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Quantitative Evaluation of the Response by the Maxillary Sinuses to the Occlusal Load.

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ABSTRACT

The origin of odontogenic sinus infections is usually related to the infection spreading from the periapical tooth tissues. However, an intensive, long-lasting loading, in particular of damaged dental arch results in deformations and destruction of the tissues holding the dental roots. If the strength capacity of parodontium is relatively high, also the other tissues of the maxilla-facial area involved in grinding of a food bolus are damaged and destroyed. The study provides substantiation of the occlusal load for genesis of the maxillary sinusitis.

Keywords: occlusion, tooth occlusion (placement), injury, sinusitis

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INTRODUCTION

The number of patients suffering from pathologies in the maxillary sinus area is generally increasing [1-6]. We distinguish different aspects of the protective function of the maxillary sinus epithelium [7-9]. It should be supposed that the function overloading of the teeth the roots of which are located within the maxillary sinus or in close proximity to it cause in response to the repeated occlusal injury a localized hyperplastic reaction of the multinucleated columnar ciliated epithelium. Our hypothesis is indirectly confirmed by the widely-spread concept of the irreversible changes of mucosa that has to be surgically removed since the medical treatment does not result in the recovery [10, 11]. The specified statement demonstrates the non-causality of the therapeutic approach explaining failure thereof in a number of cases among which there is occlusal injury maintaining inflammation in the maxillary sinus membranous lining.

METHOD

The investigation was performed with the use of the orthopantomograph featuring 3D-graphics option Toshiba PaX – Reve 3D. The linear attenuation coefficient of the X-radiation was studied by the patients; the findings were represented in the form of a histogram displaying the dependency of the emission variation within the specified segment of the distinguished secant expressed in conditional Hounsfield units. The thickness of the epithelial structures filling the maxillary sinus space located directly on periosteum or teeth roots was measured. In order to carry out the measurement a perpendicular from the examined point of the bone tissue or tooth root with the value not less than 180 HU was put along any of the appropriate axes (abscissa, ordinate or applicate) up to the point corresponding to the imaging boundary for soft tissues with the value not less than 350 HU.

MAIN PART

We have determined the objective of the research: by classifying the clinical-topographic relation of the maxillary sinuses floor and roots of the grinder teeth of the maxilla by persons not complaining about the condition of their ENT-organs to provide statistical estimation of the maxillary sinus epithelium response to occlusal load.

The research included 300 tomograms of patients, both male and female, with damaged dental arches (n = 168) and intact dental arches (n = 132) at the age from 19 to 55 years. The patients applied to dental hospitals with complain of the different disorders of the dental apparatus. Neither of the patients had complaints requiring differential diagnostics in respect of the maxillary sinus diseases.

In order to achieve the objective set the patients were divided into three groups. The first group was made of 76 patients (25,3%) the teeth roots of which sat by more than 2 mm from the maxillary sinus floor. The second group included 107 patients (35,7%) by whom at least one of the teeth roots was adjacent by more than 2 mm to the maxillary sinus floor. The third group included 117 patients (39,0%) by whom at least one of the roots could be distinguished in the maxillary sinus space. The subgroup 1A was formed from the patients of the first group having the grinding teeth of the maxilla requiring endodontic treatment or previously devitalized teeth. The patients with the grinding teeth not requiring endodontic treatment and not subjected to it before were combined into the subgroup 1B. As the result of implementation of the similar approach the subgroups 2A, 2B and 3A, 3B were formed from the patients of the second and third groups, respectively.

Within the subgroup 1A among the persons with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 45,5% of cases, among the persons with the full dental arch – in 31,6%. Within the subgroup 1B by patients with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 30,3% cases, among those with the full dental arch – in 6,3%. Totally, in the first group, opacity in the maxillary sinus projection was observed by 23 patients which made 30% (Table 1).

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Table 1: Presence of opacity within the maxillary sinus space by the patients of the first group (n=76)

Subgroup 1A, endodontic pathology detected (n=41)				Subgroup 1B, no endodontic pathology (n=35)			
Fragmented dental arch		Full dental arch		Fragmented dental arch		Full dental arch	
With opacity	No opacity	With opacity	No opacity	With opacity	No opacity	With opacity	No opacity
10 (45,5%)	12 (54,5%)	6 (31,6%)	13 (68,4%)	6 (30,0%)	14 (70,0%)	1 (6,3%)	14 (93,7%)

Within the subgroup 2A among the persons with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 84,2% of cases, among the persons with the full dental arch – in 78,8%. Within the subgroup 2B by patients with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 65,1% of cases, among those with the full dental arch – in 30,8%. Totally, in the second group, opacity in the maxillary sinus projection was observed by 77 patients which made 72,0% (Table 2).

