INFLUENCE OF ANATOMICAL FACTORS ON MAXILLARY SINUS MEMBRANE PERFORATION DURING SINUS FLOOR AUGMENTATION SURGERY

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ABSTRACT — The Schneiderian membrane perforation is the most common intraoperative complication during the sinus floor elevation. The aim of the study was to evaluate different anatomical factors that can lead to the development of perforations and to identify significance of each of them. Those factors were: the membrane thickness, the presence of septa and the angle made by the medial and the lateral walls of the sinus. Preoperatively was analyzed CBCT data of 24 patients (32 sinuses) and compared them with the intraoperative data (the perforation rate within the whole groups was 34%). The results showed that the most significant factor in the present investigation was the angle between the medial and the lateral walls (the perforation rate varies from 0% to 63%).

KEYWORDS — maxillary sinus, the Schneiderian membrane, perforation, sinus-lift surgery, cone-beam computer tomography.

INTRODUCTION

The Schneiderian membrane perforation — is the most common complication of sinus lift surgery. The frequency of its occurrence varies from 11 to 56% according to literary dat [1]. The presence of perforation increases the risk of inflammatory complications by 5–10% and reduces the survival rate of implants by up to 15% [2, 3, 4]. Also, damage to the Schneiderian membrane often leads to cicatricial changes and disruption of normal mucociliary clearance [5]. The use of Piezosurgery allows to reduce the frequency of development of this complication due to minimal traumatization of soft tissues during the formation of a bone window with lateral access and separation of the Schneiderian membrane [6, 7]. It is fundamental to assume that the anatomical features of the structure of the maxillary sinus may play a role in the development of this complication [8, 9, 10].

Aim

The aim of the study was to identify the anatomical risk factors for the development of perforation of the mucous membrane of the maxillary sinus during sinus lift surgery. The following tasks were set:

1. at the preoperative stage to study the thickness of the mucous membrane, the features of the relief of the bottom of the sinuses (septa) and the angle between the anterior-lateral and medial walls of the sinus;
2. estimate the number of perforations arising intraoperatively;
3. determine the relationship between the above factors and the number of perforations.

MATERIAL AND METHODS

For the study, 24 patients were selected from whom the data of a cone-beam computed tomography and protocol data for 32 sinus-lifting operations in these patients were studied.

The criteria for inclusion of patients in the study were:

1. the absence of teeth in the distal upper jaw;
2. the need for a sinus lift operation using the lateral window method;
3. performance of all operations by one surgeon.

Criteria for non-inclusion:

1. the presence of violations of the structure of the osteomeatal complex;
2. the presence of pathological changes in the mucous membrane of the maxillary sinus.

RESULTS

Based on the preoperative analysis of CBCT data, the expected risk factors for perforation were:

1. thickness of the sinus mucosa, less than 1.5 mm in 17 cases and more than 1.5 mm in 15 cases (Fig. 1);

2. the angle between the anterior-lateral and medial walls of the sinus in the area where the operation was necessary. According to this criterion, all the sinuses were divided into 3 groups: group A — with an angle of up to 30° (N = 8); Group B — with an angle value from 30 to 60° (N = 15); Group C — with an angle of more than 60° (N = 9) (Fig. 2);

Fig. 1. Khorguani Thick sinus membrane

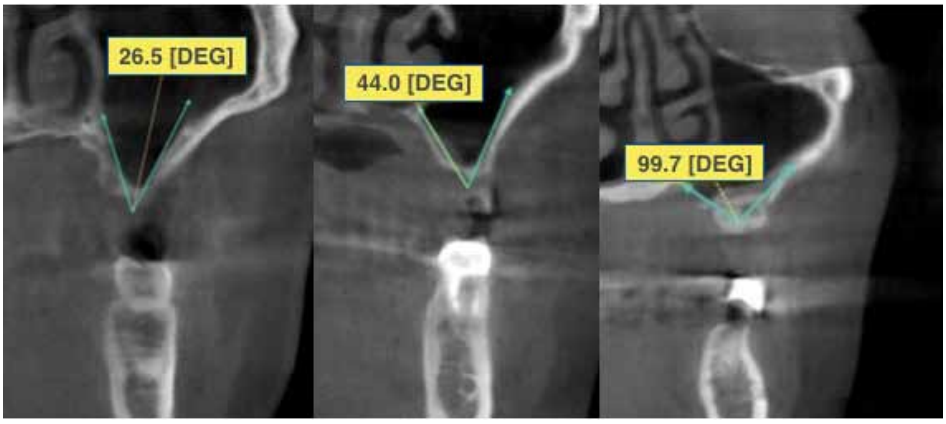

Fig. 2. Khorguani Angle degree between medial and lateral walls

3. the presence of septa in the region of the bottom of the maxillary sinus (in the course of the work, the septa was found in only one case, therefore this criterion was excluded from further research) (Fig. 3).

Analysis of the protocols of the performed operations showed that in 32 operated sinuses, perforation occurred in 11 cases (34%) (Fig.4).

