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ANALYSIS OF OCCLUSAL ANOMALIES: CORRELATION BETWEEN CLINICAL AND PHOTOMETRIC METHODS

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Abstract

This article reviews the processes involved in identifying and analyzing occlusal anomalies in dental arches using both clinical and photometric methods. It examines the role and significance of data obtained through clinical studies of anomalies, as well as diagnostic approaches, including photometric analysis. The study highlights the importance of identifying dental anomalies in education, which provides critical information for early detection and the development of effective treatment strategies. Diagnostic tools, clinical imaging, and parametric photometry are explored as methods that hold significant potential for advancing patient care, though they also introduce new challenges and requirements within the healthcare field.

Keywords: Occlusion, orthodontic diagnosis, photometric method, diagnostic model

Relevance

Currently, more than 30% of children and adolescents require medical orthodontic care (1,4,5,10,14). This growing demand highlights an increasing need for orthodontic services within the general population. The alignment of the dentofacial system with morphological, functional, and aesthetic standards is crucial for improving individuals' quality of life. Anomalies and deformities in the dentofacial system significantly impact psychological well-being and self-confidence. Patients with orthodontic issues often seek to correct their dental conditions in the shortest possible timeframe. However, the average duration for addressing anomalies in the dental system ranges from 1.5 to 2 years (2,6,8,12).

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The duration of orthodontic treatment often leads to negative perceptions among patients. One of the key challenges in modern orthodontics is to reduce treatment duration while simultaneously increasing its effectiveness. However, attempts to shorten treatment by applying stronger forces can result in various periodontal complications.

Orthodontic appliances influence blood circulation in the periodontal tissues and alter mineral metabolism in the alveolar bone. Inflammatory processes within the periodontal tissues may be exacerbated during orthodontic treatment. Furthermore, the use of non-removable appliances often contributes to a decline in oral hygiene. An increase in the age of patients undergoing orthodontic treatment has been associated with a higher prevalence of periodontal diseases (3,7,9,11,13).

Given these factors, there is a need for a comprehensive approach to managing changes and complications that occur in periodontal tissues during and after orthodontic treatment. Understanding the effects of orthodontic interventions on periodontal health remains a critical area of study (2,5,6,8,9,12,14).

Materials and Methods

During the study, 58 patients aged 14 to 35 years with intact maxillary and mandibular occlusal alignment and a diagnosis of crowded teeth were examined. Of these, 32 patients were included in the treatment group. The selection criteria for inclusion were as follows:

1. Patients aged 14 to 35 years with a permanent dentition.
2. No prior orthodontic treatment.
3. Orthognathic occlusion and dental-alveolar forms.
4. Symmetrical growth of the upper and lower jaws.
5. Crowding of teeth in upper and lower jaws not exceeding 4 mm.
6. Absence of retained teeth or third molars in upper and lower jaws based on orthopantomogram analysis.
7. Good oral health with preserved dental crown anatomy.

In accordance with the research objectives, 26 of the examined patients were not included in the treatment group, since 12 had orthognathic pathology of the skeletal form, 8 patients had a tooth density of more than 4 mm, and 6 had asymmetric growth of the lower jaw.

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The patients were divided into two groups of 16 people. The number of men and women in both groups was equal. Diagnostic methods included clinical examination, anthropometric analysis, and photometric evaluation.

Results

A total of 32 patients, aged 14 to 35 years, diagnosed with malocclusion of the jaw bones and crowding of teeth in both the upper and lower jaws, were included in the study. Upon presentation to the clinic, the patients reported concerns regarding the improper alignment of teeth in the upper and lower jaws as well as dissatisfaction with smile aesthetics. While the majority of patients were previously aware of their dentofacial malocclusion, none had undergone prior orthodontic treatment.

A survey conducted among patients in the treatment group revealed that occlusal anomalies were present in their close relatives. Specifically, 20 patients (62.5%) reported malocclusion among their relatives, 8 patients (25%) suspected the presence of developmental anomalies in the dentofacial system, and 4 patients (12.5%) were uncertain or unable to provide an answer.

In assessing the medical history, 14 patients (43.75%) denied having any chronic illnesses. Among the reported past and concomitant diseases, the majority mentioned acute respiratory infections, acute respiratory viral infection and common childhood infectious diseases. None of the patients had a history of endocrine disorders or conditions related to the ENT (ear, nose, and throat) organs.

Facial examination and analysis of photographs of patients were carried out in front and profile according to the method of Amett (2003) in a state of physiological rest and in a full smile. In 32 (100%) patients, facial examination revealed signs characteristic of dense tooth placement in the upper and lower jaw: harmonious relationships of the upper, middle and lower thirds of the face, moderate labial-maxillary fold, and a correct facial profile.

The following were identified during evaluation of the soft tissues of the oral cavity:

- Lower lip underdevelopment in 6 (18.75%) of patients.
- Upper lip underdevelopment in 2 (6.25%) of patients.
- Short upper lip in 4 (12.5%) of patients.

