



## MANAGEMENT OF ORBITOZYGOMATIC FRACTURES:CASE REPORTS

## Dental Science

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## ABSTRACT

Orbitozygomatic fractures are often encountered in oral and maxillofacial surgery as a result of road traffic accidents, violent assaults, falls and sports injuries. Management of these fractures is quite challenging to a surgeon because of the need of adequate exposure and mobilization of the fracture segments so that successful anatomical reduction can be achieved and complications like diplopia, extraocular muscle entrapment, and enophthalmos can be avoided. Here we present three case reports of orbitozygomatic fractures that were managed successfully without any postoperative complications.

## KEYWORDS

Zygomatico-maxillary complex fractures(ZMC), Maxillomandibular fixation (MMF)

## INTRODUCTION

The zygoma is the central support of cheek that gives strength to the middle third of the face. The other bones of the face with which it articulates are the maxilla, the temporal, the sphenoid and the frontal bones. When the fracture occurs along all these four articulations, it is known as the tetrapod fracture. Having a prominent position on the face, the zygoma has a lot of chances of getting ruptured due to traumatic forces.<sup>[1]</sup> Dislocation can occur either in isolation or in combination with other midfacial structures such as maxilla, nasoethmoidal and orbital area. After the nasal fractures, they are the second most common fractures of the face. About 13% of all craniofacial fractures are the zygomatic bone fractures.<sup>[2]</sup> As far as age and gender is concerned, they are found to be more common in young males than in females.<sup>[2-7]</sup> In developed countries this ratio is 3-5:1 while in the underdeveloped countries it is 10-40:1.<sup>[2]</sup> The most common etiologies are road traffic accidents, violent assaults, falls and sports injuries.<sup>[3-8]</sup> The main clinical features associated with zygomatic complex fractures are periorbital ecchymosis and edema,

subconjunctival ecchymosis without posterior limit, enophthalmos, diplopia, extraocular muscle entrapment (especially inferior rectus muscle that needs force duction test to be ruled out), flattening of the malar prominence, flattening over the zygomatic arch, pain, ecchymosis of the maxillary buccal sulcus, deformity at the zygomatic buttress of the maxilla, deformity of the orbital margin, trismus and neurosensory disturbances of the infraorbital nerve.<sup>[9]</sup> Usually the final diagnosis is confirmed by CT-scan, SMV and PNS. The treatment protocol depends on the fracture pattern that may vary between simple or comminuted, displaced or undisplaced and isolated or having concomitant fractures. Here we present a case series of six patients who were treated by surgical intervention for displaced fractures whereas the undisplaced fractures did not require any surgical intervention.

## CASE REPORTS

**Case report 1:** A 45 year old male patient reported to our department with a history of assault with rods while he was driving a loaded truck. There

was no bleeding from ear, mouth and nose. History of vomiting was absent. The patient had lost his consciousness at the time of incident and regained consciousness in an hour and was taken to nearby hospital by a passerby where he was given the primary treatment for lacerations. He travelled back to his town after 5-6 days and had constant pain and facial swelling. Pain occurred on chewing food for which he was brought to ITS dental college by his family for further treatment. Emergency treatment was done and the patient was stabilized. On clinical examination the patient had sutured skin lacerations of left frontal region. Periorbital ecchymosis was present bilaterally(Fig.1). Force duction test did not show any extraocular muscle entrapment. There was swelling on the right side of the face extending from right temporal region superiorly to 1cm below the inferior border of the mandible. Subconjunctival hemorrhage was absent. Face was bilaterally asymmetrical with flattening on the upper right region. Mouth opening was around 24mm(Fig.2a) and the occlusion was deranged with step deformity in the region of left parasymphysis fracture(Fig.2b). On palpation there was tenderness present on the right infraorbital region and zygomatic and buttress region and on left preauricular area.

Computed Tomography(CT) of the head and face were done which showed bilateral zygomaticomaxillary complex fracture involving frontozygomatic suture, zygomaticomaxillary buttress, nasomaxillary buttress, infraorbital rim on the right side and undisplaced fracture of the zygomatic arch, body of zygoma and zygomaticomaxillary buttress on left side(Fig.3a,b). The patient also had concomitant left condylar and prasympphysis fracture No intracranial pathology was seen on the CT scan.

