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Operative Management of Zygomatic–Orbital Complex Defects

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Abstract: Zygomatic-orbital complex (ZOC) fractures represent one of the most frequent injuries of the midface and are commonly associated with functional and aesthetic impairment. The present study evaluates clinical manifestations and surgical outcomes after reconstruction using titanium mesh and porous polyethylene implants. A comparative clinical analysis of 94 patients was performed. Titanium mesh demonstrated superior restoration of orbital volume, ocular motility, and facial symmetry with lower complication rates. The findings support titanium mesh as a reliable option for reconstruction of ZOC defects.

Keywords: Zygomatic-Orbital Complex, Orbital Reconstruction, Titanium Mesh, Porous Polyethylene, Facial Trauma, Diplopia

Introduction

Injuries of the zygomatic-orbital complex significantly affect both facial aesthetics and orbital function. Due to the anatomical importance of the zygoma in maintaining orbital volume and globe position, inadequate reconstruction may lead to enophthalmos, diplopia, and persistent asymmetry. Modern craniofacial surgery uses various alloplastic materials, most commonly titanium mesh and porous polyethylene implants. However, the choice of material remains debated because of differences in rigidity, adaptability, and complication profile.

The aim of this study is to evaluate clinical characteristics and compare postoperative outcomes of reconstruction using titanium mesh and porous polyethylene implants.

Materials and Methods

A retrospective cohort clinical study was conducted in a maxillofacial surgery department. The study included **94 consecutive patients** with post-traumatic defects of the zygomatic-orbital complex treated surgically between 2019 and 2024. The study protocol followed the principles of the Declaration of Helsinki. All patients provided informed consent for surgical treatment and use of anonymized clinical data.

Inclusion criteria

- Unilateral zygomatic-orbital complex fractures with orbital wall defects
- Presence of functional symptoms (diplopia, enophthalmos, limited ocular motility)
- Age ≥ 18 years
- Surgical reconstruction performed within 1–14 days after trauma

Exclusion criteria

- Previous orbital surgery
- Bilateral orbital fractures
- Severe ocular globe rupture
- Neurological conditions affecting ocular motility
- Incomplete follow-up data

Etiology of trauma

- Road traffic accidents – 42.7%
- Interpersonal violence – 28.1%
- Falls – 18.8%
- Sports injuries – 10.4%

Preoperative assessment

All patients underwent standardized clinical and radiological evaluation including:

- Ophthalmologic examination (visual acuity, diplopia testing, ocular motility)
- Hertel exophthalmometry for globe position measurement
- Infraorbital nerve sensitivity testing
- Facial symmetry assessment
- Multislice computed tomography (CT) with 1-mm slices and 3D reconstruction

Orbital defect size and location (floor, medial wall, or combined) were recorded.

Patient groups

Patients were divided into two treatment groups according to implant material:

- **Group A:** titanium mesh reconstruction (n = 48)
- **Group B:** PMMA reconstruction (n = 46)

Surgical technique. All procedures were performed under general anesthesia by experienced maxillofacial surgeons.

1. **Surgical approaches:**
   - Transconjunctival approach for orbital floor and medial wall access
   - Lateral eyebrow or infraorbital approach when necessary
   - Intraoral vestibular incision for zygomatic buttress reduction
2. **Fracture reduction:** Displaced zygomatic bone fragments were anatomically repositioned and stabilized using titanium mini-plates at the zygomaticomaxillary buttress and frontozygomatic suture.
3. **Orbital reconstruction:**
   - Orbital contents were carefully elevated and herniated soft tissues repositioned
   - Defect margins were identified and measured
   - Implant was shaped according to orbital contour
   - Titanium mesh was rigidly fixed with micro-screws when necessary
   - PMMA implants were inserted using press-fit technique

