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Research Paper

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## Reconstruction of Post-Craniotomy Supraorbital Rim Defect Using Customized 3D Titanium Mesh: A Case Report

### Supraorbital Rim Reconstruction Using Customized Titanium Mesh

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### Abstract

We report a case of a 47-year-old male with left-sided periorbital deformity, ptosis, and ophthalmoplegia following craniotomy for traumatic brain injury. CT revealed complete loss of the left supraorbital portion of the frontal bone. A customized 3D-printed titanium mesh was used for anatomical reconstruction via a bicoronal flap, re-entering through the existing craniotomy scar. Frontal sinus duct patency was confirmed intraoperatively with methylene blue, and bilateral small suction drains were placed. The patient showed excellent functional and aesthetic recovery. This case highlights the benefits of 3D planning and multidisciplinary management in post-cranial reconstructive surgery.

### 1. Introduction

Supraorbital rim and orbital roof defects may result from trauma or neurosurgical access. Their loss affects orbital volume and brow projection, leading to ocular dysfunction and facial asymmetry. Modern techniques such as custom 3D-printed mesh reconstruction allow for precise repair, especially in cases of iatrogenic loss during craniotomy (1, 4, 6).

### 2. Case Presentation

Patient: 47-year-old male

Injury: Road traffic accident

Neurosurgical intervention: Emergency craniotomy

Referral: Maxillofacial unit for post-craniotomy orbital deformity

#### Clinical Features:

- Depressed left supraorbital contour
- Left ptosis and ophthalmoplegia
- Diplopia in upward gaze
- No vision loss or CSF leakage

#### Imaging:

- CT showed:
- Loss of the left supraorbital portion of the frontal bone and orbital rim

- Frontal sinus anterior table absent
- No posterior table breach
- Normal globe position; reduced orbital volume

### 3. Surgical Intervention Approach:

- Bicoronal flap reopened through existing craniotomy scar • Wide exposure of defect margins while preserving soft tissues

#### Frontal Sinus Management:

- Patency of the frontonasal duct confirmed using methylene blue injection (2, 9)
- No cranialization required

#### Reconstruction:

- 3D-printed customized titanium mesh, designed using mirrored contralateral orbital anatomy (6)
- Mesh contoured to reconstruct the supraorbital rim and orbital roof
- Fixation with 1.3 mm screws for stability

#### Drainage:

- Small suction drains placed bilaterally in the subgaleal plane to prevent hematoma/seroma (10)
- Drains removed on postoperative day 2

#### Closure:

- Layered closure of pericranium, galea, and skin
- Meticulous scar alignment with pre-existing incision

### 4. Outcome

- Ptosis improved within 4 weeks
- Extraocular movements returned by 6–8 weeks, except for mild upgaze limitation
- Diplopia resolved in primary and reading positions
- Symmetry of the brow and forehead restored
- No postoperative complications (infection, CSF leak, mucocele)

### 5. Discussion This case demonstrates:

- How craniotomy can result in iatrogenic orbital rim and roof defects (3, 5, 7)
- The functional impact of such defects: ocular misalignment, diplopia, and ptosis • The benefits of 3D-printed mesh: precise fit, reduced OR time, improved cosmetic results (6)
- Reuse of a pre-existing bicoronal scar for minimal visible morbidity
- Methylene blue testing of the frontonasal duct to avoid unnecessary cranialization (2, 9) • The use of bilateral suction drains as a preventive measure to minimize subgaleal collections (10)

### 6. Conclusion

Customized 3D titanium mesh reconstruction via a bicoronal approach using the previous craniotomy scar, with methylene blue sinus evaluation and bilateral suction drains, is a safe and effective strategy for restoring both function and aesthetics in post-craniotomy supraorbital defects.

