



Influence of the height of the alveolar bone in the distal parts of the upper jaw on the odontogenic inflammatory processes in the maxillary sinus

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Abstract

Aim: To determine whether the height of the alveolar bone affects the transmission of inflammation from the periapex of the tooth to the maxillary sinus.

Background: The maxillary sinus is the largest of all paranasal cavities and is located in the body of the upper jaw. The inflammatory process in the teeth can often ascend to the maxillary sinuses and thus can cause odontogenic maxillary sinusitis. Untreated periapical inflammatory processes of the teeth in the distal parts of the upper jaw are the most common cause of odontogenic sinusitis. Data in the literature show that there is a correlation between the thickness of the mucosa of the maxillary sinus and the proximity of some anatomical structures, such as the height of the alveolar bone between the distal teeth of the upper jaw and the floor of the maxillary sinus.

Methods: To accomplish the task, we analyzed 109 CBCT images of patients with odontogenic cysts of the upper jaw, located in the area below the floor of the maxillary sinus. In 61 of them the residual alveolar bone was less than 3 mm. For the other 48 it was over 5 mm. The group of teeth, included in the study, consisted of premolars and molars. Above each tooth with an odontogenic cyst, the thickness of the mucosa of the maxillary cavity was measured. For normal mucosa we considered thickness of 0 – 2 mm, and for pathological – thickness of over 2 mm.

Group I – In this group we included odontogenic cysts in which the measured distance between the cystic cavity and the floor of the maxillary sinus was less than 3 mm.

Group II – In this group we included odontogenic cysts in which the measured distance between the cystic cavity and the floor of the maxillary sinus was over 5 mm.

Results: The following results were obtained in group I. Of the 61 cases with an odontogenic cyst present and alveolar bone height below 3 mm, the mean measured value in mm of sinus membrane thickness was 5.7 mm. The maximum value was 13 mm and the minimum was 2 mm. In group II we obtained the following results: we had 47 cases of radicular cysts of the distal teeth of the upper jaw, and the height of the bone to the floor of the maxillary sinus was 5 mm and more. The average thickness of the maxillary sinus mucosa was 2.21 mm. For comparison, up to 2 mm in the scientific literature is considered a healthy clinical mucosa. The minimum measured value was 1 mm and the maximum value was 8 mm.

Conclusions: Based on the results obtained, we can conclude that there is a clear relationship between the thickening of the maxillary sinus membrane and the present periapical pathology of the maxillary distal teeth when they are close to or in contact with the floor of the maxillary sinus. This dependence increases with decreasing the volume of the residual alveolar bone.

Background

The maxillary sinus is the largest of all paranasal cavities located in the body of the upper jaw. Its volume often varies from sclerotic to pneumatic type. In sclerotic maxillary sinus, there is a sufficient bone volume between the apexes of the teeth and the floor of the maxillary sinus. The pneumatic type of sinus is characterized by the fact that there is a minimal amount of bone between the apexes of the teeth and the floor or they are in an intimate relationship, and it is possible for the roots of the teeth to penetrate the sinus. The inflammatory process in the teeth can often ascend to the maxillary sinuses and thus cause odontogenic maxillary sinusitis (1, 3, 13, 20, 22, 23, 25). Odontogenic maxillary sinusitis is well-known in the dental practice and according to various sources its frequency varies from 10-12% to 50-75% among cases of maxillary sinusitis (24, 25, 26, 27). Untreated periapical inflammatory processes of the teeth in the distal parts of the upper jaw are the most common cause of odontogenic sinusitis (2, 3, 4, 5, 9, 10, 11, 17). Data in the literature show that there is a correlation between the thickness of the mucosa of the maxillary sinus and the proximity of some anatomical structures, such as the height of the alveolar bone between the distal teeth of the upper jaw and the floor of the maxillary sinus. (14, 16, 26).

Aim of the study

To determine whether the height of the alveolar bone affects the transmission of inflammation from the periapex of the tooth to the maxillary sinus.