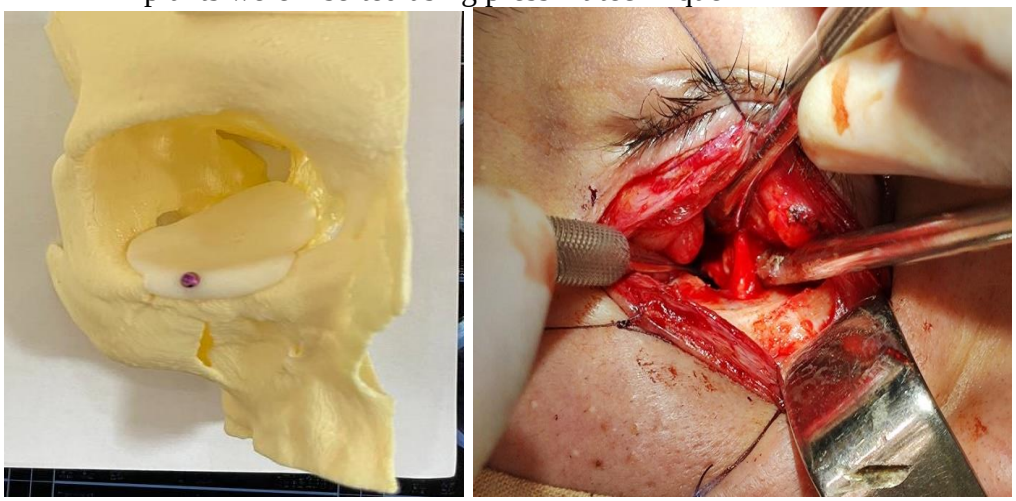


Figure 1. Elimination of a defect of the lower wall of the orbit using an individual implant

4. **Closure:** Periorbital tissues were repositioned, and incisions were closed with absorbable sutures. Frost suture was applied when indicated to prevent lower eyelid retraction.

Postoperative management

Patients received antibiotics for 5–7 days, corticosteroids for edema control, and ophthalmologic monitoring. Follow-up examinations were performed at 1 week, 1 month, 3 months, and 6 months postoperatively.

Outcome measures

Primary outcomes:

- Diplopia resolution
- Enophthalmos (>2 mm)
- Ocular motility recovery
- Facial symmetry

Secondary outcomes:

- Infection/inflammation
- Implant malposition
- Secondary enophthalmos
- Lower eyelid malposition

Statistical analysis

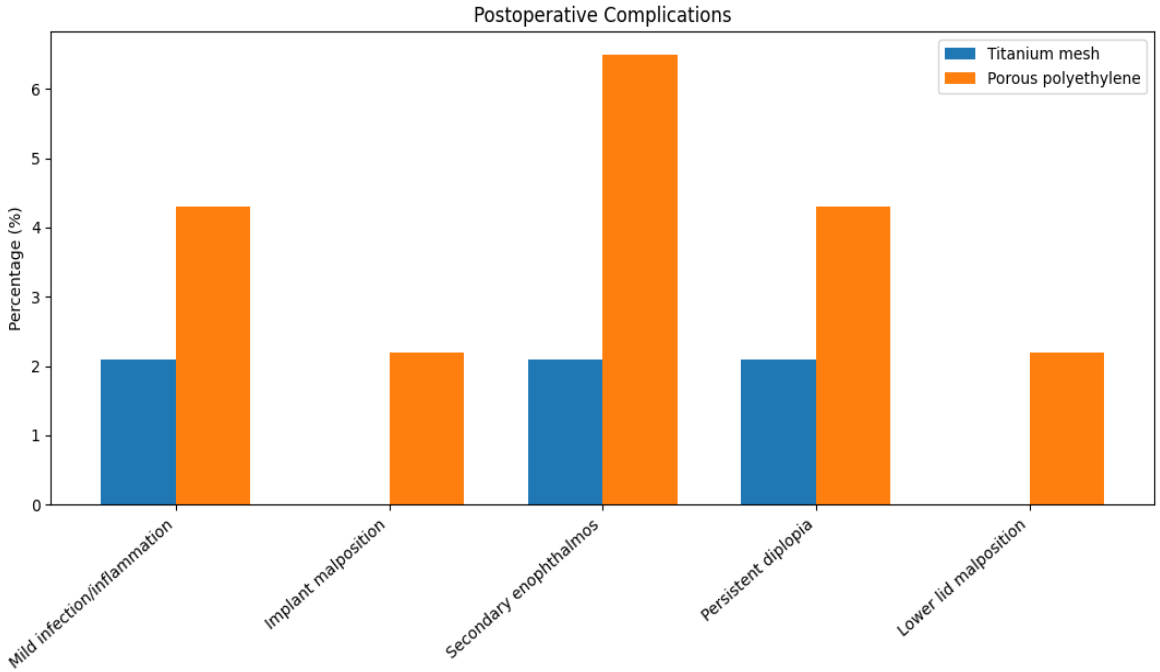
Data were analyzed using descriptive statistics. Results were expressed as percentages and compared between groups. Differences were considered clinically significant when variation exceeded 10%.

