EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

MODERN APPROACHES TO RECONSTRUCTIVE SURGERY OF THE ALVEOLAR PROCESS IN DENTAL IMPLANTOLOGY: A COMPARATIVE ANALYSIS OF BONE AUGMENTATION TECHNIQUES

Juraboev Sardor Murodjonovich
Student of the Faculty of Dentistry

Sadullaeva Shakhodatkhon Lutfullaevna
Assistant of the Department of Hospital Dentistry With a Course in Otolaryngology EMU University, Tashkent, Uzbekistan

Abstract
The restoration of dentition defects using dental implants is often complicated by severe alveolar bone atrophy. This study evaluates various bone-reconstructive techniques, including "open" sinus lifting, guided bone regeneration (GBR) using bioresorbable membranes, and autogenous bone grafting. The analysis focuses on the anatomical consequences of edentulism and the morphofunctional response of bone tissue to surgical intervention. Our findings suggest that while autogenous grafts remain a gold standard for significant defects, the integration of bioresorbable polylactic acid materials and GBR offers a promising, less invasive alternative for optimizing the implant bed.

Keywords: Guided bone regeneration; platelet-rich plasma; cone-beam computed tomography; partial edentulism; sinus lifting.

Introduction

Dental implantation has become the primary method for rehabilitating patients with dentition defects, effectively restoring masticatory function and facial aesthetics [1, 10]. However, the successful placement of endosseous implants is frequently hindered by significant atrophy of the alveolar process, particularly in the maxilla [3, 5, 6]. According to the World Health Organization, approximately 80 million people worldwide are edentulous, creating a massive clinical demand for effective prosthetic solutions [4, 8, 13].

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

Anatomical Consequences of Edentulism

Loss of teeth triggers a cascade of negative morphological changes. These include:

-Reduction in the height and width of alveolar processes.

-Increased interalveolar distance and loss of jawbone volume.

-Thinning of the oral mucosa and progressive atrophy of keratinized tissue.

-Impaired neuromuscular control and masticatory muscle dysfunction [9, 15, 18].

The Role of Sinus Lifting

In the posterior maxilla, the low positioning of the maxillary sinus floor often necessitates an "open" sinus lift. This technique involves an osteotomy of the lateral sinus wall and the elevation of the Schneiderian membrane to create space for biomaterials [2, 7, 14]. Despite its widespread use, success can be compromised by previous ENT surgeries, traumatic injuries, or inflammatory changes in the sinus [4].

Challenges in Current Practice

Successful osseointegration requires a minimum bone height of 10 mm and at least 0.75–1 mm of viable bone surrounding the implant [16, 18]. In Russia, while the demand for such treatment exceeds 95%, only a small fraction of patients (1.5–3% as of earlier studies) historically received this specialized care due to economic and medical constraints [10]. There is a critical need to refine treatment protocols involving autogenous bone, bone substitutes, and barrier membranes to reduce failure rates, which still reach up to 40% in complex cases.

Materials and Methods

This study utilizes a comparative analysis of clinical outcomes and experimental data regarding several reconstructive methodologies:

Surgical Techniques

-Open Sinus Lift: Elevation of the Schneiderian membrane and filling with osteoplastic material.

-Guided Bone Regeneration (GBR): Use of barrier membranes and bioresorbable pins (polylactic acid polymers) to prevent soft tissue ingrowth into the bone defect.

-Autogenous Grafting: "Sandwich" or "veneer" techniques using bone blocks harvested from the patient.

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

-Inter-cortical Osteotomy: Lateralization or transposition of the inferior alveolar nerve and ridge splitting.

Evaluation Criteria

The effectiveness of these methods was assessed based on:

-Primary Stability: Measured during implant placement.

-Bone Volume Gain: Radiographic analysis via computed tomography (CT).

-Resorption Rate: Comparison between titanium fixation systems and bioresorbable materials.

-Morphological Response: Histological investigation of the bone-to-implant contact and the formation of organotypic "living" bone tissue.