Material and methods

To accomplish the task, we analyzed 109 CBCT images of patients with odontogenic cysts of the upper jaw, located in the area below the floor of the maxillary sinus. In 61 of them the residual alveolar bone was less than 3 mm. For the other 48 it was over 5 mm. The group of teeth, included in the study, consisted of premolars and molars. Above each tooth with an odontogenic cyst, the thickness of the mucosa of the maxillary cavity was measured. For normal mucosa we took a thickness of 0 – 2 mm, and for pathological we considered a thickness of over 2 mm.

In the study we included the following type of odontogenic cysts – radicular.

The thickness of the maxillary sinus membrane was measured above each of the cysts selected above. We assessed the thickening of the sinus mucosa in 2 groups:

Group I – In this group we included odontogenic cysts in which the measured distance between the cystic cavity and the floor of the maxillary sinus was less than 3 mm.

Group II – In this group we included odontogenic cysts in which the measured distance between the cystic cavity and the floor of the maxillary sinus was over 5 mm.

We divided these two groups into 5 subgroups:

1 subgroup – thickening of the membrane above the tooth by 0 – 2 mm.

2 subgroup – thickening of the membrane above the tooth by 2 – 4 mm.

3 subgroup – thickening of the membrane above the tooth by 4 – 7 mm.

4 subgroup – thickening of the membrane above the tooth by 7 – 10 mm.

5 subgroup – thickening of the membrane above the tooth over 10 mm.

Results

The following results were obtained in group I. Of the 61 cases with an odontogenic cyst present and alveolar bone height below 3 mm, we had an average measured value in mm of the sinus membrane thickness of 5.7 mm. The maximum value was 13 mm and the minimum was 2 mm (Table 1 and Histogram 1)

In 1 subgroup with values of 0 – 2 mm we had only two cases of 61, or in 3.27% healthy clinical mucosa of the maxillary sinus. In subgroups 2 to 5

Table 1.

		Statistics
Дебелина на ММС при ОАК под 3мм		
N	Valid	61
	Missing	48
	Mean	5,70
	Median	5,00
	Mode	4
	Std. Deviation	2,341
	Variance	5,478
	Skewness	,982
	Std. Error of Skewness	,306
	Kurtosis	1,126
	Std. Error of Kurtosis	,604
	Range	11
	Minimum	2
	Maximum	13

we had respectively 59 cases of thickened mucosa, corresponding to chronic inflammatory thickening of the sinus mucosa, or 96.7% chance of chronic inflammation of odontogenic nature (Table 2). The distribution by subgroups was as follows:

2 subgroup – 21 cases with thickening of the membrane between 3 and 4 mm.

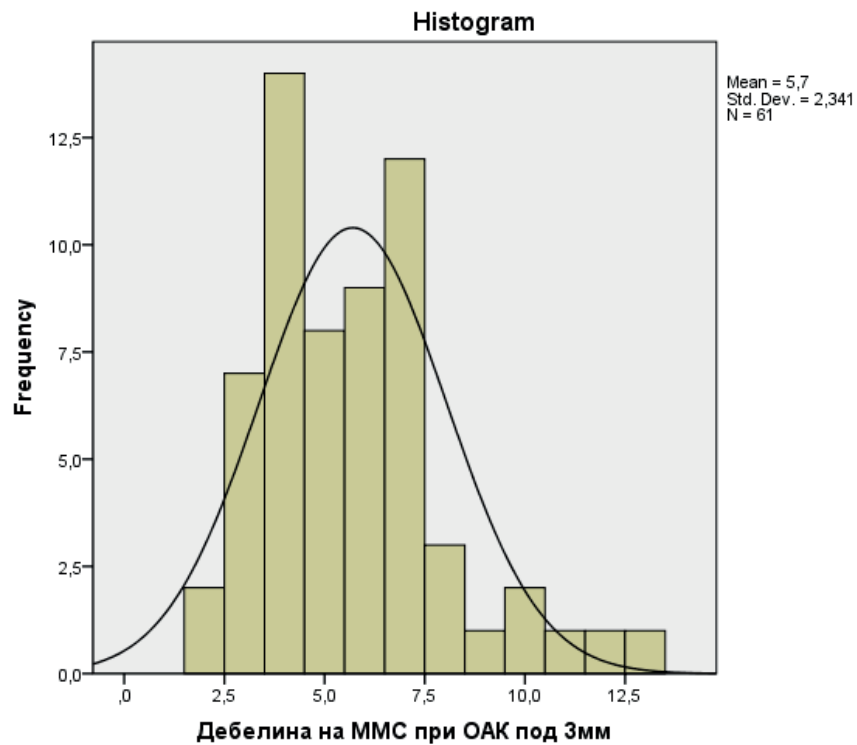
3 subgroup – 17 cases with thickening of the membrane between 5 and 6 mm.

