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CASE REPORTS

Late Management of Orbital Fracture. A Case Report.

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Abstract

Introduction: Orbital fractures are among the most complex injuries managed by maxillofacial surgeons. While delayed surgical intervention can allow edema to subside and facilitate accurate anatomical assessment, it may also increase the risk of permanent complications, such as soft tissue fibrosis and impaired ocular motility.

Case Presentation: We report the case of a 56-year-old male who sustained a left orbital fracture in a motor vehicle accident two months prior. The patient presented with persistent diplopia, hypoglobus, and telecanthus. CT imaging revealed displacement of both the superior and inferior orbital rims, along with inferior displacement of the orbital floor. Surgical correction was performed via a multi-approach technique: frontoethmoidal and upper eyelid crease incisions, intraoral maxillary vestibular access, and infraorbital incision. Reconstruction involved osteotomy and repositioning of displaced orbital segments, using titanium microplates and mesh pre-adapted to a 3D stereolithographic model for precision. The duction test confirmed restored ocular mobility intraoperatively.

Results: Two weeks postoperatively, the patient reported resolution of diplopia and demonstrated full, symmetrical ocular motility. This successful outcome, with no further complications observed, underscores the effectiveness of our surgical approach.

Conclusion: This case underscores the importance of early diagnosis and timely surgical repair in achieving optimal functional and aesthetic recovery in orbital trauma cases. Even with a late intervention, favorable outcomes can be achieved through meticulous anatomical reconstruction and advanced techniques such as stereolithographic modeling.

Keywords: Orbital fracture, stereolithographic model, diplopia, hypogeous, titanium mesh, reconstructive surgery

Introduction:

Orbital fractures are among the most complex injuries encountered by maxillofacial surgeons. Both structural anatomy and functional physiology of the orbit must be considered during diagnosis and treatment planning [1]. Delayed intervention may significantly affect outcomes, underscoring the critical importance of early and accurate diagnosis, appropriate timing, and a well-structured treatment plan for achieving optimal results [2].

Case Presentation

A 56-year-old male patient presented to Salus Hospital two months after a vehicle accident. He was initially treated in the intensive care unit for a subarachnoid hemorrhage; the patient was not referred for maxillofacial evaluation during his acute care.

On examination, he exhibited left-sided ocular dystopia, enophthalmos, and telecanthus. Palpation of the zygomatic complex revealed asymmetry and lateral and inferior displacement on the left side. (Fig. 1).

Intraoral examination confirmed asymmetry of the left maxillary zygomatic buttress. The primary concern was persistent diplopia. A forced duction test under local

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Figure 1. Clinical appearance showing left ocular dystopia.

anesthesia was positive, indicating a restriction in globe movement. (Fig. 2).

Objective:

The objective of the surgical intervention was to restore the anatomical alignment of the orbital bony rim and surrounding structures and to reestablish normal orbital volume using reconstructive materials.

Materials and Methods:

Computed tomography (CT) imaging revealed a blowout fracture of the left orbital floor with herniation of orbital contents into the maxillary sinus and displacement of the superior orbital rim. No pulsatile globe was observed clinically. (Fig. 3, 4).

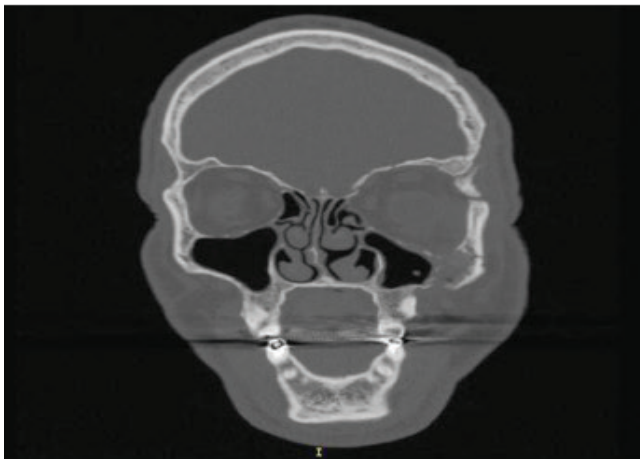

Figure 3. Coronal CT showing orbital enlargement, soft tissue herniation into the maxillary sinus, and lateral rim fracture.

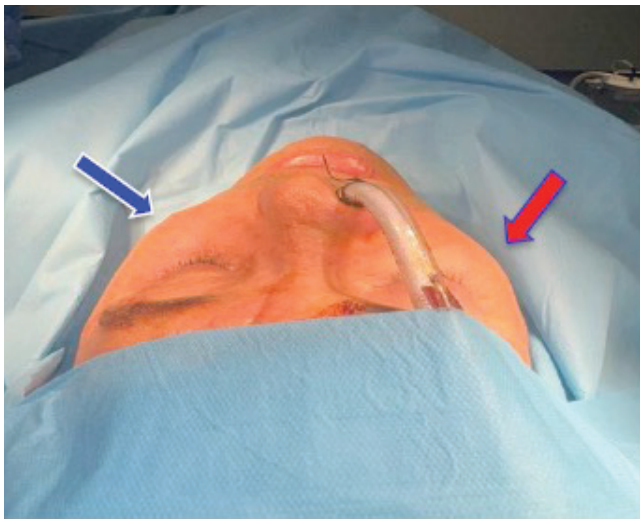

Figure 2. Posterior view indicating the displacement of the left zygomatic-maxillary complex (red arrow: healthy side; blue arrow: inferior displacement).

