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Research Article

## ANATOMICAL ASPECTS OF PLASTY OF THE ANTERIOR WALL OF THE MAXILLARY SINUS

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**Yusupov Sh.Sh.**

Tashkent Medical Academy, Uzbekistan

**Oripova A.A.**

Tashkent Medical Academy, Uzbekistan

### ABSTRACT

To date, the problem of traumatic injuries of the middle zone of the face remains extremely relevant. According to the WHO, the number of traumatic injuries is still on the rise. According to statistics, skull fractures and intracranial injuries account for 5.1% of the total number of all registered injuries according to the rates of injuries and poisonings and other accidents among the adult population in 2009. In the structure of total injuries, 1.7% is occupied by injuries of the eye and orbit. Patients with injuries of the midface require inpatient treatment in 85% of cases. Trauma to the bones of the facial skull accounts for up to 40% of the entire list of diseases in patients hospitalized for treatment in the departments of maxillofacial surgery, and accounts for almost 21% of the total number of victims with injuries in hospitals of medical institutions. Thus, the frequency of traumatism of the maxillofacial region, and in particular, the frequency of damage to the zygomatic-orbital complex, both in our country and abroad, does not decrease; on the contrary, there is an increase in the number of patients with this pathology.

### KEYWORDS

Trauma, maxillofacial region, maxillary sinus, zygomatic-orbital complex.

## INTRODUCTION

The last decades have been marked by the widespread introduction of innovative technologies for in vivo studies of various anatomical structures of the human supporting apparatus [1]. At the same time, methods for visualizing the skeletal skeleton of the face and its soft skeleton have received significant development [2-4].

In particular, modern non-invasive research methods and computer technologies make it possible to reveal the patterns of individual variability in the structure of the bones of the facial skull [5]. Such developments make a significant contribution to the study of various aspects of the clinical anatomy of the skull, which are applicable to the tasks of dentistry, otorhinolaryngology, ophthalmology and other fields of medicine [6].

It should be noted that the object of close attention of both anatomists and representatives of these clinical disciplines is the upper jaw [7].

So, on the one hand, it is involved in the morphogenesis of the facial skull as a whole, on the other hand, it is an object of surgical manipulations for specialists in various fields [8].

The results of studies of the variant anatomy of the upper jaw and its structures, such as the maxillary sinus (MS) and the canine fossa (CF), are the foundation for understanding the laws of the structural organization of the human face [9].

The study of variant variability of the shape, depth, topography of the canine fossa and the thickness of the anterior wall of the maxillary sinus makes it possible to personalize the surgical approach and the technique of rhinosurgical, reconstructive and plastic manipulations in this area, which is of great clinical importance in stopping the inflammatory processes of the maxillary sinus [10].

It should be noted that in the literature of recent years there are no data on the study of patterns of age-related and variant variability in the shape, depth, topography of the canine fossa and the thickness of the walls of the maxillary sinus in the studied individuals aged 5 to 22 years (younger age groups). These gaps in the morphology of the facial part of the skull became the rationale for a craniometric study, the results of which should be taken into account when planning surgical interventions for the maxillary sinus in pediatric and adult patients.

Currently, it is generally accepted in clinical practice that external surgical access is preferable for a number of pathologies of the maxillary sinus. A bone defect formed during perforation of the anterior wall of the maxillary sinus requires reconstructive technologies, usually with transplantation of various materials [11].

Therefore, adequate filling of the trepanation defect of the anterior wall of the maxillary sinus with allogeneic grafts was of great interest in our

work. Insufficient study of the regularities of reparative regeneration of bone tissue when filling a bone defect in the anterior wall of the maxillary sinus with cartilage allograft (CAT) or demineralized bone allograft (DBT) contributed to further research in this area.

In the literature, there are works devoted to methods of filling bone defects in the walls of the paranasal sinuses, including demineralized bone graft [12]. However, VCT is difficult to model in the operating room. Also known is the fact that VCT undergoes significant resorption in the bone bed, which leads to a loss of regenerate volume. Therefore, in our opinion, it is most optimal to use a cartilage allograft to fill a bone defect.

## MATERIAL AND METHODS

The study included 30 patients with fractures of the zygomatic-orbital complex who applied to the Department of Plastic Surgery of the multidisciplinary clinic of the Tashkent Medical Academy.