Table 2: Presence of opacity within the maxillary sinus space by the patients of the second group (n=107)

Subgroup 2A, endodontic pathology detected (n=71)				Subgroup 2B, no endodontic pathology (n=36)			
Fragmented dental arch		Full dental arch		Fragmented dental arch		Full dental arch	
With opacity	No opacity	With opacity	No opacity	With opacity	No opacity	With opacity	No opacity
32 (84,2%)	6 (15,8%)	26 (78,8%)	7 (21,2%)	15 (65,1%)	8 (34,8%)	4 (30,8%)	9 (62,2%)

Within the subgroup 3A among the persons with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 88,6% of cases, among the persons with the full dental arch – in 69,0%. Within the subgroup 3B by patients with the fragmented dental arch an opacity in the maxillary sinus projection was diagnosed in 70,4% of cases, among those with the full dental arch – in 47,1%. Totally, in the third group, opacity in the maxillary sinus projection was observed by 86 patients which made 73,5 % (Table 3).

Table 3: Presence of opacity within the maxillary sinus space by the patients of the third group (n=117)

Subgroup 3A, endodontic pathology detected (n=73)				Subgroup 3B, no endodontic pathology (n=44)			
Fragmented dental arch		Full dental arch		Fragmented dental arch		Full dental arch	
With opacity	No opacity	With opacity	No opacity	With opacity	No opacity	With opacity	No opacity
39 (88,6%)	6 (11,4%)	20 (69,0%)	8 (31,0%)	19 (70,4%)	8 (29,6%)	8 (47,1%)	9 (52,9%)

The findings of the research. From among 300 patients not complaining of the ENT-diseases that were seeking help from their dentist by 186 persons (62%) there were visualized homogenous opacities more than 2 mm thick bearing against the surfaces restricting the maxillary sinus space. In the first group 30,0% of such visualizations were detected, in the second – 72,0%, in the third – 73,5%.

By discussing the genesis of the occlusal injury resulting in the hyperplastic reaction of the maxillary sinus epithelium it should be considered:

- The solid injury caused by tooth root friction on the bone tissue of the sinus floor;
- Hydraulic injury (hydraulic shock) resulting in the increase in the filtration pressure of the crevicular fluid in the pore system of the bone tissue of the sinus floor stretching according to the pressure shock front the membranous lining of the maxillary sinus.

Among the patients included in the first group in 30,3% of cases there have been detected visualizations with thickening of the membranous lining of the maxillary sinus. By the patients of the second and third groups - 72,0% and 73,5%, respectively. According to the findings if the thickness of the sinus floor

made more than 2 mm, the total infective, solid and hydraulic injury of the maxillary sinus epithelium goes away “within the adaptation norms” [8].

In the subgroup 1A an opacity in the maxillary area sinus is observed on 16 images, in the subgroup 1B – on 7 which made 39,0% and 20,0%, respectively. In the subgroup 2A an opacity is visualized more often, in 58 cases – 81,6%, in the subgroup 2B in 19 cases - 52,7%. In the subgroup 3A an opacity is observed on 59 images, in the subgroup 3B – on 27 which made 80,8% and 61,3%, respectively. In the subgroups of patients requiring endodontic treatment or having previously devitalized teeth the number of images displaying opacity of the maxillary sinus exceeded the number of images with opacity of the maxillary sinus in the subgroups of patients not requiring and not subjected to endodontic treatment before. This fact confirms the current opinion on the possible genesis of the infectious odontogenic sinusitis.

In the subgroups of patients not requiring and not subjected to endodontic treatment before the number of images with the clean maxillary sinus was observed more often among the persons with the full dental arch than among those with a fragmented dental arch. In the subgroup 1B the number of images with a clean maxillary sinus at the full dental arch made 93,7%, at the fragmented dental arch - 70%. In the subgroups 2B the given relation made 62,2% and 34,8%. In the subgroup 3B - 52,9% and 29,6%. Taking into account the various nature of the tooth placement in an intact dental arch with marked approximal contacts and in the fragmented dental arch, it may be said that solution of continuity of the dental arch results in the increase in number of persons within the maxillary sinus area of which a homogenous opacity is observed, i. e., the localized hyperplastic reaction of the multinucleated columnar ciliated epithelium determined by the tooth moving of various nature takes place.

SUMMARY

- Visualization of homogenous opacities in the maxillary sinus projection with the thickness more than 2 mm was observed: in the first group – by 30,3% of patients, and in the second and third groups - 72,0% and 73,5% of patients, respectively which proves the consistency of the bone tissue floor with the thickness more than 2 mm as a damper of the occlusal injury of membranous lining of the maxillary sinus.
- The same number of images with homogenous opacities in the maxillary sinus projection among the patients of the second and third groups confirms the equally significant effect of the solid and hydraulic damages on the injury of the membranous lining of the maxillary sinus.

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