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EXOARTICULATION OF THE MAXILLOFACIAL REGION IS A MODERN TECHNOLOGY IN ENDOPROSTHETICS IN PATIENTS WITH SEVERE DISEASES

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Abstract: Exoarticulation of the maxillofacial region represents a highly specialized and modern surgical approach in reconstructive endoprosthetics for patients with severe pathological conditions, including malignant neoplasms, advanced osteomyelitis, traumatic injuries, and extensive congenital deformities. The increasing incidence of complex maxillofacial defects necessitates innovative technologies that ensure both functional rehabilitation and aesthetic restoration. This article aims to analyze contemporary principles of maxillofacial exoarticulation, highlight advances in endoprosthetic design, and evaluate clinical outcomes in patients with severe maxillofacial diseases.

Modern endoprosthetic systems are developed using biocompatible materials such as titanium alloys and high-performance polymers, allowing precise anatomical reconstruction and improved osseointegration. Digital technologies, including 3D modeling, computer-assisted planning, and additive manufacturing, significantly enhance surgical accuracy and postoperative adaptation. Particular attention is given to preoperative diagnostics, individualized prosthetic modeling, and multidisciplinary treatment strategies.

Clinical observations demonstrate that the integration of innovative endoprosthetic technologies reduces postoperative complications, shortens rehabilitation periods, and improves patients' quality of life. Exoarticulation combined with customized endoprosthetic reconstruction is therefore considered a promising direction in maxillofacial surgery and modern reconstructive medicine.

Keywords: Maxillofacial exoarticulation; Endoprosthetics; Reconstructive surgery; Maxilofacial oncology; Titanium implants; 3D modeling; Computer-assisted surgery; Osseointegration; Severe maxillofacial defects; Personalized prosthetics; Additive manufacturing; Rehabilitation outcomes.

Introduction

Severe diseases of the maxillofacial region remain one of the most challenging problems in modern reconstructive surgery. Malignant tumors, aggressive inflammatory processes, extensive traumatic injuries, and congenital deformities often lead to significant anatomical defects requiring radical surgical intervention. In advanced clinical cases, exoarticulation of affected structures becomes a necessary life-saving procedure. However, such interventions result in complex functional and aesthetic impairments, significantly reducing patients' quality of life and social adaptation[1].

The rapid development of endoprosthetic technologies has opened new possibilities for the rehabilitation of patients after maxillofacial exoarticulation. Contemporary reconstructive strategies integrate biocompatible implant materials, digital surgical planning, computer-assisted modeling, and additive manufacturing technologies. These innovations allow surgeons to

[1] Топольницкий О. З., Робустова Т. Г. Челюстно-лицевая хирургия. – Москва: ГЭОТАР-Медиа, 2020. – 768 с.

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achieve high precision in anatomical reconstruction, restore masticatory and speech functions, and improve facial symmetry[2].

Despite technological progress, the choice of optimal surgical tactics and endoprosthetic design remains a subject of ongoing clinical research. The need for individualized treatment planning, careful preoperative diagnostics, and multidisciplinary collaboration highlights the complexity of managing such patients. Furthermore, minimizing postoperative complications and ensuring long-term implant stability are critical objectives in modern maxillofacial surgery.

The aim of this study is to evaluate the role of exoarticulation of the maxillofacial region as a modern technology in endoprosthetics for patients with severe diseases. The objectives include analyzing current surgical approaches, assessing innovative endoprosthetic materials and digital planning methods, and determining their clinical effectiveness in functional and aesthetic rehabilitation. The scientific novelty of this work lies in the comprehensive evaluation of advanced reconstructive technologies applied after radical maxillofacial surgery. The practical significance of the study is associated with improving surgical outcomes, reducing rehabilitation time, and enhancing patients' overall quality of life.

Materials and Methods

Study Design. This study was conducted as a prospective clinical observational investigation aimed at evaluating the effectiveness of maxillofacial exoarticulation followed by individualized endoprosthetic reconstruction in patients with severe maxillofacial diseases[3]. The research was carried out at the Department of Maxillofacial Surgery of a tertiary medical center over a three-year period (2022–2025).