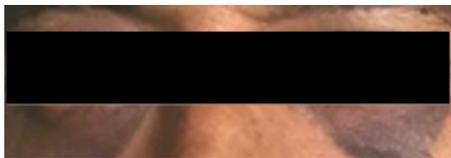


Fig.1: Bilateral periorbital ecchymosis



Fig.2a: Preoperative mouth opening, b: Preoperative photograph showing deranged occlusion



Fig.3a,b: Preoperative 3D-CT showing bilateral ZMC fracture with concomitant left condylar and parasymphysis fracture

After the open reduction and internal fixation of the left subcondylar and the parasymphysis fractures were done, we began with the open reduction and internal fixation of the right zygomatico-maxillary complex fracture. The right frontozygomatic fracture was exposed first through the Dingman approach and fixed using 1.5mm titanium miniplate(Fig.4a,b). This was followed by reduction of the zygomatic arch through Gillies temporal approach. After this the buttress fracture was approached through Keen's technique and fixed with 1.5mm plates. Then the right lateral orbital and the infraorbital rim fracture were exposed via subciliary incision. The fractured segments were

identified and fixated using 1.5mm orbital plates(4c,d). The floor of the orbital wall was comminuted and hence an orbital mesh was placed and fixed to the orbital rim(Fig.4d). No surgical intervention was done for the undisplaced ZMC fracture on the left side. Postoperative radiographs were taken(Fig.5a,b,c). Satisfactory results were obtained(Fig.6,7). There was reduced facial flattening on the left side.

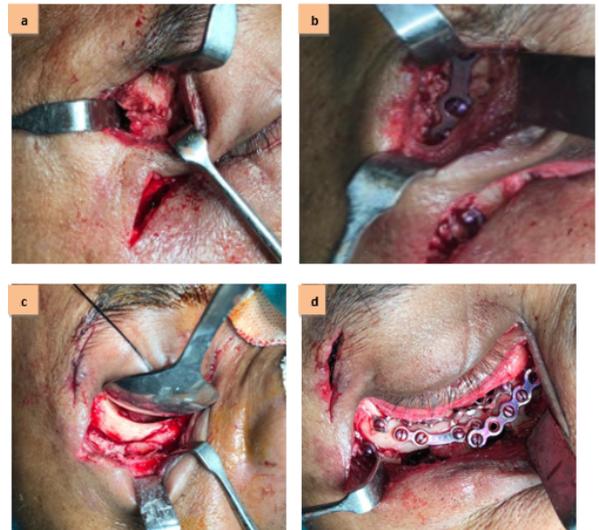


Fig.4 a: Dingman approach. b: Fixation of the right frontozygomatic fracture. c: Right orbital floor fracture exposed through subciliary incision. d: Fixation of the orbital floor using miniplates and reconstruction using orbital mesh



