Case Report

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Dentistry Section

Management of Complex Zygomaticomaxillary Fracture with Frontal and Orbital Wall Involvement Associated with a Crushed Globe: A Case Report

KRISHNA BALAJI PAMPATWAR[1], BHUSHAN MUNDADA[2], NITIN BHOLA[3]

ABSTRACT

Zygomaticomaxillary Complex (ZMC) fractures are among the most common midfacial injuries and are frequently caused by high-velocity trauma, particularly road traffic accidents. These fractures frequently affect nearby structures including the orbit, maxilla, and frontal bone, leading to serious problems with function, appearance, and vision. To restore orbital integrity, facial symmetry, and functional outcomes, prompt diagnosis and appropriate surgical intervention are essential. A 17-year-old male presented with severe facial trauma following a road traffic accident. Significant facial asymmetry, periorbital oedema, flattening of the right malar prominence, limited jaw opening, and total loss of vision in the right eye were found during the clinical examination. An ophthalmological examination revealed a crushed globe that could not be saved. A complicated right-sided ZMC fracture involving the orbital floor, lateral orbital wall, maxillary sinus walls, along with frontal bone was identified on Computed Tomography (CT) imaging of the facial bones. Significant orbital damage and fracture fragment displacement were observed. Under general anaesthesia, the patient underwent a surgical procedure. Titanium miniplates and screws were used for open reduction and internal fixation of the frontal and zygomaticomaxillary bone fractures. In order to prevent enophthalmos and restore orbital support, titanium mesh was used for orbital floor repair. Because of the permanent ocular lesion, the injured globe was eviscerated. The face contour was well restored, the mouth opening was better, the occlusion was stable, with wounds healing appropriately. The postoperative recovery was uncomplicated. In order to manage difficult midfacial fractures for the best possible functional and cosmetic rehabilitation, this case highlights the significance of thorough clinical examination, radiographic assessment, and a multidisciplinary approach.

Keywords: Facial asymmetry, Frontal bone fracture, Maxillofacial trauma, Open reduction and internal fixation, Orbital wall fracture

CASE REPORT

A 17-year-old male patient accompanied by parents, presented to the Department of Oral and Maxillofacial Surgery with complaints of pain, facial asymmetry on the right side of the face, restricted mouth opening, and loss of vision in the right eye for approximately one month following a road traffic accident. The injury occurred due to a collision between a two-wheeler and a tractor. Immediately after the accident, the patient experienced brief loss of consciousness and was taken to a tertiary care trauma centre for emergency management. On initial evaluation, the patient was conscious and oriented with a Glasgow Coma Scale (GCS) score of 14 (E4V4M6) and stable vital parameters. Primary trauma assessment was performed according to Advanced Trauma Life Support (ATLS) protocols. Emergency management included wound debridement, primary suturing of lacerations in the right periorbital region, administration of intravenous fluids, analgesics, antibiotics, and tetanus prophylaxis.

During the initial hospital stay, an ophthalmology consultation was obtained. The right eye had No Perception of Light (NPL), according to an ophthalmologic examination. The diagnosis of a crushed globe injury was supported by the clinical findings, which included significant periorbital oedema, ecchymosis, subconjunctival haemorrhage, globe rupture, and protrusion of intraocular contents. Following the stabilisation of related facial injuries, definitive ophthalmic surgery was scheduled since the globe was considered non-salvageable. Before being referred for final maxillofacial treatment, the patient was treated conservatively during the acute phase to allow for the decrease of face oedema and the stabilisation of the systemic condition.

The patient visited the Department of Oral and Maxillofacial Surgery after about a month for definitive treatment of the functional restriction and chronic facial deformity. The patient was found to be alert, oriented, and haemodynamically stable upon general assessment. An extraoral examination showed facial asymmetry caused by a flattening of the cheek contour and a depression over the right malar prominence [Table/Fig-1].

[Table/Fig-1]: Preoperative clinical photograph showing right-sided facial asymmetry with malar depression and loss of vision due to crushed globe following ZMC fracture.

The right supraorbital and infraorbital areas have healed sutured laceration scars. Ecchymosis and some residual periorbital oedema were also seen. In addition to palpable crepitus and step deformity

throughout the ZMC, palpation indicated discomfort over the right zygomatic region, infraorbital rim, and supraorbital area.

