CASE REPORT

Reconstruction of the orbital floor using titanium mesh: A study of three cases

Madhumati Singh, N. S. Mamatha, N. S. Kedarnath, R. Sathesh Kumar, S. Vijayanand, Naqoosh Haidry

Department of Oral & Maxillofacial Surgery, Rajarajeswari Dental College & Hospital, Bengaluru, Karnataka, India

Correspondence
Dr. R. Sathesh Kumar, Department of Oral & Maxillofacial Surgery, Rajarajeswari Dental College & Hospital, Mysore Road, Bengaluru, Karnataka, India. Email: sathesh511@gmail.com

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Abstract

Orbital fractures account for 40% of craniofacial injuries; of the four walls of the orbit, the floor, which is extremely thin, is the most frequently injured. According to the pertinent literature, such fractures represent 67–84% of cases of orbital fractures. Orbital floor fractures can be broadly classified as pure or impure blowout fractures; the first are isolated orbital floor fractures, and the second are also associated with an orbital rim fracture, involving other skeletal elements: zygomatic, frontal, nasoethmoidal, or maxillary bone. The main aim for the reconstruction of the orbital defect was restoration of function, esthetics anatomy, and volume. Each biomaterial has its own merits and demerits, but the most important criteria of a material, is to allow the surgical objectives to be fulfilled. Orbital reconstruction should separate the orbital contents from the paranasal sinuses and nasal cavity and should prevent enophthalmos and diplopia.

Keywords: Fractures, orbital floor, titanium mesh

Introduction

The orbit’s close proximity to the nose, paranasal sinuses, nervous system along with its important role in support and function of the eye as well as facial esthetics makes it a vital anatomical structure. A variety of injuries ranging from subtle orbital floor blowout to gross comminution may result in disruption of this anatomically complex region of the middle third of the face. With inadequate treatment, permanent orbital deformity, incapacitating visual dysfunction and unsatisfactory esthetics may handicap an individual functionally, esthetically and socially.

Orbital floor fracture results in a disruption of bony continuity permitting bone fragments, orbital contents, and torn periosteum to herniate beyond the original bony orbit leading to enophthalmos, dystopia infraorbital paresthesia and hypoglobus. Soft tissue incarceration or entrapment may also occur, causing restricted ocular movements.

According to Haug et al. reported that the average weight of orbital contents is 42.97 (±4.05) g, and almost all biomaterials should provide adequate support to the orbital floor.\(^1\)

Development of late posttraumatic enophthalmos and diplopia depend on increased orbital volume and loss of intraorbital contents, and inappropriate anatomic reconstruction and the amount of fibrosis resultant.\(^1\)

Successful treatment depends on appropriate planning, conscientious surgical dissection and unique selection of size, shape, and kind of the reconstruction material.

Titanium mesh was very appropriate reconstructive material that provides exact anatomic reconstruction.\(^2\) The objective of our study was to find the efficacy and advantages of titanium mesh reconstruction in large orbital floor defects.

Patients were reported to our department with a history of road traffic accident (RTA).

Investigation: Orthopantomogram and posterior-anterior of skull radiographs, computed tomography and blood investigations

Case Reports

Case 1

A 27-year-old female reported to our department with facial swelling followed by RTA. Also with the chief complaint of inability to open her mouth, double vision and numbness over left upper lip. On examination there was left circumorbital ecchymosis, subconjunctival hemorrhage, diplopia, step deformity in infra orbital rim, zygomatic buttress and depression of the zygomatic arch. Infraorbital paresthesia has been noted. After routine investigation, it was finally diagnosed as left zygomatic complex fracture involving floor of the orbit, infra and supraorbital rim [Figure 1a-c].

Case 2

A 30-year-old male reported to our department with the chief complaint of inability to open his mouth followed by RTA.
On examination there was right circumorbital ecchymosis, subconjuctival hemorrhage, step deformity in infraorbital rim. After routine investigation, it was finally diagnosed as right zygomatic complex fracture involving floor of the orbit, infraorbital rim [Figure 2a-c].

**Case 3**

A 27-year-old male reported to the department with the chief complaint of difficulty to open his mouth and numbness over the right cheek region. On examination there was right circumorbital ecchymosis, subconjuctival hemorrhage step deformity in infraorbital rim, zygomatic buttress depression of zygomatic arch and enophthalmos. After routine investigation, it was finally diagnosed as right zygomatic complex fracture involving floor of the orbit, infra and supraorbital rim [Figure 3a-c].