Fig.5a: Postoperative PNS. b: Postoperative SMV. c: Postoperative OPG

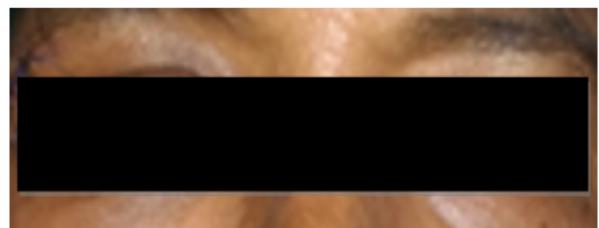


Fig.6: 3rd day follow-up showing absence of bilateral periorbital ecchymosis

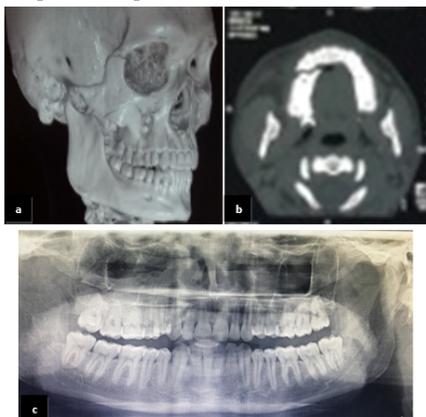


**Fig.7:Occlusion at 3<sup>rd</sup> month follow-up**

**Case report 2 :** An 18 year old male patient reported to our department with a complaint of pain & difficulty in mouth opening since 2 days. He was working in the field where he was hit by the handle of machine. After that he had no loss of consciousness or bleeding from mouth. He had bleeding from nose for which he took primary treatment from near by center. Two days later he reported to the our department through the reference of a friend. Emergency treatment was done and the patient was stabilized. Computed Tomography(CT) was taken and the head injury was ruled out due to the absence of intracranial pathology. The patient had swelling extending from the right supraorbital region till the inferior border of the mandible. Periorbital ecchymosis and subconjunctival haemorrhage was present on the same side(Fig.8a). Force duction test showed no extraocular entrapment. Limited mouth opening of around 19mm was present along with bilateral posterior open bite suspesctive of bilateral angle fracture(Fig.8b,c). The radiographic examination(Fig.9a,b,c) showed right zygomaticomaxillary complex fracture involving the zygomatic arch, frontozygomatic area, zygomatic buttress and the infraorbital rim fracture. Palatal fracture as well as the coronoid fracture were also present. Bilateral angle fractures that were suspected due to the presence of bilateral posterior open bite was also ruled out after radiographic examination.

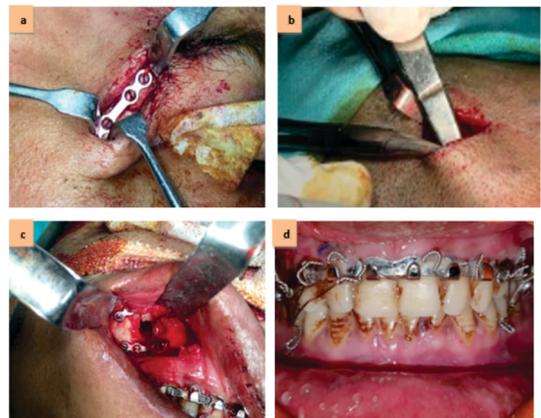


**Fig. 8**  
**a :** Preoperative photograph showing periorbital ecchymosis.  
**b :** Limited mouth opening.  
**c :** Bilateral posterior open bite.



**Fig.9a:Preoperative 3D-CT. b:Axial view in the CT scan. c:Preoperative OPG**

Patient was placed on MMF that was opened at the time of surgery. Frontozygomatic fracture was exposed through Dingman approach and fixed using a 1.5mm four hole plate with 1.5\*6mm screws(Fig.10a). Fractured zygomatic arch was reduced using Gillies temporal approach with the help of Rowe zygomatic elevator(Fig.10b). Exposure of the right buttress was done by Keen's approach and it was fixed with the help of two 1.5mm four hole plates using 1.5\*6mm screws(Fig.10c). Palatal fracture and coronoid fracture did not require any surgical intervention. Patient was kept on MMF after the surgery for 1 week(Fig.10d).

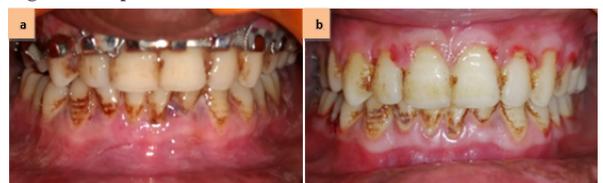


**Fig.10**  
**a :** Open reduction and internal fixation of frontozygomatic fracture by Dingman approach  
**b :** Closed reduction of zygomatic arch by Gillies temporal approach.  
**c :** Open reduction and internal fixation of buttress fracture by Keen's approach.  
**d :** MMF done

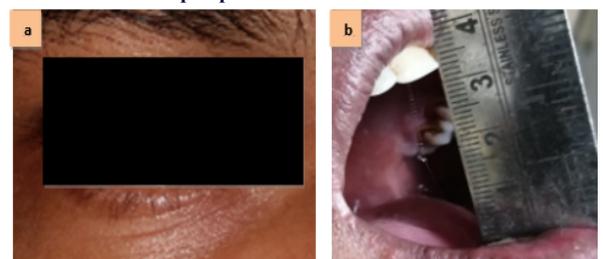
Postoperative PNS was done(Fig.11). Occlusion was satisfactory at immediate follow-up and it improved further as a result of MMF done for 1 week(Fig.12a,b). Complete absence of subconjunctival haemorrhage and periorbital ecchymosis could be observed by 18<sup>th</sup> day(13a). By one month the mouth opening exceeded 30mm(Fig.13b).