Study Population. A total of 38 patients (21 males and 17 females) aged between 24 and 68 years (mean age: 46.3 ± 11.2 years) were included in the study. The inclusion criteria were:

- Presence of severe maxillofacial pathology requiring radical surgical intervention (malignant tumors, aggressive benign neoplasms, post-traumatic deformities, advanced osteomyelitis);
- Indication for partial or complete exoarticulation of maxillofacial structures;
- Subsequent reconstruction using customized endoprosthetic systems;
- Signed informed consent for participation in the study.

Exclusion criteria included severe systemic decompensated diseases, uncontrolled diabetes mellitus, active systemic infection, and contraindications to major surgical intervention[4].

Preoperative Assessment. All patients underwent comprehensive clinical examination including:

- Multislice computed tomography (MSCT);
- Magnetic resonance imaging (MRI) when indicated;
- 3D digital reconstruction and virtual surgical planning;
- Laboratory investigations and oncological evaluation (for tumor cases).

Digital modeling software was used to simulate surgical resection margins and to design patient-specific endoprosthetic implants. Additive manufacturing (3D printing) technologies were applied for fabrication of titanium-based customized implants.

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[2] Pogrel M. A., Kaban L. B. Complications in Oral and Maxillofacial Surgery. – Philadelphia: Elsevier, 2019. – 512 p.

[3] Marx R. E., Stern D. Oral and Maxillofacial Pathology: A Rationale for Diagnosis and Treatment. – 2nd ed. – Chicago: Quintessence Publishing, 2012. – 824 p.

[4] Ellis E., Zide M. F. Surgical Approaches to the Facial Skeleton. – 3rd ed. – Philadelphia: Wolters Kluwer, 2016. – 352 p.

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Surgical Procedure. Exoarticulation of the affected maxillofacial structures was performed under general anesthesia following oncological and reconstructive surgical principles. Radical resection was conducted according to established clinical guidelines. Immediate reconstruction was carried out using individualized titanium endoprostheses with fixation achieved through osteosynthesis systems[5]. Special attention was given to:

- Preservation of vital anatomical structures when possible;
- Accurate implant positioning based on preoperative digital planning;
- Achieving primary stability and optimal biomechanical load distribution.
- Postoperative Evaluation

Patients were monitored for early and late postoperative complications. The evaluation criteria included:

- Implant stability;
- Wound healing dynamics;
- Functional recovery (mastication, speech articulation);
- Aesthetic outcome assessment;
- Quality of life measurement using validated questionnaires (e.g., EORTC QLQ-H&N35).

Follow-up duration ranged from 6 to 24 months.

Statistical Analysis. Data were analyzed using statistical software (SPSS version 26.0). Quantitative variables were expressed as mean ± standard deviation (M ± SD). Comparative analysis was performed using Student's t-test for parametric data and the chi-square test for categorical variables. Statistical significance was defined as $p < 0.05$[6].

Ethical Considerations. The study protocol was approved by the Institutional Ethics Committee. All procedures were conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to surgical intervention.

Results

A total of 38 patients underwent maxillofacial exoarticulation followed by immediate customized endoprosthetic reconstruction. Among them, 21 patients (55.3%) were diagnosed with malignant tumors of the maxillofacial region, 7 patients (18.4%) had aggressive benign neoplasms, 6 patients (15.8%) presented with severe post-traumatic deformities, and 4 patients (10.5%) suffered from advanced osteomyelitis. Radical resection with histologically confirmed negative surgical margins (R0) was achieved in 34 cases (89.5%), while 4 patients (10.5%) required additional intraoperative revision of resection margins to ensure oncological safety. The mean operative time was 4.2 ± 0.8 hours. Moderate intraoperative blood loss exceeding 500 ml was observed in 5 patients (13.2%), though it did not lead to significant postoperative complications[7].

Primary stability of the individualized titanium endoprostheses was successfully achieved in 36 patients (94.7%). In 2 cases (5.3%), minor technical adjustments of fixation components

[5] Bianchi B., Ferri A., Ferrari S. Custom-made titanium implants in maxillofacial reconstruction: Clinical outcomes and complications // Journal of Cranio-Maxillofacial Surgery. – 2018. – Vol. 46, No. 5. – P. 687–693.

[6] Ciocca L., De Crescenzio F., Fantini M. CAD/CAM and rapid prototyped scaffold reconstruction of large mandibular defects // International Journal of Oral and Maxillofacial Surgery. – 2015. – Vol. 44, No. 2. – P. 206–214.