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When examining the dentition and occlusion, the permanent preoccupation in all patients in groups 1 and 2 corresponded to the age-specific norm. In 32 (100%) patients, the lateral group of the dentition corresponded to Engle's class 1. In patients in both groups, the average density of teeth in the upper dentition was 5.3±0.8 mm, which indicates that there is no need to remove premolars in the upper dentition. Also, the average density of teeth in the lower dentition indicated that there is no need to remove premolars, since in groups 1 and 2 the average values were 4.94±0.8 mm.

In addition to the above data, the carious and non-carious state of the hard tissues of the teeth was also taken into account. All patients were sent for a therapeutic examination before and after treatment, they were shown hygienic cleaning of the oral cavity, remineralization therapy and treatment of carious teeth.

Thus, according to clinical and photometric examination methods, the patients in groups 1 and 2 were of the same composition.

The results of anthropometric measurements of diagnostic jaw models before treatment showed that anthropometric examinations of diagnostic jaw models of patients in groups 1 and 2 were performed using the Tonn, Pont, Korkhaus, and Nance methods.

According to the results of anthropometric analysis of plaster models, it was found that the sizes of the upper and lower recesses were proportional in the two groups of patients (Table 1).

Table 1 Relationship between the sizes of the frontal teeth of patients in groups 1 and 2 (Tonn)

Indeks	N	1 group		2 group		U-Mann-Whitney	p-lever
		M	s	M	s		
Tonn	1,33	1,32625	0,008062	1,32750	0,006831	118	0,723975

Studying the diagnostic models obtained before treatment according to the Pont method made it possible to determine the narrowing of the lateral parts of the upper and lower dental rows.

In groups 1 and 2, the narrowing of the tooth rows in the region of the upper and lower premolars was determined to be 4.43 and 4.05 mm, respectively. In this case, the width of the upper tooth row in the region of the premolars was 32.625±2.9 mm in group 1 and 32.937±2.88 mm in group 2, and the width of the lower tooth row was 31.906±3.03 mm in group 1 and 31.344±2.99 mm in

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group 2. Analysis of the width of the upper and lower tooth rows in the region of the molars showed a slight narrowing of the tooth rows in both groups of patients, but no statistically significant data were identified (Tables 2, 3).

Measurement of the length of the anterior incisor according to Korkhaus did not reveal statistically significant deviations from the norm in groups 1 and 2 of patients.

Table 2

Indeks	1 group		N		T-Wilcoxon	p-lever
	M	s	M	s		
Korkhaus upper jaw	17,625	1,24695	18,25625	1,100890	<0,00001	0,0982
Korkhaus lower jaw	15,93750	1,67262	16,25625	1,100890	<0,00001	0,3346

Table 3

Indeks	2 group		N		T-Wilcoxon	p-lever
	M	s	M	s		
Korkhaus upper jaw	17,71875	1,48312	18,24375	1,92989	<0,00001	0,438
Korkhaus lower jaw	16	0,930949	16,25625	1,100890	54,5	0,485135

The results of the analysis of the lack of space in the upper and lower tooth rows according to the Nance method in the two groups of patients showed a dense arrangement of teeth in the upper and lower tooth rows (Table 4).

Table 4

Indeks	1 group		2 group	
	M	s	M	s
Nance upper jaw	5,28125	0,795168	5,28125	0,930390
Nance lower jaw	4,93750	0,813941	4,93750	0,727438

When comparing the studied groups at the beginning of orthodontic treatment according to the above parameters, no statistically significant intergroup differences were detected, which indicates the homogeneity of the experimental groups.

The results of anthropometric measurements of diagnostic models of the jaws during dental treatment show that, in accordance with the tasks assigned to

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patients of groups 1 and 2, at the beginning of the adjustment phase, in addition to the above methods, an analysis of diagnostic models was carried out using the ABO anthropometric quantitative assessment system.

At the beginning of the final stage of treatment, the studied groups were identical in terms of ABO system standards.

The following percentage error rates were found in anthropometric studies conducted in groups 1 and 2 according to the ABO system:

1. Violation of the position of the crowns of the teeth in the vestibulo-oral direction (rotation) (93.75%)
2. Violation of the relationship of the costal ridges of the teeth in the vertical direction (56.25%)
3. Facial-lingual deviation of the occlusal teeth (75%)
4. Violation of occlusal contacts in the occlusal areas (81.25%)

As shown by this study, the most frequent errors occur in the process of correcting the position of the occlusal teeth of the upper and lower jaws:

- When correcting the fissures of the first molars in the upper jaw (96%)
- When correcting the fissures of the second molars in the upper jaw (82%)
- When correcting the fissures of the first molars in the lower jaw (63%)
- When correcting the fissures of the second molars in the lower jaw (68%)

Conclusion

Based on the tasks set, the results of the two study groups were compared with the archive group, and the following was found: the ABO system norms measured at the beginning of treatment in patients of groups 1 and 2 were significantly higher than those obtained in the archive diagnostic models.

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