**Fig.11:Postoperative PNS**



**Fig.12a:Postoperative occlusion on 1<sup>st</sup> day follow-up.b:Occlusion at 1 month follow-up improved further due to MMF for 1 week**



**Fig.13a:18th day follow-up showing absence of subconjunctival**

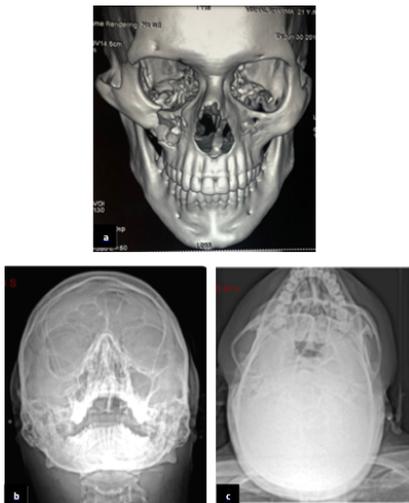
haemorrhage and periorbital ecchymosis. b: Increased mouth opening at one month follow-up

**Case report 3:**

A 21 year old male patient reported to our department with a history of road traffic accident one and a half month back. He had flattening of the malar bone on the right side. Occlusion was found to be satisfactory and the mouth opening was around 22mm(Fig.14a,b,c). CT scan, SMV and PNS reported malunited right tetrapod mouth opening was around 22mm



**Fig.14a:**Flattening of the right zygomatic bone. **b:**Preoperative occlusion was satisfactory. **c:**Preoperative mouth opening was around 22mm



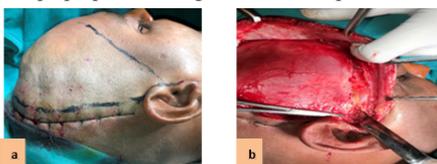
**Fig.15a:**Preoperative 3-D CT. **b:**Preoperative PNS view. **c:** Preoperative SMV

The treatment plan was to refracture the sutures of right zygoma and then realign the osteotomized zygoma at correct position using ORIF and thereby provide adequate prominence to the right side of face. 3-D stereolithographic models of the patient(Fig.16) were created which were refractured and the three-point fixation was done at the right frontozygomatic suture, the zygomaticomaxillary buttress and the zygomatic arch. The fixation was done using 1.5mm titanium miniplates using 2\*6mm screws.



**Fig.16:**Stereolithographic models

The patient was planned under general anaesthesia. A hemiconoral flap was raised to expose the malunited right frontozygomatic and the zygomatic arch fracture on the right side(Fig. 17a,b). The sutures were refractured and realigned to in proper position using 1.5mm titanium plates.



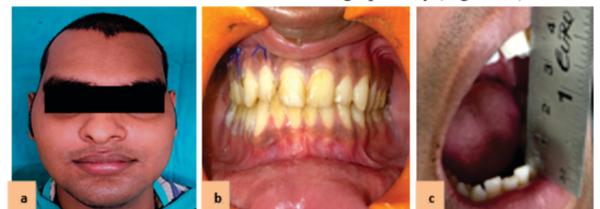
**Fig.17a:**Marking for the hemiconoral incision. **b:**Elevation of the hemiconoral flap



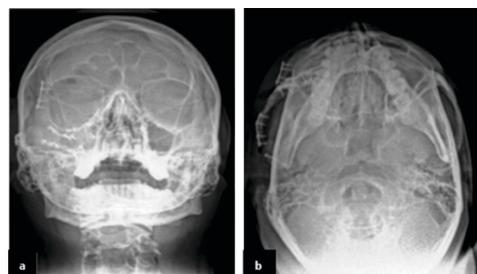
**Fig.18a:** b:Fixation of the right frontozygomatic fracture as first point of fixation. **b:** Fixation of the right zygomaticomaxillary buttress as second point of fixation. **c:**Subtarsal incision given to expose the right infraorbital fracture. **d:**Fixation of the right infraorbital rim fracture as third point of fixation. **e:** Fixation of the right zygomatic arch fracture as fourth point of fixation. **f:**Sutured surgical site