4 subgroup – 18 cases with thickening of the membrane between 7 and 10 mm.

5 subgroup – 3 cases with thickening of the membrane over 10 mm.

In group II we obtained the following results: we had 47 cases of radicular cysts of the distal teeth of the upper jaw, and the height of the bone to the floor of the maxillary sinus was 5 mm and more. The average thickness of the maxillary sinus mucosa was 2.21 mm. For comparison, up to 2 mm in the scientific literature is considered a healthy clinical mucosa. The minimum measured value was 1 mm and the maximum value was 8 mm (Table 3 and Histogram 2).

In 1 subgroup with values of 0 – 2 mm we have 33 cases.



Histogram 1.

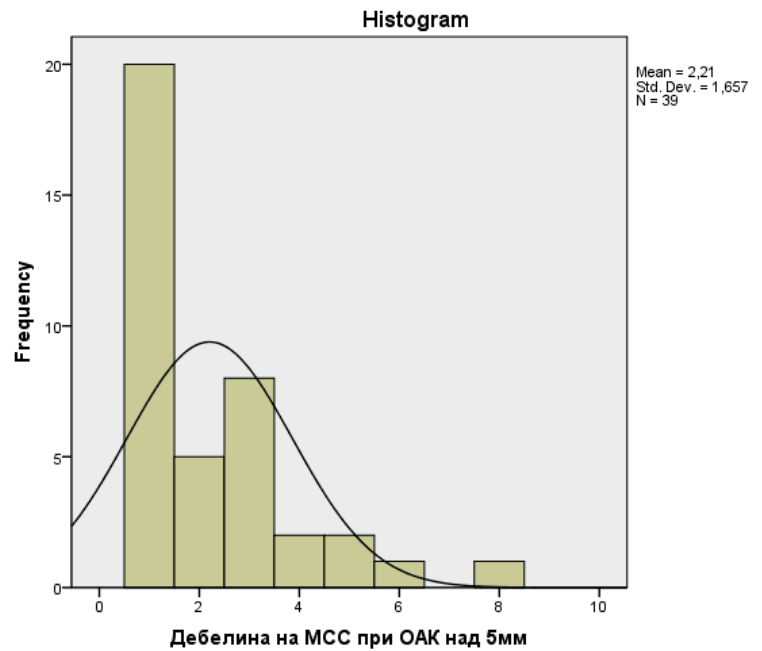
Table 2.

Дебелина на ММС при ОАК под 3мм

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	2	1,8	3,3	3,3
	3	7	6,4	11,5	14,8
	4	14	12,8	23,0	37,7
	5	8	7,3	13,1	50,8
	6	9	8,3	14,8	65,6
	7	12	11,0	19,7	85,2
	8	3	2,8	4,9	90,2
	9	1	,9	1,6	91,8
	10	2	1,8	3,3	95,1
	11	1	,9	1,6	96,7
	12	1	,9	1,6	98,4
	13	1	,9	1,6	100,0
		Total	61	56,0	100,0
Missing	0	47	43,1		
	System	1	,9		
	Total	48	44,0		
Total		109	100,0		

Table 3.