To examine patients with this pathology, we use clinical (history taking, subjective and objective research methods), clinical and instrumental (radiography and MSCT of facial bones and SNPs) and laboratory (general blood and urine tests, bacteriological) research methods.

## RESULTS AND DISCUSSION

The results of the study of the variability of the thickness of the anterior wall of the maxillary sinus, as well as the shape, depth and

topography of the canine fossa, depending on the age and gender of the individual, made it possible to personalize the surgical approach to the maxillary sinus and select the optimal allograft to fill the bone defect in the anterior wall of the maxillary sinus.

Morphological study of bone defects of the maxillary sinus in the intact state and when replenished with biografts determined the conditions and indications for performing micromaxillotomy with further plasty of bone defects in its anterior wall.

Clinical studies on the replacement of bone defects in the anterior wall of the human maxillary sinus using VCT and CAT were carried out in order to confirm the available experimental data previously obtained on laboratory animals.

Taking into account the results of experimental morphological studies, the possibility of using two types of biomaterial has been substantiated.

Namely, after 45 days, the integrity and continuity of the anterior wall of the maxillary sinus was visualized on the cone-beam computed tomography of 4 patients when the defect was closed with a demineralized bone allograft. The replaced bone regenerate did not differ in structure from the adjacent healthy bone tissue, but was significantly inferior to it in volume ( $43 \pm 12.4\%$  of the original volume).

In the study of cone-beam computed tomography of 4 patients with the replacement of a bone defect in the anterior wall of the

maxillary sinus with a cartilage allograft on the 45th day, the newly formed thin bone tissue covering the cartilage allograft in the form of a “shell” was visually determined with the preserved volume of implanted ChAT ( $79 \pm 4.1\%$ ).

When performing cone-beam computed tomography in 3 patients without replacement of the bone defect of the anterior wall of the maxillary sinus, on the 45th day, a slight compaction of the newly formed bone tissue was observed along the edge of the defect, and the regenerate was represented by dense connective tissue, more resembling cicatricial deformity.

The operating technique has been worked out on the basis of anthropometric studies. The perforated hole was placed on the anterior wall of the maxillary sinus (taking into account its thickness) in the area of the projection of the canine fossa. With the help of a physical dispenser bur, the burr hole was expanded according to the shape of the canine fossa and taking into account its depth. So, in persons under 12 years of age with a significantly greater thickness of the anterior wall of the sinus wall (more than 3 mm), as well as a shallow depth and narrow shape of the OC, it is most optimal to use burs for trepanation of the maxillary sinus in childhood. Also, taking into account the thickness of the anterior wall of the maxillary sinus and the parameters of the OC, the most optimal biomaterial was chosen. In patients older than 12 years, with an anterior wall thickness of the maxillary sinus less than 3 mm, and in the presence of a deep and wide OC, it is

possible to use both a physical dispenser bur and a trocar.

So, with a thickness of the anterior wall of the maxillary sinus less than 1.5 mm and a medium-wide shape and shallow depth of the canine fossa, which is typical for patients over 12 years old, a demineralized bone allograft was used..

An allogeneic cartilage graft was used in patients with an anterior wall thickness of the maxillary sinus more than 1.5 mm and in the presence of a wide shape and great depth of the OC. The lateral displacement of the OC bottom in relation to the teeth of the upper jaw, as well as the presence of right-sided asymmetry in the shape, depth of the OC, and thickness of the anterior wall of the maxillary sinus were taken into account when planning a surgical approach to the maxillary sinus.

Before surgery, systemic antibacterial and anti-inflammatory therapy was carried out for several days. Additionally, the nasal mucosa was irrigated with local decongestants in order to sanitize the maxillary sinus and restore the natural route of exudate outflow from the maxillary sinus cavity.

Given the above, below is a clinical case that confirms the expected results of a clinical trial.

Patient M., 44 years old, applied to the Department of Oral and Maxillofacial Surgery with complaints of headache, mainly on the right side, heaviness in the right half of the face, in the projection of the right maxillary sinus, aching pain in teeth 16, 17, which occurs during



chewing. In the anamnesis, the patient had no information about a previous cold and injuries in this area. There are general somatic diseases - chronic pancreatitis. Hepatitis, HIV, allergic reactions to drugs denies.

