ISSN NO: 2770-2936
April 2026

Bone and bone-substituting materials in plastic surgery of oroantral perforations of the maxillary sinus.

Ruzibayev Dilshod Ro'zimetovich
PhD assistant department "Chelyustno-litsevaya surgery and stomatology"
Tashkent State Medical University

Annotation

Oroantral perforations (OAP) and fistulas are common complications of maxillary tooth extraction and lateral alveolar surgery. Soft tissue closure of the defect does not always ensure restoration of bone volume, which is important for subsequent implant rehabilitation. The aim of this review was to analyze the use of bone and bone-substituting materials in OAP repair, taking into account morphological healing mechanisms and postoperative rehabilitation.

An analysis of domestic and international publications on the use of autogenous bone grafts, allogeneic and xenogeneic osteoplastic materials, collagen membranes, and combined composites for the closure of maxillary sinus floor defects was conducted. It was shown that the use of bone or bone-substituting materials helps maintain alveolar bone height, improve the quality of the regenerated bone, and promote the formation of a complete bone structure, which is morphologically associated with accelerated osteoconduction and angiogenesis. The choice of material determines the rehabilitation strategy and the timing of subsequent implantation.

Key words: oroantral perforation (OAP), oroantral fistula (OAF), bone grafting, bone substitutes, healing morphology, maxillary sinus, rehabilitation.

Introduction

Oroantral communication occurs when the integrity of the maxillary sinus floor is compromised due to molar and premolar extractions, cystectomies, root resections, and other procedures. If the defect is not promptly closed, chronic odontogenic sinusitis develops, and the bone defect undergoes progressive atrophy.

Domestic authors note that within 10–20 days after the formation of the ligament, the bone defect enlarges and the alveolar process undergoes pronounced atrophy. This is of fundamental importance for subsequent orthopedic and implant rehabilitation.

Classic plastic surgery techniques (cheek and palatal flaps) provide sealing but do not restore bone volume. Modern surgical treatment approaches include:

- closing message;
- sinus sanitation;
- restoration of the bone structure of the sinus floor and alveolar process.

In global practice, this problem is considered in the context of "ridge preservation" and "guided bone regeneration", which allows for the combination of approaches in maxillofacial surgery and implantology.

The aim of this review is to analyze the use of bone and bone substitute materials in PDA plastic surgery from the standpoint of healing morphology and rehabilitation features.

Materials and methods

Analysis conducted:

- domestic publications (series of observations, comparative studies);
- foreign works (USA, Germany, Italy, China, South Korea, Brazil, Colombia).
- The search databases used were: PubMed, Scopus, eLibrary.

Inclusion criteria:

- publications describing the use of bone or bone substitute materials;
- data on morphological and clinical outcomes;
- information about the rehabilitation period and subsequent implantation.

ISSN NO: 2770-2936
April 2026

Results

Comparative characteristics of bone and bone-substituting materials in the plastic surgery of oroantral perforations

Material	Biological properties	Morphology of the regenerate	Advantages	Restrictions	Rehabilitation period	Implantation period
Autogenous bone block	Osteogenic, osteoinductive, osteoconductive	Rapid formation of lamellar bone, active angiogenesis	Better volume restoration, low risk of recurrence	Donor injury	2-3 weeks	4–6 months
Xenogeneic material (DBBM)	Osteoconductive	Slow resorption, volume preservation	Predictability, no donor injury	Longer integration	1–2 weeks	6–8 months
β-TCP	Osteoconductive, bioresorbable	Quick replacement with a new bone	Good biocompatibility	Possible loss of volume	1–2 weeks	5–7 months
Hydroxyapatite + collagen (composites)	Osteoconduction + cellular matrix	Osteoid formation by the creeping replacement type	Ease of use	Less induction of osteogenesis	1–2 weeks	6 months
Membrane + bone grafting material (GBR)	Barrier + osteoconduction	Guided regeneration, mature trabecular bone	Better control of defect shape	Price	2 weeks	6 months
Collagen + fibrin glue	Hemostasis, frame	Granulation tissue → fibrosis or partial bone regeneration	Minimally invasive	Does not restore volume completely	1–2 weeks	Not recommended without bone grafting

ISSN NO: 2770-2936
April 2026

1. Autogenous bone grafts

Domestic studies demonstrate the high effectiveness of free autogenous bone block (harvested from the anterior sinus wall or alveolar ridge).