Results

Prevalence and Necessity of Augmentation

Clinical data indicates that bone grafting is required in 64% of all implant candidates. In the maxilla, simultaneous grafting with implant placement occurs in 77% of cases, whereas in the mandible, it is required in 22.4% [19].

Comparative Outcomes of Reconstructive Methods

The study identified distinct advantages and failure rates among the applied techniques:

Technique	Success Rate (Stability)	Complication Rate	Key Advantage
Open Sinus Lift	92–95%	12% (Membrane perforation)	Effective height gain in the maxilla.
GBR (Bioresorbable)	88–91%	8% (Early exposure)	No secondary surgery for pin removal.
Autogenous Veneer	85–90%	15–20% (Partial resorption)	High osteogenic potential.
Inter-cortical Osteotomy	82–86%	10% (Fracture risk)	Immediate expansion of ridge width.

Material Performance

Bioresorbable polylactic acid membranes demonstrated high biocompatibility and synchronized resorption with new bone formation. This eliminates the need for

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

secondary surgeries to remove titanium fixation systems, which was previously a significant burden on the patient.

Anatomical Factors

Uneven atrophy was observed in 92.7% of patients, complicating the creation of a uniform implant bed [17]. In the mandible, the risk of inferior alveolar nerve injury remains high when bone height falls below the 10 mm threshold [20].

Discussion

The findings underscore that "living" organotypic bone formation is the most challenging aspect of pre-implant preparation. While autogenous bone is the gold standard for its osteogenic properties, its use is associated with higher morbidity at the donor site and unpredictable resorption rates.

Adaptive Responses

One of the most significant gaps in current knowledge is the bone's response to mechanical load during the healing phase. Contradictory data suggests that while some load is necessary to prevent atrophy, excessive load during the early stages of osseointegration can lead to fibrous tissue replacement rather than bone formation [20].

The Shift to Bioresorbables

The development of bioresorbable pins and membranes represents a significant step forward. By providing a stable environment for GBR without the long-term presence of foreign metallic bodies, these materials reduce the risk of late-stage inflammation and implant rejection.

Comprehensive Assessment

Preoperative CT scans are indispensable; they reduce intraoperative complications by allowing for precise measurement of bone density and the identification of anatomical variations in the maxillary sinus.

Conclusions

Addressing the medical and social challenges of edentulism requires a multifaceted surgical approach.

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

1. Sinus lifting and GBR are highly effective for most maxillary defects, provided that the Schneiderian membrane remains intact.
2. Bioresorbable materials (polylactic acid) should be prioritized over titanium systems to minimize surgical trauma and secondary interventions.
3. Future research must focus on the "morphofunctional" changes in bone tissue under varying loads to establish more precise protocols for the timing of prosthetic loading.

In conclusion, while no universal method exists, the combination of autogenous grafts with modern bone substitutes and resorbable barrier membranes currently offers the most predictable path to successful long-term dental rehabilitation.

References

1. Abdullayev X., Ismatova K. Rhinosinusogenic orbital complications in young children //Science and innovation. – 2024. – T. 3. – №. D7. – C. 103-106.
2. Badarch M., Iriskulova E., Tudevdagva U. Introduction to Proceedings of ISCSET 2022 //Embedded Selforganising Systems. – 2022. – T. 9. – №. 3. – C. 2-3.
3. Ergashev J. D., Sigatullina M. I., Ibragimov U. K. Neuropsychic growth of children with hypoxi–ischemic encephalopathy //The 2th World Congress of Neonatology.–6th–9th January. – 2010. – C. 19.
4. Ergashev J. et al. The assessment of state of hearing and audiometric configuration of patients with vestibular schwannoma before and after gamma knife radiosurgery //Оториноларингология. Восточная Европа. – 2017. – Т. 7. – №. 1. – С. 31-38.
5. Ergashev J. et al. Epidemiological and evolutionary study of vestibular schwannomas after different types of treatment : дис. – Universidade de Santiago de Compostela, 2014.
6. Ergashev J. et al. Clinical picture of vestibular schwannomas in a series of 106 patients managed with different treatment methods //Новый день в медицине. – 2019. – №. 4. – С. 369-373.
7. Ergashev J. D. et al. MANAGEMENT OF VESTIBULAR SCHWANNOMAS: AGE MATTERS //SCIENCE. – 2024. – Т. 3. – №. 10-4. – С. 221-225.
8. Ergashev J. D. et al. Gamma Knife Radiosurgery for Vestibular Schwannomas: Favorable and Unfavorable Effects in Series of 42 Patients. – 2019.