Examination of the temporomandibular joint showed no clicking, deviation, or soreness in the preauricular area, and bilateral motions were smooth, synchronous, and painless. However, rather than intrinsic temporomandibular joint restriction, mouth opening was limited to approximately 25 mm due to mechanical impingement of the displaced zygomatic arch on the coronoid process [Table/Fig-2]. An intraoral examination revealed stable bilateral occlusion and no signs of mandibular fracture or intersegmental movement. The intraoral soft-tissues, including the oral mucosa, were within normal limits.

[Table/Fig-2]: Clinical photograph showing reduced mouth opening measured using a digital Vernier caliper in a postoperative maxillofacial trauma patient.

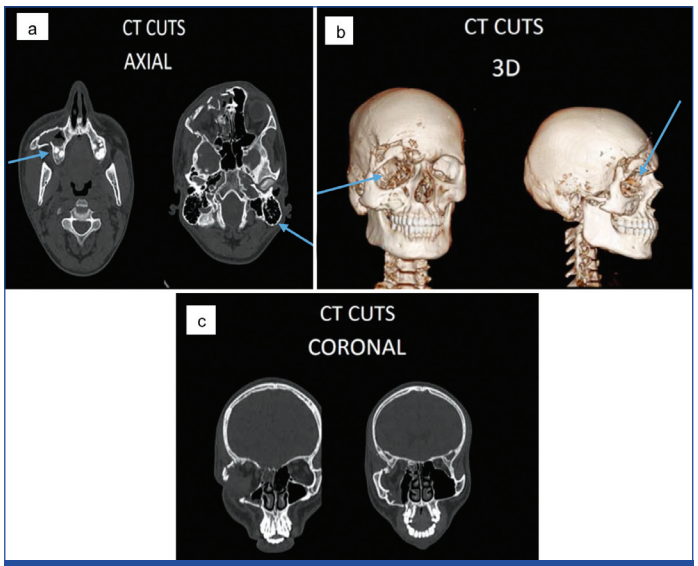
A definitive surgical procedure was then scheduled after radiological assessment revealed severe right-sided ZMC fractures with related orbital and frontal bone involvement. As the patient was a minor, written informed consent for treatment and publication of clinical details and images was obtained from the patient's parents/legal guardian.

Investigations

The right ZMC, right supraorbital rim, frontal bone, and orbital walls were fractured, and the right eye globe was crushed, as demonstrated by CT of the facial bones of the facial bones. Significant displacement of broken segments including the zygomatic body, orbital floor, lateral orbital wall, and frontozygomatic area was verified by axial, coronal, sagittal, and three-dimensional reconstructed images [Table/Fig-3a-c]. The injury was categorised as a Type C fracture, which denotes a complicated zygomatic fracture including the zygomatic body and accompanying damage of neighbouring orbital and facial skeletal structures, according to Zingg's classification of zygomatic fractures [1]. A definitive diagnosis of right-sided Zingg Type C ZMC fracture with accompanying frontal bone fracture, orbital wall fractures, as well as crushed globe of the right eye was made based on clinical and radiographic evidence.

Therapeutic Intervention

The patient was scheduled to have surgery while under general anaesthesia. Following a typical preoperative assessment and determining surgical fitness, intravenous propofol (2 mg/kg) and fentanyl (2 µg/kg) were used to produce general anaesthesia. Vecuronium (0.1 mg/kg) was then used to relax muscles in order to permit endotracheal intubation. For sufficient surgical access to the face skeleton, nasotracheal intubation was carried out. Oxygen, nitrous oxide, sevoflurane, and sporadic muscle relaxants were used to maintain anaesthesia while vital signs were continuously monitored. The right eye was then eviscerated and the right ZMC, frontal bone, and orbital wall fractures were openly reduced and internally fixed [Table/Fig-4].