### Keywords

Supraorbital rim reconstruction, Orbital roof defect, Craniotomy complication, 3D printed mesh, Bicoronal approach, Frontal sinus, Methylene blue, Surgical drain

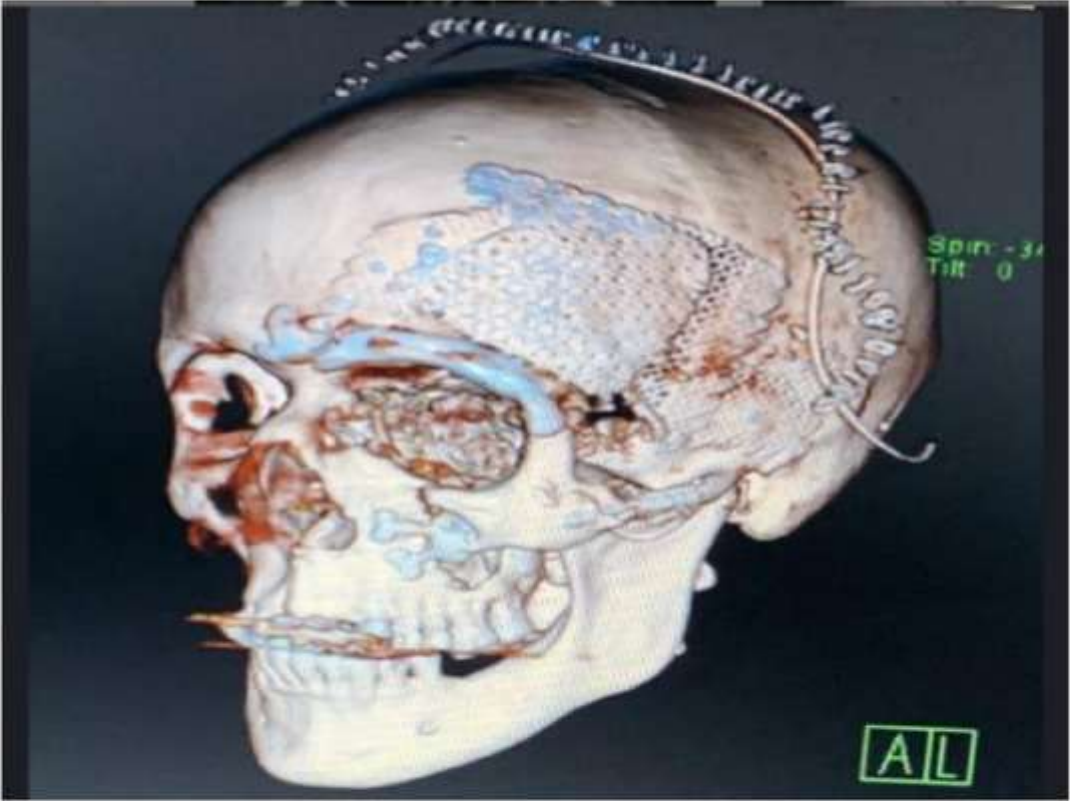
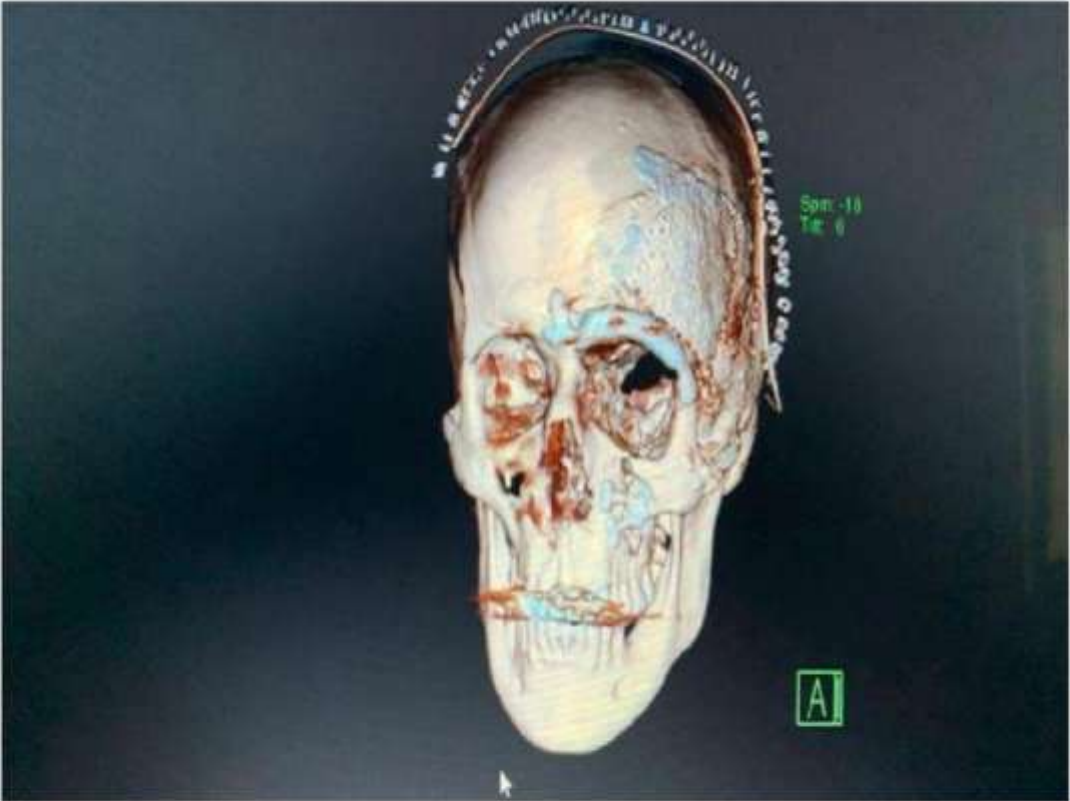
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Postoperative 3D CT Scan