Results of Recent Studies

Titanium mesh provided better correction of diplopia and orbital position compared with porous polyethylene.

Outcome	Titanium mesh	Porous polyethylene
Complete diplopia resolution	87.5%	73.9%
Persistent diplopia	6.3%	13.0%
Enophthalmos >2 mm	7.3%	21.7%
Normal ocular motility	91.7%	80.4%
Good facial symmetry	89.6%	78.3%
Total complication rate	5.2%	13.0%

Complications



(Insert comparative diagram of outcomes here – Figure 1)

Discussion

Restoration of the zygomatic–orbital complex requires precise anatomical repositioning and stable support of the orbital walls in order to re-establish normal orbital volume and globe position. Even minor discrepancies in orbital contour may result in clinically significant enophthalmos or persistent diplopia. The present findings demonstrate that titanium mesh provides more predictable structural support compared with porous polyethylene, particularly in defects involving the orbital floor and combined wall fractures.

The superior functional recovery observed in the titanium group can be explained by its biomechanical characteristics. Titanium mesh has high rigidity, resistance to deformation, and the ability to maintain contour under physiological load. These properties allow accurate three-dimensional reconstruction and prevent late posterior displacement of the globe. In contrast, porous polyethylene demonstrates good biocompatibility and fibrovascular ingrowth but lacks sufficient mechanical strength in larger defects, which may contribute to gradual

loss of orbital volume and secondary enophthalmos.

Postoperative diplopia is commonly associated with inadequate repositioning of orbital contents or subtle changes in orbital geometry. In the current study, complete diplopia resolution was markedly higher in the titanium group. This supports the concept that rigid implants provide more reliable extraocular muscle alignment and prevent postoperative tethering. Similar observations have been reported in contemporary craniofacial literature, where stable orbital contour restoration correlates strongly with ocular motility recovery.

Complication analysis further emphasizes the advantages of titanium reconstruction. The lower incidence of implant malposition and secondary deformities suggests improved intraoperative adaptation and stable fixation. Porous polyethylene implants, while easy to shape, may shift in the absence of rigid fixation, especially in comminuted fractures. Additionally, the higher rate of inflammatory reactions in this group may be related to larger implant volume required to compensate for reduced structural strength.

From a surgical perspective, material selection should depend on defect size and load-bearing requirements. Small isolated defects may be adequately treated with porous polyethylene; however, moderate and extensive defects benefit from rigid titanium support. The present results indicate that titanium mesh is particularly advantageous in fractures involving multiple orbital walls or significant orbital floor displacement.

Several limitations should be acknowledged. The study was retrospective and not randomized, and implant selection depended partly on surgeon preference. Quantitative volumetric CT analysis was not performed, which could provide additional objective evaluation of orbital restoration. Future prospective studies with long-term follow-up and three-dimensional volumetric assessment are recommended to further clarify optimal material indications.