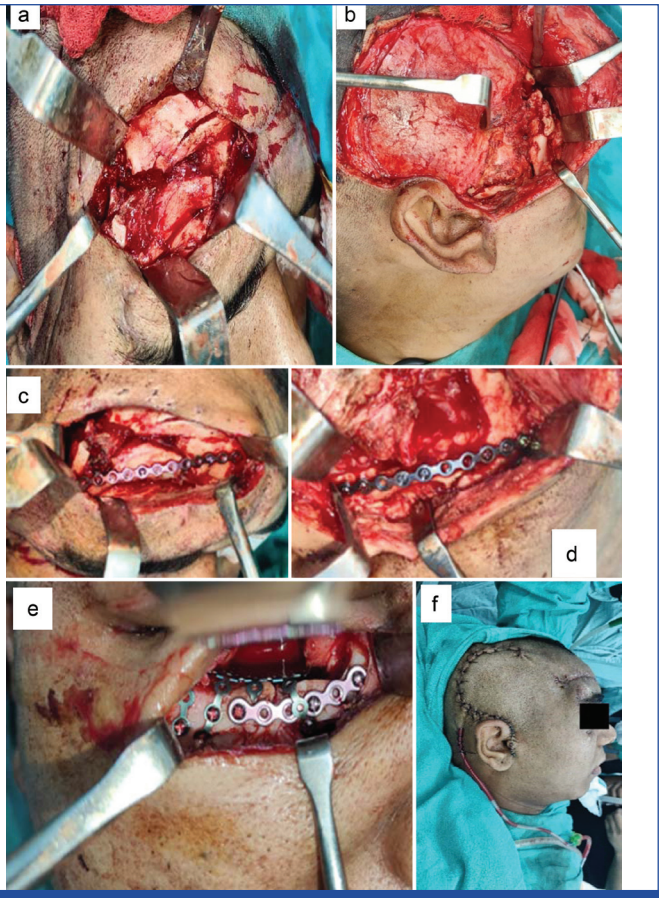


[Table/Fig-3]: Preoperative CT images: a) Axial; b) Coronal; and (c) Three-dimensional reconstructed CT images demonstrating a right ZMC fracture with associated frontal bone and orbital wall fractures, along with evidence of a crushed right globe.

[Table/Fig-4]: Intraoperative image showing crushed globe injury of the right eye with prolapsed intraocular contents prior to evisceration.

In order to properly expose the ZMC, orbital rim, orbital floor, and frontal bone fractures, surgical access was obtained by combining a right maxillary vestibular incision, right subciliary/infraorbital incision, and right hemicoronal approach. Following exposure, the malunited fracture fragments were mobilised by releasing the surrounding fibrous tissue and early callus formation at the fracture sites. The ZMC was reduced anatomically, and the orbital framework and facial buttresses were restored using multiple fixation points. A four-hole 1.5 mm titanium miniplate with screws was used to stabilise the frontozygomatic suture area; a four-hole 2.0 mm titanium miniplate was used to fix the zygomaticomaxillary buttress; and a 1.5 mm titanium miniplate was used to support the infraorbital rim. A 1.5 mm titanium miniplate device was used to minimise and repair the frontal bone fracture [Table/Fig-5a-f].

The surgical site was thoroughly irrigated to achieve haemostasis, and closure was performed in layers. Following uneventful extubation, the patient was shifted to the surgical critical care unit for close postoperative monitoring. Intravenous ceftriaxone 1g twice daily and metronidazole 500 mg three times daily were administered for infection prophylaxis. Pain management included intravenous paracetamol 1g every 8 hours and tramadol 50 mg as required. To lessen postoperative oedema, 8mg of intravenous dexamethasone was administered twice a day for 48 hours. Antiemetics and proton



[Table/Fig-5]: Intraoperative findings and surgical management: a) Surgical exposure of the right ZMC fracture; b) Anatomical reduction of the fractured zygomaticomaxillary segment; c) Fixation of the fracture using titanium miniplates and screws; d) Orbital floor reconstruction using titanium mesh; e) Evisceration of the non-salvageable right globe; f) Immediate postoperative photograph showing closure of surgical incision sites following fracture fixation and orbital reconstruction.

pump inhibitors were recommended as supportive treatments. Topical antibiotic eye ointment was administered to the operated socket following evisceration, and routine sterile dressing changes were carried out after an ophthalmologist consultation.