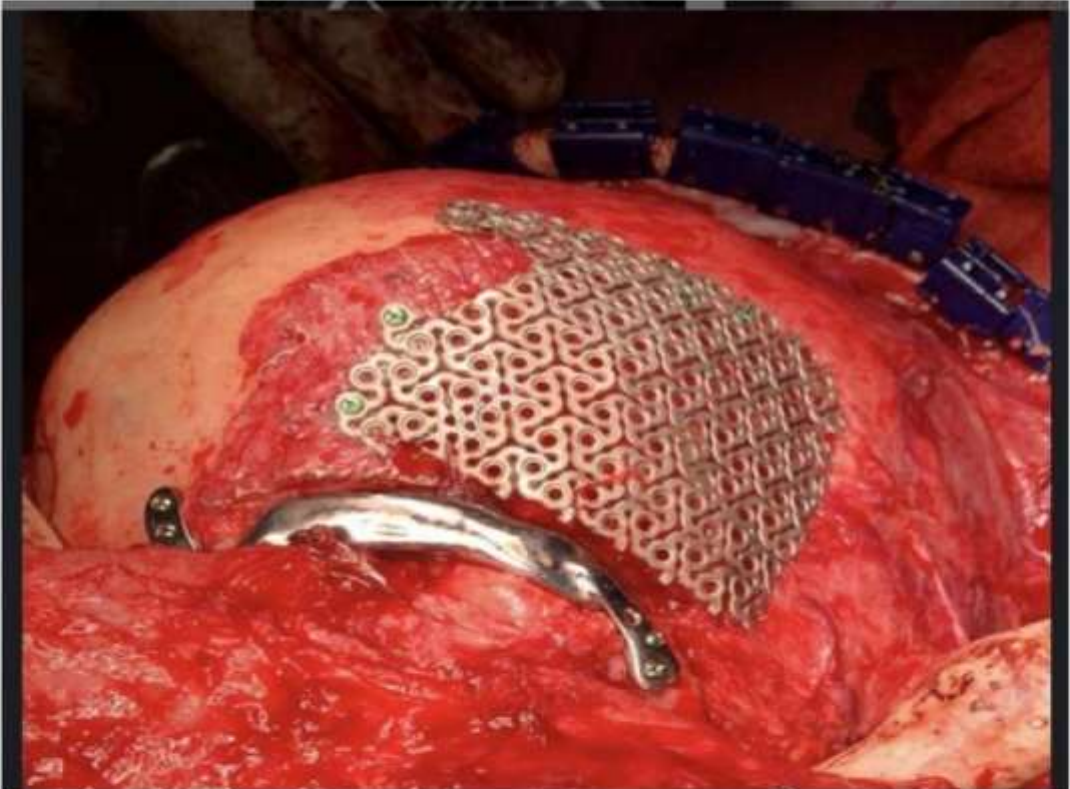


**Postoperative Clinical**

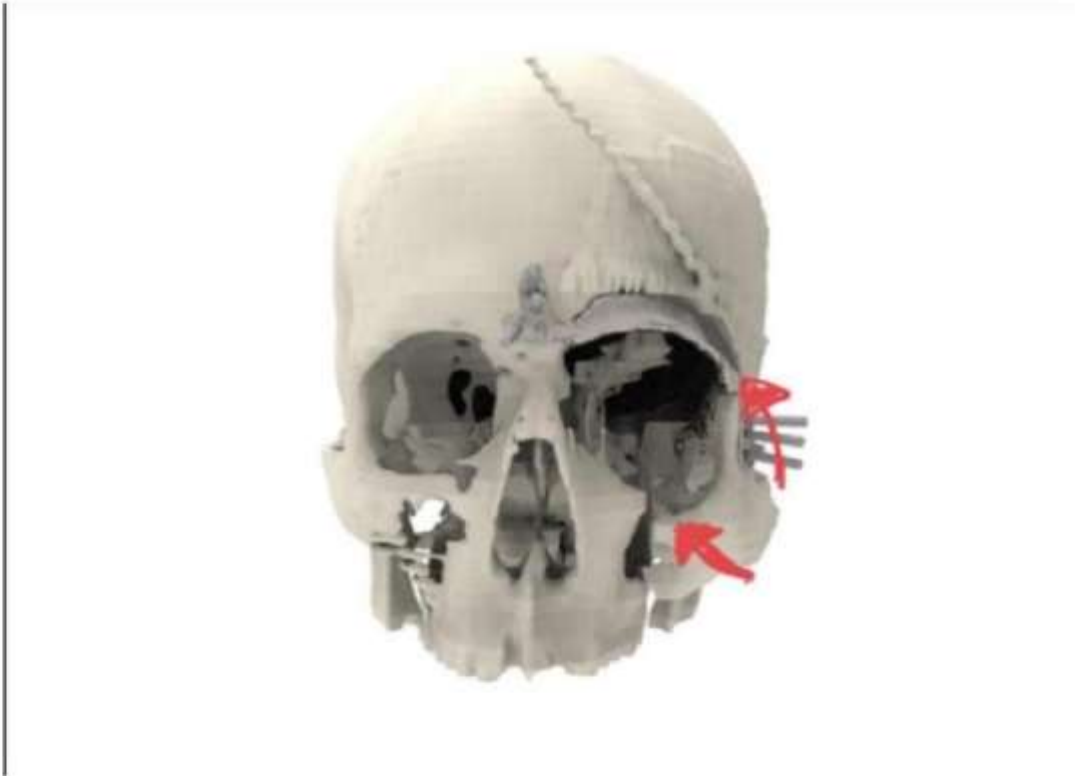