Objectively: General condition is satisfactory. The face is symmetrical. Integuments of physiological coloring, clean. Regional lymph nodes are not enlarged. Palpation in the projection of the exit of the II branch of the trigeminal nerve is slightly painful. The opening of the mouth is free. The bite is neutral. Percussion of 15-17 teeth is sharply painful. There is no tooth mobility. The attachment of the frenulum of the upper, lower lip and tongue is normal. The vestibule of the oral cavity is average.

The mucous membrane of the oral cavity (palate, mucous membrane of the cheeks, lips, alveolar process) is brightly hyperemic, moist. Palpation of the hard palate, alveolar process of the lower jaw, tongue and sublingual region is painless. The mucous membrane of the gums in the area of 15-17 teeth is brightly hyperemic, edematous. Abundant soft plaque covers all teeth to 1/2 of the height of the crown. In the area of the teeth of the upper and lower jaws, there are supra- and subgingival dental deposits.

16-17 teeth were previously treated for complicated caries, comparative percussion

(horizontal and vertical) is sharply painful, palpation of the anterior wall of the maxillary sinus and alveolar process in the projection of the tops of the roots of 15-17 teeth is sharply painful.

The mucous membrane of the pharynx is pink, there is no discharge along the posterior wall of the pharynx, the palatine tonsils in the arches are without raids, the anterior and posterior palatine arches are thin.

The patient was referred for a CT scan, which revealed subtotal occultation of the right maxillary sinus with a single hyperdense inclusion (Figure 1).

It is important to note that the specified x-ray picture is characteristic of a fungal lesion of the maxillary sinus, in particular for aspergilloma (synonym: fungal body, mycetoma).

The presence of hyperdense inclusions in the sinus is due to the fact that *Aspergillus* sp. have an iron deposition system and indicate an active proliferation of fungi.

At the same time, many otorhinolaryngologists and dentists, detecting a similar phenomenon on a radiograph or tomogram, mistakenly regard it as a “filling material”, because modern sealers used to seal root canals are X-ray positive.

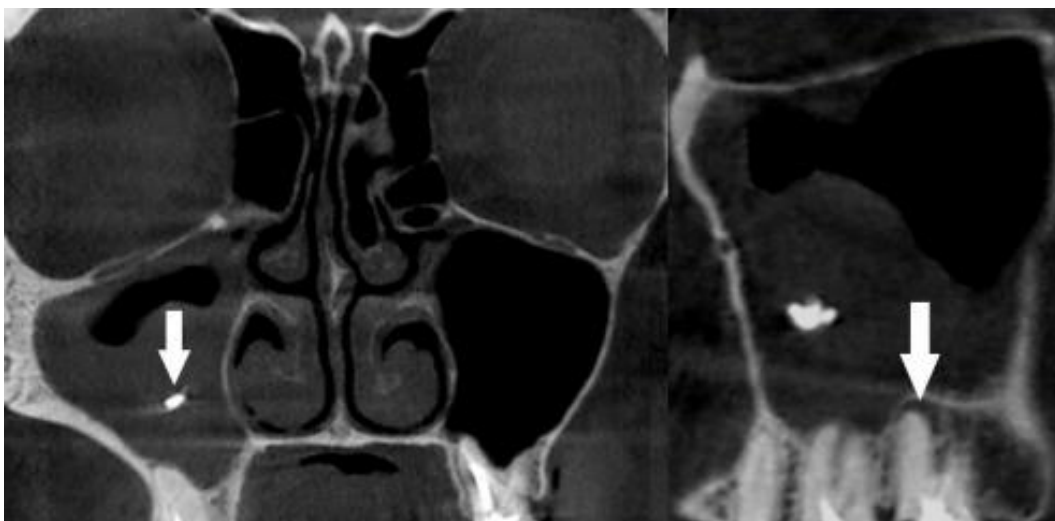


Figure 1 - Patient H., 40 years old. CBCT. Isolated lesions of the right maxillary sinus. Left coronary projection - the arrow indicates a hyperdense shadow in the center of the aspergilloma; on the right sagittal projection - the arrow marks the granuloma on the proximal buccal root of the 17th tooth.