Under general anesthesia, open reduction and internal fixation using titanium plates and screws. Orbital floor was explored and reconstructed using titanium mesh and screws.

Infraorbital nerve paresthesia has been resolved gradually over the period of 6 months after the reduction of fracture segments.

We observed there was late enophthalmos due to the atrophy of orbital fat in two of our cases (one female and one male). There was persistent mild diplopia in upper extreme gaze noted in that female patient which was corrected using prism glasses.

**Discussion**

In the reconstruction of the orbital floor, timing is vital to restore lost globe support and to normalize orbital volume to prevent a functional and cosmetic defect. Delayed surgery permits cicatricial contracture of herniated or incarcerated intraorbital contents. If diplopia is caused by the inferior rectus or the inferior oblique muscles being caught in the fracture, surgery is required to free them within 3 weeks or these delicate muscles will atrophy since timely reduction of orbital soft tissue limits the degree of ischemia caused by entrapment. Burnstine recommends surgical repair within 2 weeks if greater than half of the floor is depressed.[4]

All patients were operated upon for reconstruction of the orbital floor within 2 weeks from the day of the trauma.

The indications for surgical exploration of the fractured orbital floor include:

1. Hypoglobus or enophthalmos >2 mm
2. Limitation of extraocular muscle function,
3. A large orbital floor defect with herniation of soft tissue into the maxillary sinus on computed tomography (CT) or fractures that involve >50% of the floor

4. Step deformity along the infraorbital margin with paraesthesia of the infraorbital nerve causing numbness

Jason K. Potter reviewed the biomaterials that were available for orbital floor reconstruction to provide insight into their selection and application. Because of the diversity of problems that may present in orbital reconstruction and limitations of each material, currently no single material is ideal. Rigid materials are best suited for reconstruction of large defects to prevent sagging and displacement into the maxillary antrum.

Titanium mesh has good biocompatibility and is easily adjustable. It is easy to trim and mold exactly to the orbital contour. Because of the structure, connective tissue can grow into the implant meshwork, thus preventing its migration. It can be reliably fixed with screws in areas such as the infraorbital border. Titanium mesh has good physical strength in thin sections, and it produces less artifacts on CT scans than other metals. It can be sterilized in conventional autoclaves. However, the mesh structure makes removal difficult. Ingrowth of fibrous connective tissue through mesh pores has been documented in at least one recent study.

Literature is plenty with several studies where titanium has been compared with various other materials. According to Edward Ellis III, orbital defects reconstructed with titanium mesh showed better overall reconstructions than those reconstructed with bone grafts. However, subsequent orbital trauma may displace titanium mesh toward the orbital apex endangering the optic nerve.

In our cases, all patients underwent orbital floor reconstruction with titanium mesh. Preoperatively all the patients showed signs of enophthalamos and restriction of eye movements.

Postoperatively, the orbital volume of all the patients was restored with resolution of enophthalamos. Normal eye movements were restored. None of the patients showed signs of infection nor extrusion of the implant. The mesh was stable on CT evaluation without any dislodgement.

Goals of orbital floor reconstruction are to relieve the incarcerated or prolapsed orbital content from the fracture and to bridge the fractured site with an implant to regain the anatomical shape and volume of the orbital cavity. It can be achieved by interposing an autologous graft or alloplastic material between the remnant orbital floor and the soft tissues prolapsed into the maxillary sinus, suitably repositioned inside the orbit. Our experience with these patients in orbital floor reconstruction with titanium mesh has been encouraging, and the results obtained were satisfactory.

**Conclusion**

Titanium mesh is apt material for of orbital floor reconstruction, and complications were mostly due to problems in reforming anatomical shape and volume.

Surgical procedure decreases the frequency of post-operative diplopia and enophthalamos in blowout fractures which needs correction with less complications. There is no unanimity exists on the choice of implants for orbital floor reconstruction and several materials are available. The ideal material for the reconstruction of the orbital skeleton is influenced by many factors including specific characteristics of the injury, cost, patient choice and experience and opinion of the surgeon. For small defects, <2 cm with enophthalamos and limitation in ocular movements due to entrapment of the extraocular muscles, prolene mesh can be used. For larger defects, involving the infraorbital rim, with gross commination of the orbital floor and herniation of the orbital contents into the maxillary antrum, calvarial graft or titanium mesh can be used.

**References**