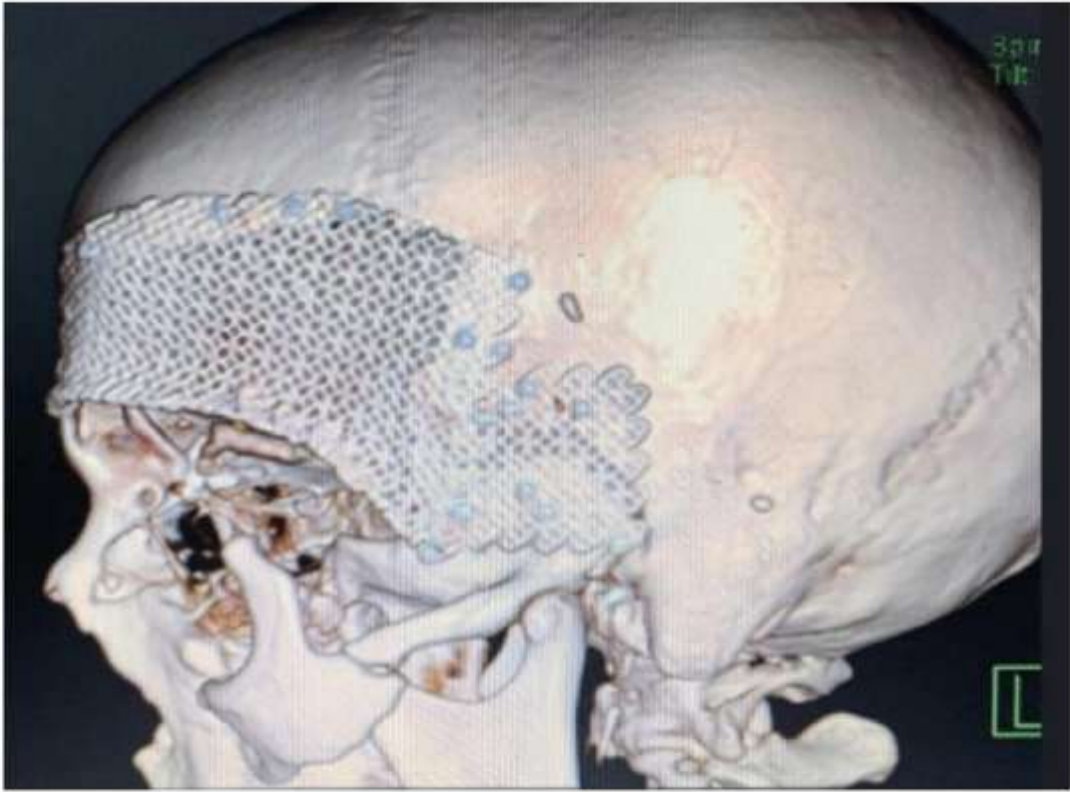


Intraoperative

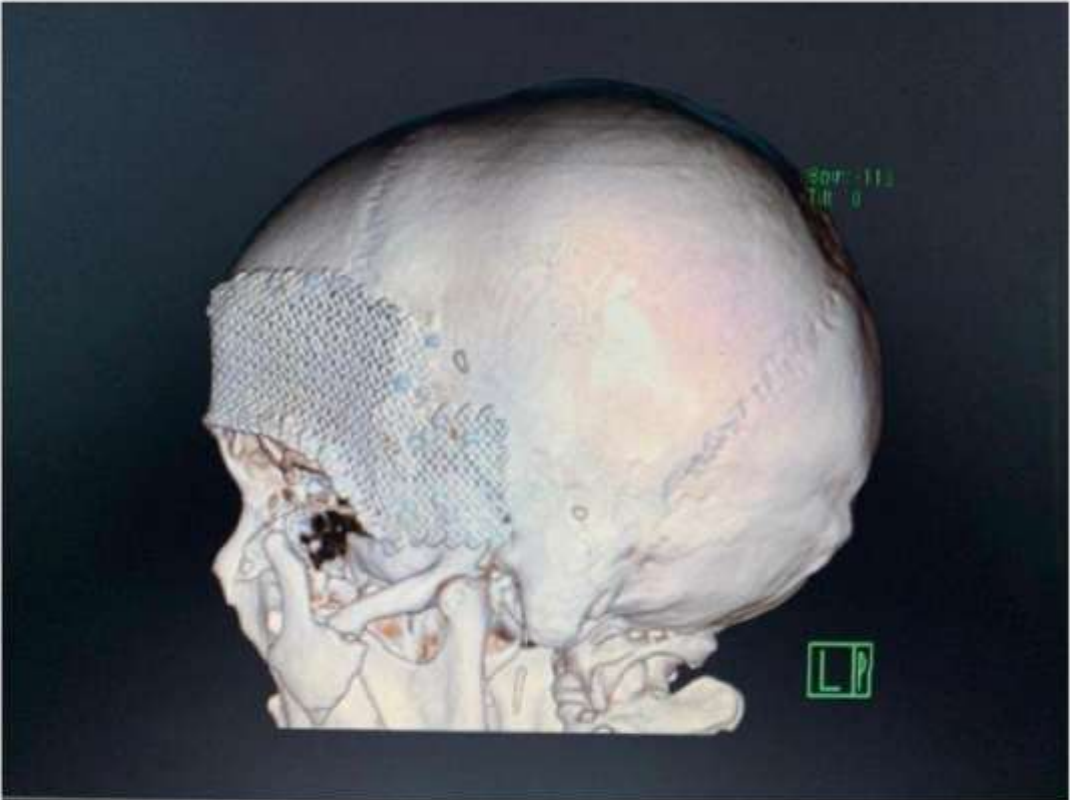


**Preoperative Lab Preparation**





Preoperative 3D CT Scan



**Preoperative Clinical**