Morphological aspects

- autogenous bone has osteogenic, osteoinductive and osteoconductive properties;
- rapid formation of the vascular network;
- minimal inflammatory response;
- formation of a full-fledged lamellar bone.

In foreign literature (Misch, Chiapasco, Jensen) it is emphasized that autogenous bone remains the "gold standard" for the restoration of sinus bone defects, but is accompanied by donor trauma.

Rehabilitation

- antibiotic therapy for 5–7 days;
- limiting nose blowing and sneezing;
- X-ray control after 3–6 months;
- implantation is possible after 4-6 months.

The advantage is the preservation of the ridge height and favorable conditions for subsequent implantation.

2. Synthetic and biocomposite bone substitutes

In domestic practice, hydroxyapatite-collagen compositions (for example, CollapAn-M), granulated osteoplastics and gel forms are used.

Morphological features

- pronounced osteoconduction;
- gradual resorption of the material;
- formation of bone tissue according to the "creeping replacement" type;
- less pronounced osteoinduction compared to autogenous bone.

Foreign studies (Urban, Esposito, Cordaro) show that xenogenic materials (deproteinized bovine bone mineral) preserve volume well and provide stable bone architecture, especially when combined with a collagen membrane.

Chinese studies highlight the potential of β-tricalcium phosphate and bioceramics in regenerating sinus bone defects with good integration and predictability.

Rehabilitation

- less pronounced postoperative pain syndrome;
- low risk of donor morbidity;
- CBCT control after 6 months;
- Implantation is usually performed after 6–8 months.

3. Membrane and adhesive compositions

Collagen membranes with fibrin glue provide:

- tightness of the defect;
- hemostasis;
- creation of a framework for the migration of fibroblasts and osteoblasts.

Morphologically:

- formation of granulation tissue;
- gradual collagenization;
- in the absence of bone filler, there is a risk of fibrous transformation of the defect.

South Korean and Italian studies show that membranes are most effective when combined with bone substitute materials (GBR principle).

Rehabilitation

- gentle regimen for 10–14 days;
- elimination of sinus pressure;
- control after 1 and 3 months.

ISSN NO: 2770-2936
April 2026

4. Combined methods (bone material + membrane)

The most modern approach is the use of bone substitute material with a barrier membrane (guided bone regeneration).

Morphologically:

- directed migration of osteogenic cells;
- prevention of epithelial ingrowth;
- formation of a more mature bone structure.

Foreign RCTs demonstrate high predictability of regeneration in sinus floor defects.

Discussion

Data comparison shows:

- soft tissue grafting ensures closure of the communication, but does not prevent bone atrophy;
- autogenous bone provides the best morphological indicators of regeneration;
- xenogenic and synthetic materials provide stable volume with less trauma;
- Combined methods are the most promising from the point of view of implantological rehabilitation.

Morphologically, healing goes through the following phases:

- inflammation;
- proliferation;
- osteoid formation;
- remodeling.

Bone materials accelerate the transition to the osteogenesis phase due to osteoconduction and stimulation of angiogenesis.

Conclusion

The use of bone and bone substitute materials in PDA plastic surgery is justified when implantation is planned.

Autogenous transplants provide the most complete regeneration, but are accompanied by donor trauma.

Xenogenic and synthetic materials demonstrate high predictability and a favorable rehabilitation profile.

The most promising strategy is a combination technique using a barrier membrane.

Multicenter randomized trials are needed to standardize treatment protocols.

Bibliography

1. Sirak S.V., Kopylov V.N., Alimov R.A. Plastic surgery of the alveolar process bone tissue of the upper jaw in case of perforation of the maxillary sinus // Dentistry. 2015. No. 4. P. 19–27.
2. Malanchuk V.O., Kopchak A.V., Brodetsky I.S. Use of free autogenous bone graft in surgical treatment of odontogenic sinusitis with oroantral communication // Modern Dentistry. 2013. No. 3. P. 22–29.
3. Tairov V.V., Aliev R.G. Restoration of the height of the alveolar process in case of oroantral perforation // Bulletin of Dentistry. 2016. No. 2. P. 11–17.
4. Mustafaev R.M., Aliev M.A. Use of hemostatic adhesive composition in complex treatment of defects of the maxillary sinus floor // Russian Dental Journal. 2014. No. 5. P. 1–8.
5. Lazutikov V.A., Sysolyatin S.P. Review of methods of plastic surgery of odontogenic perforations of the maxillary sinus // Dentistry. 2012. No. 6. P. 65–70.
6. Methods of treatment of odontogenic perforated maxillary sinusitis // Clinical dentistry. 2011. No. 4. P. 3–10.
7. Histopathology of alveolar floor tissues in oroantral communication // Kuban Scientific Medical Bulletin. 2017. No. 5. P. 96–102.
8. Diagnostics of oroantral communications and prevention of odontogenic perforative sinusitis // Dentistry. 2010. No. 2. P. 45–49.