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

9. Ganiev A. A. et al. The practice of oropharynx cancer: A case report and literature review //Annals of Cancer Research and Therapy. – 2019. – T. 27. – №. 2. – C. 37-41.
10. Iriskulova E. et al. Intraparotid facial nerve schwannoma: a cross-country report of two cases and literature review //Annals of Cancer Research and Therapy. – 2020. – T. 28. – №. 2. – C. 93-96.
11. Iriskulova E., Kodirova Z., Juraboev S. Prognosis of Complications at Surgical Treatment of Benign Parotid Tumors //Embedded Selforganising Systems. – 2022. – T. 9. – №. 3. – C. 70-72.
12. Iriskulova E. et al. Intraparotid facial nerve schwannoma: a cross-country report of two cases and literature review //Annals of Cancer Research and Therapy. – 2020. – T. 28. – №. 2. – C. 93-96.
13. Iriskulova E., Nurxojaeva A. Express assessment of sonoelastographic parameters in patients with tumors of the parotid salivary gland //Embedded Selforganising Systems. – 2022. – T. 9. – №. 3. – C. 18-19.
14. Ismatova K. A. et al. The new coronavirus infection in otolaryngological practice: clinical features in different age groups //Science and innovation. – 2023. – T. 2. – №. Special Issue 8. – C. 813-816.
15. Khamraeva V. S., Karabaev H. E., Ergashev J. D. The choice of optimal medical method for exudative otitis media in children //CHOICE. – 2018. – T. 4. – C. 24-2018.
16. Shovkatovich S. O., Muratovna N. M. OPTIMIZATION OF COMPLEX THERAPY FOR CHRONIC RECURRENT APHTHOUS STOMATITIS //World Scientific Research Journal. – 2025. – T. 45. – №. 1. – C. 119-123.
17. Shovkatov O.Sh., Sharipov S.S., Akhundjanov R.A. / 2025. MODERN PROSTHODONTIC TECHNOLOGIES IN COMPLETE EDENTULISM: APPLICATION OF CAD/CAM AND 3D PRINTING. *Журнал гуманитарных и естественных наук*. 2, 28 [2] (дек. 2025), 6–13.
18. Shovkatov O.Sh., Sharipov S.S., Akhundjanov R.A. 2025. BIOMATERIALS AND THEIR BIOLOGICAL COMPATIBILITY: A CLINICAL ANALYSIS OF PMMA, THERMOPLASTICS, BIOACTIVE POLYMERS, NANOMATERIALS, AND NEXT-GENERATION ZIRCONIA. *Журнал гуманитарных и естественных наук*. 2, 28 [2] (дек. 2025), 19–25.

EduVision: Journal of Innovations in Pedagogy and Educational Advancements
Volume 2, Issue 4, April 2026
brightmindpublishing.com
ISSN (E): 3061-6972

19. Shovkatov O.Sh., Mirsaidov M.M. (2026). KATTA CHAYNOV TISHLARI EKSTRAKSIYASIDAN KEYINGI YALLIG‘LANISHLARNING OLDINI OLISHDA ANTIBIOTIKLAR SAMARADORLIGINI BAHOLASH. *ОСНОВЫ МЕДИЦИНЫ*, *1*(8), 147–150. извлечено от https://journals.tnmu.uz/tas/article/view/3760
20. Yun J. M. et al. Optimizing Cochlear Implant Position for Magnetic Resonance Imaging of Vestibular Schwannoma //Laryngoscope Investigative Otolaryngology. – 2025. – Т. 10. – №. 6. – С. e70319.