The performed craniometric analysis according to CBCT showed that the thickness of the anterior wall of the maxillary sinus was 2.5 mm, with a medium-wide (62.2%) and medium-deep (4.2 mm) OC. The topography of the bottom of the canine fossa was projected in the region of the 16th tooth. Under inhalation anesthesia and infiltration (s. articaini 1.5%, s. adrenalini 1:100000), the patient underwent micromaxillotomy with simultaneous resection of the tip of the 17th tooth. In the vestibule of the mouth under the upper lip on the right in the projection of the canine fossa, an incision was made along the transitional fold. The mucous membrane of the vestibule of the mouth, together with the periosteum, was separated, the anterior wall of the maxillary sinus was skeletonized, and access to the maxillary sinus

was created using a physiodispenser with bur (d=5.5 mm). When opening the sinus, a putty-like dense mass of green-brown color was found - mycetoma. After removal of the mycetoma, the bone defect of the anterior wall of the maxillary sinus and the alveolar process of the upper jaw with a total diameter of 7 mm was closed with a cartilage allograft using the press-fit technique. It is important to note that the use of a cartilage allograft is justified by earlier microbiological studies and is protected by a patent.

On the control cone-beam tomogram performed six months later (Figure 2), the paranasal sinuses are without pathology, the defect in the anterolateral wall of the maxillary sinus and the alveolar process of the upper jaw decreased to 5

mm as a result of partial replacement of the

cartilaginous allograft with bone tissue.



Figure 2 - Patient H., 40 years old. CBCT. Condition after micromaxillotomy on the right. Left coronal projection - paranasal sinuses without pathology; right sagittal projection - the arrow indicates the bone defect after micromaxillotomy.

To assess the improvement in the quality of life of patients after surgical intervention on the maxillary sinus, a questionnaire was conducted using the SNOT-22 (Sinonasal outcome test) questionnaire.

According to the results of the SNOT-22 questionnaire, the assessments of complaints made by patients before and after micromaxillotomy with reconstruction (main group) and micromaxillotomy without reconstruction (control group) were compared.

The overall score for complaints made by patients before surgery according to the SNOT-22 questionnaire in the main group was  $24.7 \pm 8.1$  points, in the control group it was  $22.5 \pm 7.0$  points and did not differ significantly ( $p > 0.25$ ), that is, all patients before surgery presented similar complaints. Therefore, the division of

patients, according to complaints made before surgery, into the main or control group is weak, but significant ( $V = 0.36$ ,  $p = 0.18$ ).

In general, there was no special selection in the groups according to the diagnosis. Also, it did not statistically matter what age the patient complained of ( $V = 0.14$ ,  $p > 0.92$ ) and what gender ( $\phi = 0.19$ ,  $p > 0.11$ ).

Post-treatment responses showed the following:

The average total score of complaints made by patients after micromaxillotomy with reconstruction of CAT or VCT was several times lower than in the control group:  $4.0 \pm 1.6$  points versus  $23.6 \pm 4.7$  points in the first group.

Complaints of patients after micromaxillotomy with reconstruction of CAT or VCT differ sharply from complaints of patients in the control group.

Significantly lower average response scores and even complete zeroing of scores were noted for such complaints as nasal congestion, cough, dense nasal discharge, hearing loss, dizziness, earache, facial pain, decreased sense of smell and taste, fatigue, reduced work capacity, anxiety and irritability.

The studied patients of the control clinical group, operated on by the micromaxillotomy technique, without restoration of the bone defect, noted the persistence of such complaints as a runny nose, decreased sense of smell, and periodic facial pain..

Objectively, all patients who have undergone medical and surgical treatment for chronic diseases of the maxillary sinus after the operation of micromaxillotomy note an improvement in their health status. But patients of the main clinical group who were operated on by micromaxillotomy with reconstruction of a bone defect in the anterior wall of the maxillary sinus CA or VCT note the most pronounced improvement in health, a decrease in the clinical symptoms of the disease and an increase in the quality of life..

## CONCLUSION

The correlation between the special selection of the treatment method and the complaints of patients belonging to one of the clinical groups (main/control) was  $V=0.1$ ,  $p>0.7$ . That is, no selection of patients to a specific clinical group was carried out. No differences were found in the main complaints, however, there was a

significant decrease in the severity of the symptom - pain / heaviness in the face in the main group. In the control group, the persistence of the severity of this symptom is due to a defect in the anterior wall of the maxillary sinus. There is also a reliable mathematical evidence of an improvement in the health status and quality of life of patients who underwent micromaxillotomy with reconstruction of CAT or VCT in comparison with patients belonging to the control (intact) group. The performed CBCT and the SNOT-22 clinical test may prove the effectiveness of introducing micromaxillotomy with reconstruction of a bone defect with connective tissue allografts into clinical practice.

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