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Features of Determination of Parameters of Masticatory Function in Patients with Dentition Defects and Dentoalveolar Deformities

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Abstract.

The objective of the research was to improve the efficiency of diagnosis of dentoalveolar deformities based on the study of clinical peculiarities and parameters of chewing efficiency in different groups of people.

Materials and methods. The results of clinical examination of 98 patients of different ages (20 to 59 years) with dentition defects are presented in this article.

Results. The objective study using statistical methods showed a difference in parameters of chewing efficiency between patients with dentition defects of various localization with co-existent dentoalveolar deformities. There were established some factors which develop in parallel with the change in the parameter of chewing efficiency, namely the degree of displacement (chewing ability of the teeth-antagonists reduces in case of reduction in their contact area), the state of the periodontal tissues of displaced teeth (the ability to cut, nibble or crush food reduces if pathologic tooth mobility occurs), trophic level of the teeth that are deformable or surround the area of displacement (chewing efficiency reduces if innervation and blood supply are absent).

Conclusions. The results indicate unreliable indicators obtained when using standard statistical method for determining the efficacy of chewing in patients with dentoalveolar deformities, the severity of the clinical picture of periodontal status and high rates of pathologic occlusion in these people.



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Problem statement and analysis of the recent research

The dentoalveolar deformities may result in some complications including changes in the temporomandibular joint, the progression of pathologic changes in the periodontium, bruxism [1, 5]. These pathological conditions affect the rate and degree of progression of other changes in the masticatory apparatus. However, quite often the opposite pathology can be observed, namely the development of secondary deformities is stimulated if there are any periodontal or occlusal changes.

The relationship of these abnormalities in the chewing system can be clearly seen when evaluating masticatory efficiency in patients with dentition defects of various localization and dentoalveolar deformities. The determination of chewing efficiency in patients with dentition defects and dentoalveolar deformities allows us to determine the route cause of a particular disease. Moreover, when determining the indicators of chewing function the mechanism of developing the secondary deformities becomes clear.

These data directly indicate a need for consideration and detailed study of masticatory efficiency in patients with dentition defects and secondary deformities in order to treat such pathology of the dentoalveolar system effectively

The objective of the research was to improve the efficiency of diagnosis of dentoalveolar deformities based on the study of differences in chewing efficiency between different groups of people.

Materials and methods

At the Department of Prosthetic Dentistry of the IFNMU there were examined 168 people who suffered from an abnormal chewing function or aesthetic appearance. 96 patients with dentition defects at the age of 20-59 years being selected for the study were divided into two groups. Group I included patients with dentition defects without any complications. Group II included individuals with dentition defects and co-existent dentoalveolar deformities.

The clinical evaluation was conducted considering all the patient's complaints, past medical history and disease history, data of physical examination, biometric analysis of diagnostic models, photometric determination of the contact area of the teeth-antagonists, results of an X-ray examination and data obtained when comparing statistical and functional chewing tests.

The objective study allowed us to evaluate the presence of dentition defects and features of developing dentoalveolar deformities in patients. The analysis of diagnostic models allowed us to determine changes in the contact area of the teeth-antagonists rationally as well as to establish chewing efficiency using the statistical method. The results of an X-ray examination allowed us to assess the periodontal status of deformable teeth and interconnect the influence of clinical picture of changes in tooth retaining apparatus with reduced chewing efficiency. Statistical evaluation of chewing efficiency allowed us to study the differences in chewing indicators in case of defects of different localization. It should be noted that according to the rules of determining chewing efficiency using the statistical method the tooth performs its normal chewing if teeth-antagonists are present. However, it does not indicate how to calculate the chewing indicators in case of deformities.

Statistical analysis of the results was performed using computer programs STATISTIKA-6 and the Microsoft Excel spreadsheet software statistical functions. Student's t-test and Fisher's exact test were used. The difference was considered significant at $p < 0.05$.

Results

Considering the complaints and the results of clinical examination of patients it was found that among 168 people 96 (57.1%) patients with the absence of one or more teeth applied to the clinic of prosthetic dentistry to repair dentition defect in order to restore chewing function or

aesthetic appearance. The systemization of the results of physical examination and analysis of diagnostic models allowed us to divide all the patients into groups as follows: Group I included 52 (54.2%) patients with dentition defects without any complications; Group II included 44 (47.8%) individuals with dentition defects and co-existent dentoalveolar deformities.

When studying chewing efficiency in patients of both groups the statistical method was used. It was found that there are some inconsistencies in the determination of masticatory efficiency index according to Agapov's table depending on localization of defects with co-existent deformations.

When conducting the statistical determination of chewing efficiency in patients of Group I there were found no inconsistencies, namely the results of physical examination were similar to normal values. Dentition defects were grouped by the Kennedy classification of the defects: class I - 4 (6.9%) cases, class II - 9 (15.5%) cases, class III - 25 (43.1%) cases, class IV - 20 (34.5%) cases. Dentition defects in both jaws were detected in 6 (11.5%) persons only.