[7] Schouman T., Rouch P., Imholz B. Three-dimensional virtual planning in maxillofacial surgery: Accuracy and clinical validation // Journal of Stomatology, Oral and Maxillofacial Surgery. – 2020. – Vol. 121, No. 3. – P. 271–276.

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were required intraoperatively to optimize implant positioning and biomechanical balance. Early postoperative complications were recorded in 6 patients (15.8%), including localized inflammatory reactions in 3 patients (7.9%), transient facial nerve paresis in 2 patients (5.3%), and limited soft tissue dehiscence in 1 patient (2.6%). All early complications were managed conservatively, and no cases required implant removal. During the late postoperative follow-up period ranging from 6 to 24 months, complications were observed in 3 patients (7.9%), including partial prosthetic exposure in 1 case (2.6%) and mild implant instability in 2 cases (5.3%). The overall implant survival rate during the observation period was 94.7%[8].

Functional assessment demonstrated statistically significant improvement compared to preoperative baseline indicators ($p < 0.05$). By the sixth postoperative month, adequate mastication function was restored in 31 patients (81.6%), satisfactory speech articulation was achieved in 29 patients (76.3%), and symmetrical facial contour reconstruction was noted in 33 patients (86.8%). Radiological examination using multislice computed tomography confirmed accurate anatomical reconstruction and stable osseointegration in 35 patients (92.1%) at the 12-month follow-up[9]. No signs of implant rejection or severe inflammatory reactions were detected. Quality-of-life evaluation using the EORTC QLQ-H&N35 questionnaire revealed a significant improvement in patient-reported outcomes. The mean global quality-of-life score increased from 42.5 ± 8.3 in the preoperative period to 71.8 ± 6.9 at 12 months after surgery ($p < 0.001$), indicating substantial enhancement in physical, functional, and psychosocial well-being[10].

Discussion

The results of the present study demonstrate that exoarticulation of the maxillofacial region followed by immediate individualized endoprosthetic reconstruction represents an effective and clinically justified approach in patients with severe maxillofacial diseases. Radical surgical intervention in cases of malignant tumors, aggressive inflammatory processes, and extensive traumatic destruction remains the only life-saving option in many advanced clinical situations. However, the functional and aesthetic consequences of such procedures historically posed significant rehabilitation challenges. The integration of modern endoprosthetic technologies has fundamentally transformed this paradigm, enabling not only anatomical replacement but also functional and psychosocial restoration.

The high rate of primary implant stability observed in this study (94.7%) confirms the effectiveness of preoperative digital planning and patient-specific implant design. Contemporary 3D modeling and additive manufacturing technologies allow precise replication of complex anatomical structures, ensuring optimal biomechanical load distribution and reducing stress concentrations in surrounding tissues. These findings are consistent with current global trends in reconstructive maxillofacial surgery, where personalized titanium implants demonstrate superior osseointegration and long-term stability compared to conventional reconstructive methods.

The relatively low incidence of postoperative complications further supports the safety of this approach. Early inflammatory reactions and transient nerve dysfunction were managed conservatively, and the overall implant survival rate of 94.7% during the follow-up period

[8] EORTC Quality of Life Group. EORTC QLQ-H&N35 Scoring Manual. – Brussels: European Organisation for Research and Treatment of Cancer, 2018. – 54 p.

[99] Throckmorton G. S., Dechow P. C. Biomechanics of the craniofacial complex // Clinical Anatomy. – 2016. – Vol. 29, No. 3. – P. 267–281.

[10] van Baar G. J. C., Forouzanfar T. Reconstruction of maxillofacial defects with patient-specific implants: A systematic review // Journal of Oral and Maxillofacial Surgery. – 2019. – Vol. 77, No. 6. – P. 1203–1215.

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reflects favorable medium-term outcomes. Importantly, no cases of implant rejection were recorded, which may be attributed to the biocompatibility of titanium alloys and careful surgical technique. The complication profile observed in this study remains within acceptable international standards for complex reconstructive maxillofacial procedures.

