violation of the symmetry of the central teeth - were observed in 12 children (10%), infraocclusion in 24 children (20%), supraocclusion in 18 children (15%), and secondary edentulism in 20 children (16.67%). The average prevalence of dental caries in children aged 10-18 was 68.7%. In this case, the prevalence of dental caries in 10-year-old children was 63.5% on average. at the age of 13 - 62.7%; At the age of 15 - 47.8%, at the age of 18 - 41.4% ($r<0.001$), the greatest increase in the prevalence of caries was observed in children aged 10 to 13 years.

Keywords Anomalies and deformations, Occlusal surface, Oral cavity

1. Introduction

During the period of mixed dentition, the dental-jaw system is in the phase of growth and formation, so anomalies and deformities addressed in a timely manner will lead to the normalization of growth later on. All the above confirms the need for a new approach in diagnosing, treating, and preventing anomalies and deformities in the dental-jaw system, which arise due to changes in the occlusal plane of children's dental arches. In our scientific research, we conducted dental examinations among 155 children aged 10 to 18. Among them, 120 children had deformities in the occlusal plane of their dental arches, and 35 children were healthy (see Figure 1). They had come to the "Dental Center" of the Bukhara State Medical Institute for treatment. Patient histories were collected and analyzed, their views on the onset and development of the condition were heard, and a detailed objective examination was carried out.

2. Methodology

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155 children aged 10-18 were examined.

1. Children with deformities in the occlusal plane of their dental arches **(120 children)**
2. Children with normal occlusion **(35 children)**

57 of the examined children were girls and 63 were boys. All the examined children were grouped into age categories based on the stages of occlusion development according to D.A. Calvelis:

- **Group 1** – Late mixed dentition period (10-13 years), consisting of 52 children (28 boys and 24 girls);
- **Group 2** – Permanent dentition period (14-18 years), consisting of 68 children (36 boys and 32 girls).

In the main group, we identified local and general etiological and pathogenetic factors leading to supraocclusion, infraocclusion, and tooth loss in the dental arches. Special attention was given to analyzing the age at which the children lost teeth and the resulting morphological and functional changes.

The dental examination and inspection were conducted using a generally accepted standard set of dental instruments, including a survey, patient complaints, objective examination, inspection of the oral mucosa, teeth and dental arches, periodontal tissues, chewing muscles, and the

temporomandibular joint. Previous orthodontic treatment, surgery in the facial-jaw area, and the patient's complaints were also identified. [1,3,5]

During the clinical examination, a medical history was collected, and attention was paid to the presence or absence of local and general systemic diseases, as well as salivation. During the tooth inspection, the color, size, position, presence of decayed or broken teeth, sensitivity changes, mobility, and the condition of the alveolar bone in the location of missing teeth were noted. The movements of the lower jaw in vertical, transverse, and sagittal directions were evaluated. The functional aspect of the diagnosis included dynamic tests (breathing, speech, swallowing). Clinical functional tests according to Ilyina-Markosyan were carried out. The orthodontic diagnosis was made according to D.A. Calvelis' classifications. In facial and head anthropometric examination, several points and landmarks exist [2,7]. In our scientific research, we used several of them. Facial type – According to the classification of Garson and Kollman, there are three types of face: broad, medium, and long [4,6].

To determine the facial type, we identified two parameters: 1) the height of the face from the front and 2) the width of the face between the cheekbones, which we measured using a caliper. In our scientific work, to achieve our objective, it is possible to qualitatively determine the facial profile type without using a patient photo. The face was classified as straight, concave, or convex. To determine the facial profile type, we used a flat rectangular colorless plate (15 x 5 cm). Analysis of the models was carried out according to the methodology of O.J. Nazarov (2010). Radiographic examination methods – Among functional examinations of teeth, jaw, and temporomandibular joint, radiographic examination plays a key role. Our examinations using the orthopantomogram (OPG) showed that the condition of the upper and lower dental arches, occlusion relationships, and the sequence of tooth eruption were analyzed in the main group of patients. Cephalometric radiography – In this radiographic method, the examination is initially performed from a considerable distance (approximately 1.5 meters). In such an examination, the X-rays are directed parallel to each other, which minimizes projection distortions and shows the object in its minimal state. As a result, it is possible to obtain a full-sized image of the head and neck, which is an advantage of this research method. Currently, there is a technique to convert a three-dimensional image into a two-dimensional one. [8]