The frontozygomatic suture and the zygoaticomaxillary buttress were fixed followed by infraorbital rim fracture and lastly the zygomatic arch fracture.(Fig.18a-f)

The postoperative result was satisfactory. Flattening of the zygomatic bone on the right side that was present before the surgery had reduced(Fig.19a,b,c). Postoperative PNS and SMV were taken that could show the fixation of the fractured sites radiographically (Fig.20a,b).



**Fig.19a:**Flattening of the zygomatic bone on the right side was reduced. **b:**Occlusion was undisturbed. **c:**Mouth opening increased to around 37mm



**Fig.20a:**Postoperative PNS. **b:**Postoperative SMV

## DISCUSSION

The integrity of the zygomatic bone is important for maintenance of normal facial width and prominence of the cheek. Various surgical approaches are used to achieve successful treatment outcome, including the Gilles temporal approach, percutaneous approach, bicoronal scalp flap approach, Dingman's or lateral supraorbital approach, upper eyelid, transconjunctival, infraorbital lower eyelid, and intraoral vestibular approaches such as Keen's and Quinn's approach<sup>[10-13]</sup>. Though the intraoral approaches have a number of advantages over extraoral approaches<sup>[14-22]</sup>, when the fractures are severely displaced, further exposure of the zygomaticofrontal junction or the inferior orbital rim is required. It also requires additional rigid fixation.

The biomechanics of the facial skeleton were investigated and discussed by Rudderman and Mullen<sup>[23]</sup>. They reported that the fractured zygomatic segments can move in six possible directions. There is translation and rotation across x, y and z axis. When a miniplate is applied across the frontozygomatic suture, it helps in resisting translation and rotation along an axis that is perpendicular to the plane of miniplate. It also offers little resistance to rotation along the linear axis of the plate. Stabilization can be improved by placing an additional plate in such a way that the weak axis of both plates do not coincide with a line that is connecting the two plates. Three fixation points can be chosen such that they do not lie on the same straight line. Pearl reported that the fixation to reposition the maxilla should be done in at least three locations in order to achieve three dimensional correction<sup>[24]</sup>. If the reduction is done only at the frontozygomatic suture and inferior orbital rim, there can still be persistent lateral rotation in anterior maxillary buttress region, leading to expansion of the intra-orbital volume behind the axis of globe. A number of studies have been carried out to find out post-reduction rotational stability of zygomatic bone fracture after miniplate fixation. Davidson et al also found that maximum stability can be achieved by three-point fixation at fronto-zygomatic suture, inferior orbital rim and zygomatico-maxillary buttress<sup>[25]</sup>. O'Hara et al also found the similar results in his study<sup>[26]</sup>. However, prospective clinical studies are required.

More the complexity of the zygomatic complex fractures, more are the risk of complications that include diplopia, enophthalmos, extraocular muscle entrapment, facial asymmetry, persistent flattening of the malar prominence, neurosensory disturbances of the infraorbital nerve, malocclusion, limited mandible range of motion and enophthalmos<sup>[23-26]</sup>. These complications can be because of trauma that occurs initially, surgical intervention, or incorrect surgical treatment. Inadequate reduction often requires second surgery<sup>[27]</sup>.

Neither of our patients developed any complication and neither did they require the second surgery. It can be concluded that surgical approaches should be used only when the fractures are displaced, while the non-displaced ones can be managed by non-surgical approach alone. Number of plates should be sufficient to provide stability but unnecessary plating can be avoided in undisplaced fractures, still giving a satisfactory outcome.

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**Ethical:** The work done is in accordance with the Code of Ethics of the World Medical Association (Declaration of Helinski)

**Conflict of interests:** The authors declare that they do not have any conflict of interest

**Patient consent:** Written informed consent was obtained from all patients

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