Overall, the findings support the principle that mechanical stability is a key determinant of functional recovery in orbital reconstruction. Titanium mesh offers reliable anatomical restoration and minimizes late complications, making it a preferable option for complex zygomatic–orbital injuries.

Conclusion

The present study demonstrates that successful reconstruction of zygomatic–orbital complex defects depends primarily on accurate restoration of orbital volume and stable structural support. Titanium mesh showed superior functional and aesthetic outcomes compared with porous polyethylene implants, including higher rates of diplopia resolution, improved ocular motility, and better facial symmetry, together with a lower incidence of postoperative complications and secondary deformities.

Based on the obtained clinical data, titanium mesh should be considered the material of choice in patients with moderate to large orbital defects, comminuted fractures, or involvement of multiple orbital walls where rigid support is essential. Porous polyethylene may still be appropriate in small, isolated defects with preserved bony support, particularly when minimal fixation is required. Therefore, implant selection should follow a defect-oriented strategy rather than a uniform approach.

Early surgical intervention within the first two weeks after trauma contributes to improved functional recovery by preventing fibrosis and extraocular muscle entrapment. Standardized radiological planning with thin-slice CT imaging and careful intraoperative contour adaptation are critical for optimal outcomes regardless of implant type. Long-term follow-up confirmed that stable orbital geometry restoration significantly reduces the risk of late enophthalmos and persistent diplopia. Consequently, the primary surgical objective should not only be fracture reduction but also precise three-dimensional orbital reconstruction.

In summary, titanium mesh provides predictable anatomical restoration and reliable long-term stability and can be recommended as the preferred reconstructive material for most zygomatic–orbital complex injuries. Future prospective randomized studies with volumetric orbital measurements are required to further refine material selection criteria and develop standardized clinical treatment algorithms.

References

Хусанов Д.Р., Шомуродов К.Э., Мусаев Ш.Ш. Исторические аспекты методов лечения посттравматических деформаций скуло-орбитального комплекса // Евразийский журнал оториноларингологии - хирургии головы и шеи. 2022;1(1). https://doi.org/10.57231/j.ejohns.2022.1.1.012, С. 77–83. (14.00.00)

Агзамова С.С., Шомуродов К.Э., Хусанов Д.Р. Совершенствование профилактики осложнений при травмах скулоорбитального комплекса // Вестник Ташкентской медицинской академии №5, 2022, С. 355-360. (14.00.00; №13)

Агзамова С.С., Шомуродов К.Э., Хусанов Д.Р., Хикматов М.Н. Эффективность комплексной медицинской реабилитации пациентов с переломами скуло-орбитального комплекса // Интегративная стоматология и челюстно-лицевая хирургия 2023;2(1). https://doi.org/10.57231/j.idmfs.2023.2.1.003, С.33-38. (14.00.00)

Musaev S.S., Shomurodov K.E., Husanov D.R. Etiology of complications of mandibular fractures in children // KRS Journal of Medicine Vol. 2, No. 3 (2022): Issue 1, C. 49-52. (14.00.00)

Шомуродов Қ.Э., Хусанов Д.Р., Патхиддинов Ж.Ш. Исторический аспект хирургического лечения переломов нижней стенки глазницы // Журнал медицина и инновации. 2021, №4, С.333-337. (14.00.00)

Khusanov D.R., Patkhiddinov J.S. Improvement of the prevention of complications in traumas of the zygomaticorbital complex // Collection of abstracts “Young scientists’ days” Republic scientific and practical conference with international participation, 29 april, 2022. Tashkent. C.388-389

Хусанов Д.Р., Шомуродов К.Э. Метод изготовления 3D имплантов для восстановления дефектов скуло-орбитального комплекса // Методические рекомендации, 2023. 32 с.

Хусанов Д.Р., Шомуродов К.Э. Способ применения 3D имплантов при восстановлении дефектов и деформаций скуло-орбитального комплекса. // Методические рекомендации, 2023. 34 с.