A surgical plan was developed using stereolithographic (STL) models derived from a high-resolution CT scan (with a slice thickness of 0.5 mm) created in collaboration with a biomedical engineer in Italy. The engineer's expertise in creating accurate 3D models based on the CT scan data was instrumental in planning the surgical approach and adapting the titanium reconstruction plates.

These models were used to pre-adapt titanium reconstruction plates.

This STL model was created in collaboration with a biomedical engineering team in Italy and served as a template for adapting titanium reconstruction plates that were needed, showcasing the innovative use of technology in our surgical approach.

Under the guidance of our experienced surgical team, the patient was placed under general anesthesia with nasal intubation. Surgical access was achieved via frontoethmoidal, upper eyelid crease, infraorbital, and intraoral vestibular

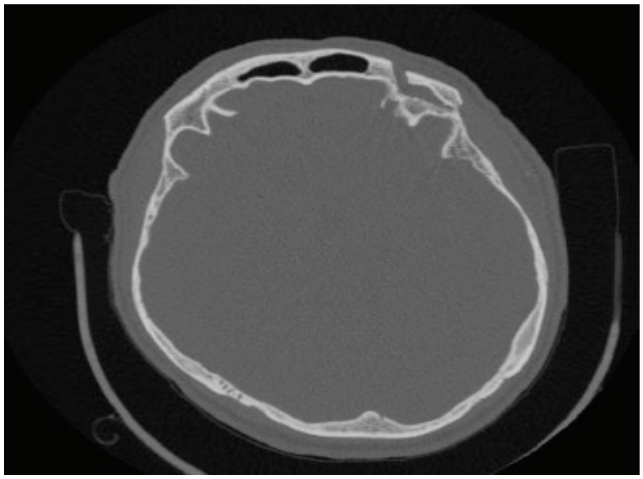

Figure 4. Axial CT showing fracture of the superior orbital rim.

incisions. Meticulous subperiosteal dissection allowed for complete exposure of orbital rim fractures. Entrapped soft tissues were released using a Freer elevator, and a malleable retractor was used to retract the globe.

Figure 5. Surgical approaches—1. Fronto-ethmoidal; 2. Infraorbital; 3. Upper eyelid crease incision.

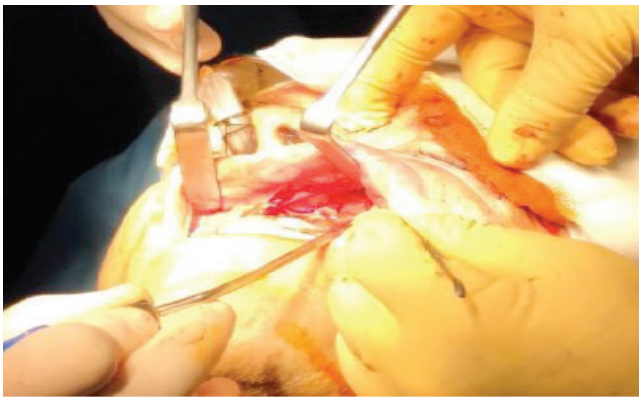

Figure 6: Intraoral maxillary vestibular approach.

Malpositioned bone fragments were repositioned and fixed with plates pre-adapted to the 3D model. A titanium mesh was placed and fixed at the infraorbital rim to reconstruct the orbital floor. After fixation, soft tissues were reassessed to ensure there was no entrapment, and a final forced duction test was performed before the closure of incisions. (Fig. 7, 8).

Figure 7. Rapid prototyping model created with a 3D printer.

Figure 8: The surgeon pre-bending plates on the stereolithographic model.

Results:

Two weeks after the surgery, the patient was recalled for reevaluation of the situation. It was noticed that the patient felt much better. There was no diplopia anymore. In lateral, downward, and upward gaze, both eyeballs moved symmetrically. It was noted that a slight enophthalmos and epicanthus of the left eye were still present. (Fig. 9).

Figure 9. The symmetrical movement of the eyeballs in all directions.

Discussion

The timing of orbital fracture management remains controversial. While delayed treatment can reduce orbital edema and facilitate planning, it may lead to complications such as fibrosis and restricted global mobility. It's essential to weigh these potential risks against the benefits of reduced edema and improved surgical planning when deciding on the timing of intervention.

In cases with linear orbital rim fractures without muscle herniation and minimal diplopia, conservative management, including corticosteroids and ocular movement exercises, may be adequate [5]. Surgical intervention is indicated in the presence of muscle entrapment on imaging, a positive duction test, or complex midface fractures [5].

Matteini et al. reported that the optimal timing for surgical repair and treatment ranged from 1 hour to 12 days, with a mean of 4 days [3]. In some cases, even early surgical intervention fails to resolve functional or cosmetic concerns, necessitating secondary reconstruction.

3D printing technologies enhance precision, reduce operative time, and improve outcomes by enabling preoperative plate adaptation, thereby reducing anesthesia duration and institutional costs. These technologies allow the creation of accurate 3D models that can be used to pre-adapt titanium reconstruction plates, thereby improving surgical precision and reducing the risk of complications.[6]

Conclusion

This case underscores the importance of early diagnosis and timely surgical repair in achieving optimal functional and aesthetic recovery in orbital trauma cases. Even with a late intervention, favorable outcomes can be achieved through meticulous anatomical reconstruction and advanced techniques such as stereolithographic modeling.

COI Statement: This paper has yet to be submitted in parallel, presented fully or partially at a meeting, podium, or congress, published, or submitted for consideration beforehand.

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