Comparison of intraoperative data with CBCT data allowed to determine that:

1. at a mucosal thickness of up to 1.5 mm, perforation appeared in 7 cases out of 17 (41%); with a thickness of 1.5 mm or more — in 4 out of 15 (27%);
2. with the angle between the anterior-lateral and medial wall up to 30° (group A), the perforation of the Schneiderian membrane occurred in 5 cases out of 8 (63%); when the value is from 30 to 60° (group B) — in 4 out of 15 (27%); at a value of 60° and more (group C) — in no case did the perforation occur (0%).

DISCUSSION

The results of the study showed that most often perforation occurs at small values of the angle between the anterior-lateral and medial walls of the sinus. Moreover, if the angle exceeds 60°, then even if there are other anatomical risk factors (thickness of the mucosa less than 1.5 mm, the presence of septa), the likelihood of this complication is significantly reduced (Fig. 5).

CONCLUSION

When analyzing the data obtained, it was found that the angle between the anterior-lateral and medial walls of the maxillary sinus can be a leading risk factor for the occurrence of mucosal perforation. CBCT allows to measure the angle and predict the development of perforation of the Schneiderian membrane. It is recommended to start exfoliation of the mucous membrane from the distal parts of the maxillary sinus, where the angle is at its maximum, which will reduce the tension of the membrane, and reduce the frequency of occurrence of this complication.

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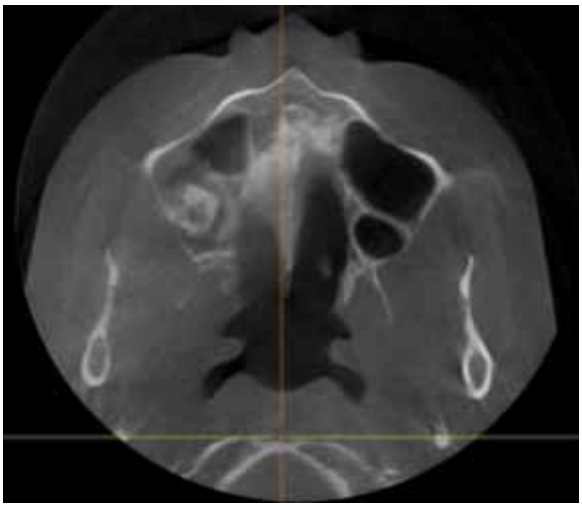

Fig.3. *Khorguani Maxillary sinus septa*

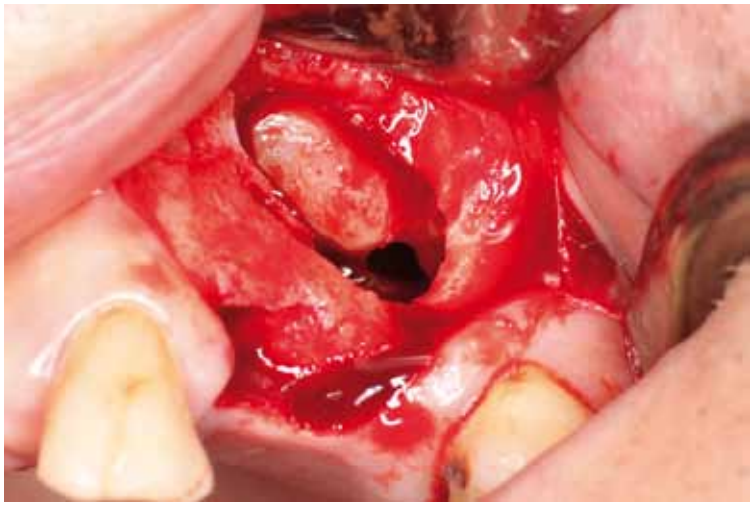

Fig.4. *Khorguani Perforation of sinus membrane*

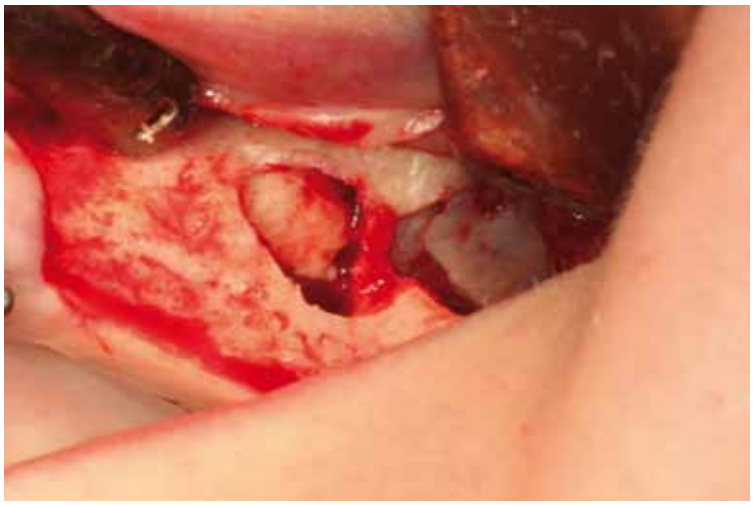

Fig.5. *Khorguani Maxillary sinus septa intraoperatively*

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