Cephalometric radiography can be performed in two projections: lateral (sagittal) and direct anterior (frontal). The lateral cephalogram allows for a clear assessment of the jaw's relationships. We analyzed the cephalometric radiographs using the Schwarz, Downs, and Tweed methods. Schwarz's method uses points located on the cranial base (anterior part) as landmarks. For studying the cephalometric radiograph according to Schwarz, the following points are considered fundamental: Se (Sella), N (Nasion), Or (Orbitale), Sna (Spina nasalis anterior), Snp (Spina nasalis posterior), Po (Porion), Ss (Apoint), Sn (Subnasale), Spm (Bpoint), Pg (Pogonion), Go (Gonion), Gen (Gnation). The A-point is the subspinal point, the deepest point on the upper jaw's apical base, while the B-point is the supramental point, the deepest point on the lower jaw's apical base. The statistical analysis of the results was conducted using the Statistica software package for Windows 7.0 and the EXCEL-2007 program. The distribution parameters of the analyzed features are presented in the form of the mean (M ± m) and the standard deviation. To compare the means of more than one group, multiple comparison methods were used (Newman-Keuls); for comparing multiple groups, the Student t-test was applied. The Spearman correlation coefficient was calculated. A difference between groups was considered statistically significant at $p < 0.05$.

3. Results

The types of occlusal disorders in children's dental arches and their prevalence rates are shown in. The symmetry of the central incisors was disrupted in 11 children (9.6%), and infraocclusion was observed in 24 children (21%). In the main group of children, the primary causes of tooth loss were identified as dental caries and its complications, according to the medical histories collected from the children and their parents. Based on the research conducted and the medical histories gathered from the children and their parents, we can state that 85-90% of children do not know about the eruption of the first permanent molar at the age of 6.5–7 years. As a result, during the early mixed dentition period, milk teeth (deciduous teeth) are affected by caries. Consequently, due to the complications of caries, permanent teeth are also extracted. In the main group of children, caries is widely spread on the chewing surfaces of the molars, particularly in the natural fissures. Caries lesions were detected in the cervical part of the frontal teeth. The examinations showed that the prevalence of dental caries in 10-year-old children was 63.5% on average. In 13-year-olds, it was 62.7%; in 15-year-olds, it was 47.8%, and in 18-year-olds, it was 41.4% ($p < 0.001$). The data presented in indicates that the highest increase in the spread of caries was observed in children between 10 to 13 years old. In this group, the intensity of the caries process in permanent teeth was 2.41 ± 0.12 on average. The caries intensity of permanent teeth in 18-year-olds was 2.55 ± 0.02. A comparative analysis of the spread of caries in permanent teeth was conducted for children aged 13 to 18 in the main group. In our study, the average spread of the caries process in the main group of.

In the main group of children, the hygiene index for the 14–18-year-old group was the highest, reaching 2.82. The data presented in Table 1 shows that the initial oral hygiene condition was poor in children from the main group who were planned for comprehensive treatment. In the main group, dental calculus was detected in 71.4% of the children.

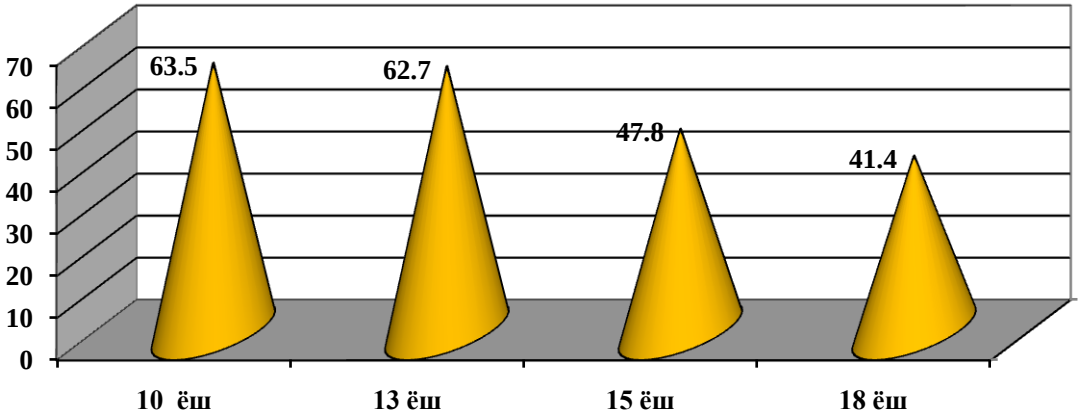

Figure 1. Prevalence of permanent tooth caries in children aged 10 to 18 years (%)

Table 1. Hygiene Index (HI) in children with occlusal deformities in dental arches and healthy children

Children's age	GI			
	Main group, n=120		Control group, n=35	
	Abs	M±σ	Abs	M±σ
10-13 age	52	2,17±0,37*	16	1,11±0,14
14-18 age	68	2,82±0,76*^{x}	19	1,31±0,21

Izoh: * - compared to the control group (* - P<0,01) – reliability difference is defined.