Statistics		
Дебелина на МСС при ОАК над 5мм		
N	Valid	39
	Missing	70
Mean		2,21
Median		1,00
Mode		1
Std. Deviation		1,657
Variance		2,746
Skewness		1,667
Std. Error of Skewness		,378
Kurtosis		2,972
Std. Error of Kurtosis		,741
Range		7
Minimum		1
Maximum		8


Histogram 2.

In 2 subgroup – 10 cases.

In 3 subgroup – 3 cases.

In 4 subgroup – 1 case.

In 5 subgroup – no cases.

We have clinically healthy mucosa in 33 out of 47 cases or in 70% of all cases. We diagnosed pathologically altered mucosa in 14 out of 47 cases or in 29.78% (Table 4).

Discussion

Cone – beam computed tomography is the gold standard when studying the pathology of the maxillary sinus. Yuh-Hau Hsu et al. (21) examined the thickness of the maxillary sinus membrane in normal and pathology using CBCT. Their measurements before tooth extraction in the maxillary sinus area showed a sinus mucosal thickness of 4.53 ± 2.46 mm, but a few months after extraction these values were significantly reduced.

Vijay Apparaju et al. (14) conducted a retrospective study of 240 CBCT images of the maxillary sinus mucosa in order to determine the minimum residual amount of alveolar bone that can prevent periodontal infection from reaching the sinus cavity. After a careful analysis of the data obtained, the authors concluded that there is a positive correlation between the thickness of the residual alveolar bone and the possibility of spreading the pathological process from the apical area to the maxillary sinus.

In a retrospective study, Umut Aksoy and Kaan Orhan (13) investigated the relationship between odontogenic pathology and sinus mucosal thickening. CBCT images of 294 patients (151 men, 143 women) aged 18 to 78 years were considered. Results (ratio of thickened sinus mucosa with and without periapical lesions is 42.1 / 53.6%, respectively, higher percentage of mucosal thickening in patients with alveolar bone loss, relationship of sinus mucosal thickening with sex, age, missing teeth) demonstrated that the maxillary sinuses are significantly affected by various odontogenic conditions, such as periapical infections and lesions.

According to a number of authors (3, 5, 6, 7, 9, 12, 13, 18, 20) the risk of pathological changes in the mucosa of the maxillary sinus is significantly higher in the presence of periapical changes. Merve Sakir, Sebnem Ercalik Yalcinkaya (15), citing the results of their retrospective study on data from 50 patients, concluded that the available periodontal pathology increases this risk 62,364 times compared to cases where the maxillary sinus mucosa is adjacent to healthy teeth of the same patient. According to S Peñarrocha-Oltra et al. (8) the probability of thickening of the sinus mucosa in the presence of a periapical change increases up to 2.4 times, and the development of odontogenic sinusitis up to 1.7 times, and according to Melek Tassoker (19) the presence of even 1 periapical lesion in the vicinity



Table 4.

Дебелина на МСС при ОАК над 5мм

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	20	18,3	51,3	51,3
	2	5	4,6	12,8	64,1
	3	8	7,3	20,5	84,6
	4	2	1,8	5,1	89,7
	5	2	1,8	5,1	94,9
	6	1	,9	2,6	97,4
	8	1	,9	2,6	100,0
	Total	39	35,8	100,0	
Missing	0	8	7,3		
	System	62	56,9		
	Total	70	64,2		
Total		109	100,0		

of the maxillary sinus increases the development of a pathological process in it 5.24 times for the right side and 4.67 times for the left side.

The present study proved that the amount of bone separating the apexes of the teeth from the floor of the maxillary sinus can significantly affect the development and spread of pathological processes of dental origin. 96.7% have a chance of developing an inflammation of odontogenic origin at an alveolar bone height below 3 mm. This percentage decreases significantly with alveolar bone height of 5

mm and up – 29.78%.

Conclusions

Based on the results obtained, we can conclude that there is a clear relationship between the thickening of the maxillary sinus membrane and the present periapical pathology of the maxillary distal teeth when they are close to or in contact with the floor of the maxillary sinus. This dependence increases with decreasing the volume of the residual alveolar bone.

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