ISSN NO: 2770-2936
April 2026

9. Misch CE. Contemporary Implant Dentistry. 3rd ed. Mosby; 2008.
10. Chiapasco M., Zaniboni M. Clinical outcomes of GBR procedures in the posterior maxilla. Clin Oral Implants Res. 2009;20(S4):113–123.
11. Urban IA, Monje A. Guided bone regeneration in the posterior maxilla. Int J Oral Maxillofac Implants. 2019;34:10–20.
12. Jensen OT, Terheyden H. Bone augmentation procedures in localized defects. Periodontol 2000. 2008;47:195–210.
13. Esposito M., Grusovin MG, Rees J. Interventions for replacing missing teeth: bone augmentation techniques. Cochrane Database Syst Rev. 2010;(3):CD003607.
14. Cordaro L., Torsello F., Chen S. Bone regeneration in maxillary sinus floor defects. Clin Oral Implants Res. 2015;26(2):122–130.
15. Del Fabbro M., Testori T., Francetti L., Weinstein R. Systematic review of sinus floor augmentation procedures. Int J Periodontics Restorative Dent. 2004;24(6):565–577.
16. Pjetursson BE, Tan WC, Zwahlen M., Lang NP A systematic review of sinus floor elevation. Clin Oral Implants Res. 2008;19:129–145.
17. Wallace SS, Fromum SJ Effect of maxillary sinus augmentation on implant survival. Ann Periodontol. 2003;8(1):328–343.
18. Stacchi C., Andolsek F., Berton F. Intraoral bone block grafts for sinus repair. J Oral Maxillofac Surg. 2012;70(5):e326–e334.
19. Schwartz-Arad D., Herzberg R., Dolev E. The prevalence of oroantral fistula following sinus surgery. J Oral Maxillofac Surg. 2004;62:1470–1472.
20. Guo J., Chen Y., Tian W. β -tricalcium phosphate for sinus floor repair: clinical evaluation. J Oral Implantol. 2017;43(2):103–110. (China)
21. Kim YK, Yun PY, Um IW Autogenous tooth bone graft in sinus repair. J Korean Assoc Oral Maxillofac Surg. 2014;40:21–27. (South Korea)
22. Sánchez AR, Sheridan PJ, Kupp LI Oroantral fistula management: clinical study. Int J Oral Maxillofac Surg. 2007;36:808–811. (USA)
23. Galindo-Moreno P., León-Cano A., Ortega-Oller I. Xenografts in sinus floor reconstruction. Clin Implant Dent Relat Res. 2012;14(3):421–432. (Spain)
24. Avila-Ortiz G., Neiva R. Biomaterials for bone regeneration. Periodontol 2000. 2019;79:14–27.
25. de Oliveira-Neto PJ, et al. Treatment of oroantral fistula using bone graft and membrane. Braz Oral Res. 2013;27(1):75–80. (Brazil)
26. Rahpeyma A., Khajehahmadi S. Autogenous bone graft in oroantral fistula repair. J Craniofac Surg. 2015;26(6):e521–e524.
27. Al-Moraissi EA, Al-Sharani HM Treatment of oroantral fistula: systematic review. J Craniomaxillofac Surg. 2016;44:163–172.
28. Visscher SH, van Minnen B., Bos RR Closure of oroantral communications. J Oral Maxillofac Surg. 2010;68:1384–1391.
29. Güven O. A clinical study on oroantral fistula. J Craniomaxillofac Surg. 1998;26:267–271.
30. Tawfik MA, et al. Platelet-rich fibrin and bone graft for sinus floor repair. Int J Oral Maxillofac Surg. 2016;45:107–113.