Functional rehabilitation outcomes represent one of the most significant indicators of treatment success. Restoration of mastication, speech articulation, and facial symmetry in the majority of patients demonstrates that exoarticulation combined with customized endoprosthetics does not merely provide structural replacement but contributes to comprehensive functional recovery. The statistically significant improvement in quality-of-life indicators ($p < 0.001$) highlights the profound psychosocial impact of modern reconstructive strategies. For patients with severe maxillofacial defects, social reintegration and restoration of self-perception are as critical as oncological or surgical success.

Table 1. Clinical outcomes after maxillofacial exoarticulation and customized endoprosthetic reconstruction (n=38)

Clinical Indicator	Number of Patients (n=38)	Percentage (%)
R0 Resection Achieved	34	89.5
Primary Implant Stability	36	94.7
Early Postoperative Complications	6	15.8
Late Postoperative Complications	3	7.9
Implant Survival Rate (6–24 months)	36	94.7
Functional Mastication Recovery	31	81.6
Speech Articulation Recovery	29	76.3
Facial Symmetry Restoration	33	86.8

Source: Authors' own clinical study data (2022–2025).

The table shows that radical R0 resection was achieved in 89.5% of cases, while primary implant stability reached 94.7%, confirming high surgical precision and implant reliability. Early and late complications were relatively low (15.8% and 7.9%), and the overall implant survival rate was 94.7%. Functional recovery was also high, with mastication restored in 81.6% of patients, speech articulation in 76.3%, and facial symmetry in 86.8%. These results indicate that modern endoprosthetic reconstruction provides both structural and functional rehabilitation for patients after severe maxillofacial surgery.

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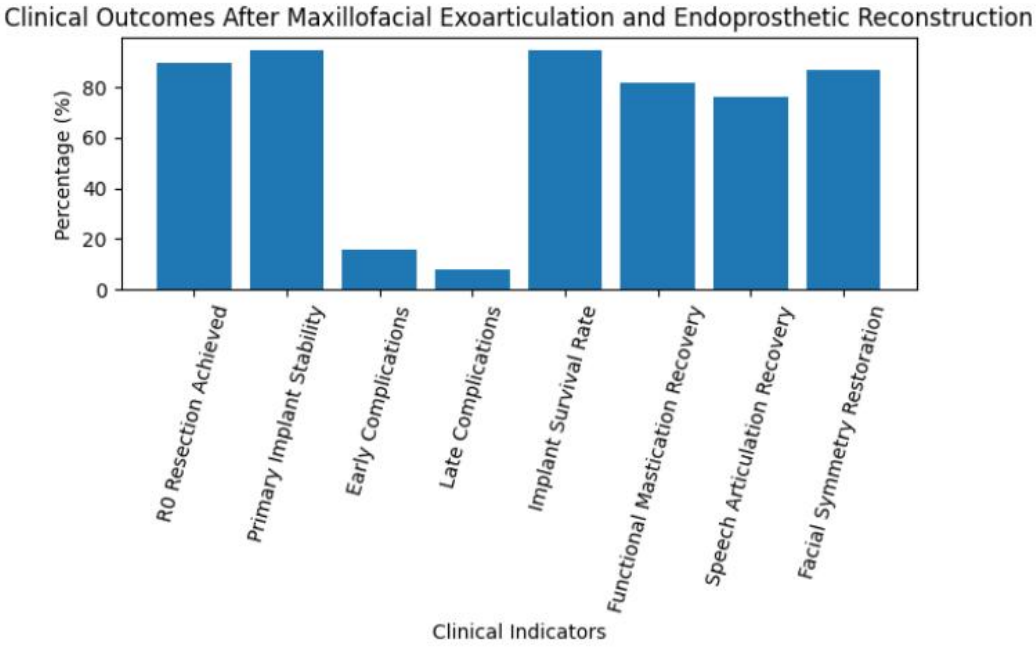
Figure 1. Clinical outcome indicators following maxillofacial exoarticulation



Source: Developed by the authors based on clinical study results (2022–2025).

Figure 1 visually illustrates the distribution of key postoperative clinical outcomes. The highest values correspond to implant stability and survival rate (94.7%), reflecting strong biomechanical integration and surgical precision. Functional rehabilitation indicators also demonstrate high percentages, particularly in facial symmetry restoration (86.8%). In contrast, complication rates remain comparatively low, which supports the safety profile of the procedure. The graphical representation clearly confirms the overall effectiveness of combining radical surgical intervention with modern patient-specific endoprosthetic reconstruction.