The values of the papilla-margina-alveolar index and inflammatory changes in periodontal tissues according to the Schiller-Pisarev test in children of the main group were clearly and reliably distinguished from the data of the healthy group. Signs of bleeding from the gingival pockets were detected in children with deformation of the occlusal surface of the tooth rows. Dental calculus was detected in 72.6% of children of the main group.

In the control group, subgingival and supragingival tartar was detected in 15 children. It was determined that the children of the main group need to undergo "professional" oral hygiene, which includes learning hygienic skills and monitoring tooth brushing. According to the CPITN index, the need for oral hygiene measures in the main group was 75.7%, in the control group - 39.2%.

The results of facial measurements are presented in Table 2. Studies have shown that the highest rate of growth in physiological facial height was observed in healthy boys aged 14-18 years. Thus, in children and adolescents with deformities of the occlusal surface of the dental rows, the morphological and physiological height of the face grows at different rates compared to healthy children (especially at the age of 14-18). In healthy children, the growth rate of the anthropometric parameters of the face is almost the same over the same period of time.

Studies have shown that the highest rate of growth in physiological facial height was observed in the main group of children aged 14-18 years.

Table 2. 10-18 morphological parameters of the face in the group of children with occlusal deformations of the tooth rows and healthy children

Facial measurements (см)	Groups	Sex; n= 155	
		Boy	gril
Physiological height of the face	NG	19,11±1,15	19,01±1,29
	AG	19,01±1,87	18,5±2,09
Morphological height of the face	NG	12,31±0,71	12,21±0,91
	AG	12,19±1,76	12,03±1,79
The height of the upper part of the face	NG	6,4±0,82	6,62±1,13
	AG	6,4±1,21	6,62±1,09
The height of the middle part of the face	NG	6,31±0,45	6,78±0,71
	AG	6,27±1,41	6,78±1,23
The height of the lower part of the face	NG	6,42±0,61	6,43±0,71
	AG	6,25±1,02	6,19±0,76

In healthy boys aged 14-18 years, the physiological facial height was on average 19.11±1.15 cm (no growth rate), while in girls this parameter was on average 19.01±1.29 cm (growth rate -1.6%). In healthy children, the morphological facial height was on average 12.31±0.71 (growth rate -1.01%), while in girls it was on average 12.21±0.91 (growth rate -1.21%).

Thus, in children and adolescents with dental deformities, the morphological and physiological height of the face grows at different rates compared to healthy children. In healthy children, the growth rate of the anthropometric parameters of the face is almost the same over the same time period.

The Pon index of pemolar teeth is equal to 80, and the index of molar teeth is equal to 64. The four upper incisors are divided by the index number by multiplying the width dimension by 100 (11,12,21,22 sum of width*100/index). Peremolar index changed by 0.8 mm and molar index by 1.1 mm in the main group of patients aged 14-18 years.

In the main group, morphological features of the occlusal

surfaces of the teeth were observed - in children, the upper first and second molars also had areas of fusion, but more often in the teeth on the chewing side than in the teeth on the opposite side. In 8 patients, hyper-balancing supercontacts were detected on one side. The reasons for their occurrence are differentIn the central occlusion, it did not prevent the connection of the tooth rows, during the occlusal movement of the lower jaw to the left side, premature contact occurred in the distal slope of the palatal cusps in 7 teeth on the upper right side and in the anterior cusps in 8 teeth from the lower right side, which did not allow contact with the teeth on the working side.

In accordance with the records, the implementation of these movements in the articulator showed that the violation of the direction of movement and asymmetry of the lower jaw is formed due to the presence of balancing and hyperbalancing supercontacts. Symmetric contact of incisors was not present in 6 patients. Unilateral balancing contacts were found in lateral occlusion of patients with intact tooth rows.

Posterior contact position also shifted laterally in 18 patients, 13 of whom had matching posterior contact position and central occlusion. Lateral occlusion movements were symmetrical in 7 patients, the amplitude of these movements was limited. Protrusive movements were disturbed in all patients, deviated from the anterior sagittal line. In 2 patients, protrusion and side occlusion movements were severely limited to 1-2 mm due to the dysfunction of the thoracic cavity.

When determining the angles of the transverse occlusion curves, the angle values were determined between the horizontal, the junction of the cusps of the opposing molars of the same name and the separate right and left transverse curves for these teeth.