Dentition defects in patients of Group II were also grouped by the Kennedy classification of the defects: class I - 7 (11.1%) cases, class II - 13 (20.6%) cases, class III - 24 (24.1%) cases, class IV - 19 (30.2%) cases. Dentition defects in both jaws were detected in 19 (43.2%) patients (including 16 individuals with dentition defects on one side). In these 16 patients there were observed some inconsistencies in determining the statistical value of chewing efficiency since if antagonistic defects and dentoalveolar deformities are present chewing efficiency in these areas does not match the clinical picture. In particular, there were detected 9 clinical cases of antagonism of the teeth, which does not occur normally (it developed due to deformation in one direction on both jaws) and 7 cases of the lack of antagonism, which occur normally (it developed due to diversified teeth displacement) as a result of dentoalveolar deformities.

Table 1

Distribution of dentition defects depending on localization according to the Kennedy classification (number of people/percentage)

	Class II	Class II	Class III	Class IV
Deformations are absent	4 (6.9%)	9 (15.5%)	25 (43.1%)	20 (34.5%)
Deformations are present	7 (11.1%)	13 (20.6%)	24 (24.1%)	20 (34.5%)

According to the results of X-ray and objective examinations there was determined that among patients of Group I changes in the periodontal tissue of the teeth limiting the defect were observed in 11 (21.2%) cases and pathologic tooth mobility was detected in 2 (3.9%) cases only. These parameters were higher in patients of Group II: changes in the periodontal tissue of the teeth limiting the defect were detected in all 44 (100%) cases, and pathologic tooth mobility was observed in 25 (56.8%) cases. Pathologic tooth mobility was found in 27 patients. It was mainly characterized by moving to the sagittal direction (the first degree - 19 (28.1%) people) and matching the circular amplitude (the second degree - 8 (8.3%) people). Having analyzed the data of the spot radiography it should be noted that the expansion of periodontal gap in the direction opposite to the displacement and, in turn, narrowing of periodontal gap at the other site are typical for displaced teeth.

When evaluating the teeth surrounding the defect among patients with secondary deformities (Group II) in 66 (68.75%) cases devital teeth were detected, in 28 (29.2%) cases aesthetics was restored and in 19 (19.8%) cases teeth were intact. At the same time in patients with dentition

defects without co-existent secondary deformities devital teeth were found in 17 (32.7%) cases, 29 (55.8%) teeth were aesthetically restored and 46 (88.5%) teeth were intact while in patients of Group II these parameters were 36 (81.8%), 25 (56.8%) and 13 (29.5%), respectively.

Having analysed diagnostic models there was found that in Group I abnormal teeth antagonism was observed in 9 (17.3%) cases, while in Group II it was found in 42 (95.5%) cases. The indicators of teeth articulation on their lateral side differed from normal values, namely for the maxillary premolars they were 5.39 ± 0.34 mm, for the mandibular premolars they were 4.78 ± 0.27 mm, for the maxillary molars they were 9.25 ± 0.29 mm, for the mandibular molars they were 8.55 ± 0.35 mm. This process was characterized by the change in physiological cusp-fissure contact with the loss of one or more keys of occlusion.

Discussion

After a detailed study of the indicators of masticatory efficiency in patients with dentition defects using the statistical method of diagnosis it can be stated that the rational use of this method is impossible in patients with dentoalveolar deformities as indicated by Z.R. Ozhohan [4]. In patients with dentition defects without secondary deformities the indicators of chewing efficiency when using the statistical method corresponded to the rules of using Agapov's indicators. At the same time the indicators of masticatory efficiency in patients of Group II were significantly different from those in the table.

Having studied the features of the state of the periodontal status of teeth in both groups in detail, it can be stated that changes in the trophic processes were more often observed in patients of Group II. Changes in the periodontal tissues among individuals of Group I were observed in 21.2% of cases and among patients with secondary deformities - in 100% of cases. Pathologic tooth mobility in patients with dentition defects was observed in 3.9% of cases being significantly lower than in patients of Group II (56.8%). The above-mentioned indicators are higher compared to those obtained by Yu.B. Zolotareva [2], which is associated with greater number of people being recruited to study groups. Devitalization of teeth was found to cause an abnormal chewing function as when comparing the results of clinical cases of Group I and Group II it was observed in 32.7% and 81.8%, respectively. The indicators of the presence of intact teeth were 88.5% versus 29.5%, respectively.

It should be noted that the development of secondary deformity is accompanied not only by changes in tooth position in the dental arch but changes in dental occlusion (95.5% of cases among patients of Group II) and the development of artificial supercontacts resulting in the pathological dental abrasion. Moreover, even the absence of complications such as secondary deformity does not ensure the stability of occlusion of the teeth-antagonists, as this pathology was found in 17.3% of cases.

Conclusions

1. The study revealed that data of determining chewing efficiency using the statistical method in patients with dentoalveolar deformities of Group II can not be considered as significant as a result of non-compliance to rules of determination of this indicator.

2. The state of the periodontal tissues of displaced teeth was characterized by the severity of the clinical picture in patients of Group II (100% of cases with changes in the periodontal tissues and 56.8% of cases with fixed pathologic mobility) compared to the data obtained in patients of Group I (21.2% and 3.9%, respectively) indicating the influence of the state of the tissues surrounding the tooth on the parameters of chewing efficiency.

3. Pathologic occlusion was observed in patients of Group II (95.5%) as well as in patients with dentition defects (17.3%) indicating its importance in the development of secondary deformities and affecting the rate of their occurrence.

Prospects for further research

The study of the causes and consequences of differences in parameters of chewing efficiency is necessary and promising in order to make the rational diagnosis as well as to treat dentoalveolar deformities.

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