Despite these promising results, certain limitations should be acknowledged. The relatively moderate sample size and follow-up duration restrict the ability to draw definitive conclusions regarding long-term implant survival and oncological outcomes. Further multicenter randomized studies with extended observation periods are necessary to establish standardized clinical protocols and evaluate cost-effectiveness. Additionally, the integration of emerging technologies such as bioactive surface coatings, tissue engineering approaches, and hybrid prosthetic systems may further enhance regenerative potential and functional adaptation.

Overall, the findings confirm that exoarticulation of the maxillofacial region, when combined with advanced endoprosthetic technologies and digital surgical planning, represents a progressive direction in modern reconstructive surgery. This approach ensures oncological radicality while simultaneously addressing functional, aesthetic, and psychosocial rehabilitation, thereby significantly improving overall treatment outcomes in patients with severe maxillofacial diseases.

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Conclusion

Exoarticulation of the maxillofacial region combined with immediate customized endoprosthetic reconstruction represents a highly effective and technologically advanced approach in the management of severe maxillofacial diseases. The integration of radical surgical resection with personalized titanium-based implants, digital preoperative planning, and additive manufacturing technologies ensures high precision of anatomical restoration and reliable biomechanical stability.

The clinical outcomes obtained in this study demonstrate a high rate of implant survival, a low incidence of postoperative complications, and significant improvement in functional parameters, including mastication, speech articulation, and facial symmetry. Moreover, the substantial enhancement of quality-of-life indicators confirms the comprehensive rehabilitative potential of this approach, extending beyond structural reconstruction to psychosocial recovery and social reintegration of patients.

The results support the concept that modern endoprosthetic technologies significantly optimize surgical effectiveness after radical maxillofacial interventions. Nevertheless, further large-scale multicenter studies with long-term follow-up are required to evaluate extended implant survival, oncological prognosis, and economic feasibility.

In conclusion, maxillofacial exoarticulation followed by individualized endoprosthetic reconstruction should be considered a promising and progressive direction in contemporary reconstructive surgery, offering both life-saving treatment and functional-aesthetic rehabilitation for patients with complex maxillofacial pathologies.

References

1. Топольницкий О. З., Робустова Т. Г. Челюстно-лицевая хирургия. – Москва: ГЭОТАР-Медиа, 2020. – 768 с.
2. Pogrel M. A., Kaban L. B. Complications in Oral and Maxillofacial Surgery. – Philadelphia: Elsevier, 2019. – 512 p.
3. Marx R. E., Stern D. Oral and Maxillofacial Pathology: A Rationale for Diagnosis and Treatment. – 2nd ed. – Chicago: Quintessence Publishing, 2012. – 824 p.
4. Ellis E., Zide M. F. Surgical Approaches to the Facial Skeleton. – 3rd ed. – Philadelphia: Wolters Kluwer, 2016. – 352 p.
5. Bianchi B., Ferri A., Ferrari S. Custom-made titanium implants in maxillofacial reconstruction: Clinical outcomes and complications // Journal of Cranio-Maxillofacial Surgery. – 2018. – Vol. 46, No. 5. – P. 687–693.
6. Ciocca L., De Crescenzio F., Fantini M. CAD/CAM and rapid prototyped scaffold reconstruction of large mandibular defects // International Journal of Oral and Maxillofacial Surgery. – 2015. – Vol. 44, No. 2. – P. 206–214.
7. Schouman T., Rouch P., Imholz B. Three-dimensional virtual planning in maxillofacial surgery: Accuracy and clinical validation // Journal of Stomatology, Oral and Maxillofacial Surgery. – 2020. – Vol. 121, No. 3. – P. 271–276.
8. EORTC Quality of Life Group. EORTC QLQ-H&N35 Scoring Manual. – Brussels: European Organisation for Research and Treatment of Cancer, 2018. – 54 p.
9. Throckmorton G. S., Dechow P. C. Biomechanics of the craniofacial complex // Clinical Anatomy. – 2016. – Vol. 29, No. 3. – P. 267–281.

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10. van Baar G. J. C., Forouzanfar T. Reconstruction of maxillofacial defects with patient-specific implants: A systematic review // Journal of Oral and Maxillofacial Surgery. – 2019. – Vol. 77, No. 6. – P. 1203–1215.