The areas of the first molars ranged from 0 to 4.0° in all cases. In the area of the second molars, the angles of the transverse curves ranged from 0 to 5° in 8 cases, from 5.5 to 9.0° on the right and left in 18 cases, and 9 degrees or more in 14 cases.

In the main group, in the region of the first molars of the teeth on the right and left, the angles of the transverse occlusion curves were from 0 to 4.5o in 2 cases, from 5.0 to 9.0o in 5 cases, and 9 or more in 12 cases. In the region of the second molars, the angles of the transverse occlusion curves were 9.0o or more in 100% of cases.

In computer tomography, the correlation of joint head displacement was analyzed depending on the type of bite. In 20% of children with orthognathic bite, the head of the mandibular joint was displaced and in 80% it was located in a normal central position. In 71.4% of children with distal bite, the head of the mandibular joint is shifted upwards and backwards, only in 28.6% the head of the joint is in the central position. In 73.3% of children with deep bite, the head of the mandibular joint was displaced upwards and backwards, in 26.7% no displacement was observed. We found out that 33.3% of children with medial bite had displacement of the joint head, and 66.7% had a normal position of the joint head.

Table 3. Conditions of the head of the mandibular joint depending on the type of bite

Type of bite	ChPJB joint head position		Total
	pathological	Normal	
Orthognathic	2 (20%)	8 (80%)	10
Distal	10 (71,4%)	4 (28,6%)	14
Medial	4 (33,3%)	8 (66,7%)	12
Deep	11 (73,3%)	5 (26,7%)	15
open	6 (54,5%)	5 (45,5%)	11
Crossed	12 (70,6%)	5 (29,4%)	17

Stages of treatment of children with deformations in the occlusal level of the tooth row:

1) oral cavity sanitation and caries prevention measures were carried out, surgical preparation (lip and tongue plastic surgery), elimination of upper respiratory tract pathologies - improvement of nasal breathing.
2) correcting the shape of the arches of the tooth row using orthodontic appliances, for this, removable orthodontic appliances consisting of various elements, myobarrests and acetal microprostheses were used instead of missing teeth.
3) In the retention period - a dense fissure-contact was achieved with the help of a non-removable retainer, removable retention devices.

The effectiveness of orthodontic treatment was assessed using radiological, diagnostic models, anthropometric examinations, and photometry.

The complex treatment we recommend:

1. Late replacement bite - 10-13 years old: use of myofunctional caps to normalize the relationship of the jaws, as well as caps to normalize the myobridges and occlusal level, replacing lost teeth with acetal microprostheses.
2. Permanent bite - 14-18 years old: use of non-removable mechanical impact (braces) orthodontic appliances to ensure the relationship of the jaws, gluing of antagonistic teeth in a normal position and caps to normalize the occlusion level, replacing lost teeth with acetal micro-prostheses.

For the prevention of periodontal inflammatory diseases, use Ginginorm, a natural herbal remedy, 3 times a day for 15-20 minutes. gargling before meals is prescribed and the development of complications is not allowed.

4. Conclusions

according to the results of the study, it was found that the deformations of the dental rows increase in direct proportion to the age group of children. Occlusal disorders of the dental rows in children - violation of the symmetry of the central teeth - were observed in 12 children (10%), infraocclusion in 24 children (20%), supraocclusion in 18 children (15%), and secondary edentulism in 20 children (16.67%).The average prevalence of dental caries in children aged 10-18 was 68.7%.

In this case, the prevalence of dental caries in 10-year-old children was 63.5% on average. at the age of 13 - 62.7%; At the age of 15 - 47.8%, at the age of 18 - 41.4% ($r<0.001$), the greatest increase in the prevalence of caries was observed in children aged 10 to 13 years.

It was found that it is possible to assess normal or pathological facial growth processes in children using anthropometric measurements. The highest rate of growth in physiological facial height in children with deformities caused by the loss of molar teeth was observed in the main group of children aged 14-18 years. The highest rate of growth in physiological facial height in boys and girls was found in the age group of 14-18 years.

Late replacement bite - 10-13 years old: use of myofunctional caps to normalize the relationship of the jaws, as well as caps to normalize the myobridges and occlusal level, replacing lost teeth with acetal microprostheses.

Permanent bite - 14-18 years: the use of non-removable mechanical impact (braces) orthodontic devices to ensure the relationship of the jaws, the clinching of antagonistic teeth in a normal position and caps to normalize the occlusion level, replacing lost teeth with acetal microprostheses, compared to the basic treatment, a 93.4% positive result was achieved.

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