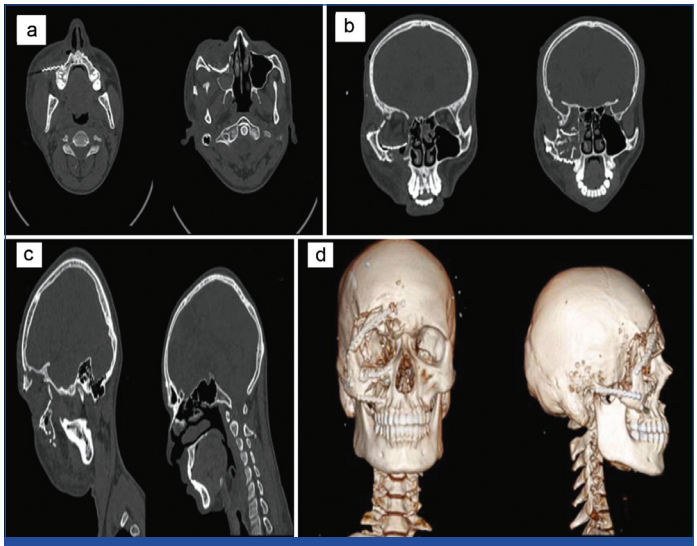
The patient was maintained on Nothing By Mouth (NPO) for the initial six hours postoperatively, followed by clear liquids once fully conscious. A soft/liquid diet was advised for two weeks to minimise stress on the facial bones and fixation sites. The patient was instructed to avoid chewing hard foods, wide mouth opening, and excessive jaw movements during the healing period. Adequate hydration and nutritional supplementation were encouraged.

After orbital repair and evisceration, some eye precautions were recommended. The patient was advised to maintain good eye dressing cleanliness, refrain from sleeping on the afflicted side, and not massage or put pressure on the operated eye. For at least four to six weeks, activities that might raise orbital pressure were prohibited, including nasal blowing, sneezing with a closed mouth, heavy lifting, leaning forward, and vigorous physical activity. For wound assessment, prosthetic eye planning, and healing process monitoring, routine follow-up with the ophthalmologist and maxillofacial surgery teams was recommended. On the second postoperative day, a postoperative CT scan verified adequate fracture reduction, stable fixation, and correct orbital mesh installation.

Follow-up and Outcomes

A postoperative CT scan was obtained on the second postoperative day to evaluate fracture reduction, fixation stability, and orbital reconstruction, which confirmed satisfactory alignment of the fractured segments and appropriate placement of the titanium plates and orbital mesh [Table/Fig-6a-d].

During the early postoperative phase, occlusion remained steady and facial symmetry was restored. Following surgery, the patient was routinely monitored on postoperative days 7, 15, one month, three months, and six months. Mouth opening improved from 25 mm preoperatively to 38 mm at the 1-month follow-up and to 42 mm at the 3-month follow-up, demonstrating a notable functional recovery. Additionally, the patient showed acceptable facial aesthetics, improved facial shape, and adequate malar projection. During the follow-up period, there were no indications of neurosensory deficiencies, plate exposure, wound dehiscence, malocclusion, or surgical site infection.



[Table/Fig-6]: Postoperative radiological assessment: a) Axial CT image showing satisfactory reduction of the right ZMC; b) Coronal CT image demonstrating stable fixation of the orbital wall and frontal bone fractures; c) Sagittal CT image confirming restoration of orbital anatomy; d) Three-dimensional reconstructed CT image showing proper alignment of the midfacial skeleton.

On the second postoperative day, a postoperative CT scan verified stable fixation, appropriate orbital mesh placement, and good reduction of fracture segments. Clinical follow-up photos from later visits showed functional improvement and preserved face symmetry. The ophthalmology team conducted evisceration of the non-salvageable right eye during the same surgical procedure because of the crushed globe injury. The patient was recommended for ocular prosthetic rehabilitation after the socket had sufficiently healed over a period of around six to eight weeks. To enhance both psychological rehabilitation and aesthetic attractiveness, a customised ocular prosthesis was designed and then placed [Table/Fig-7].

[Table/Fig-7]: Postoperative clinical photographs at 3 month follow-up showing restored facial symmetry, improved malar projection, stable occlusion and increased mouth opening after surgical management.

DISCUSSION

Among the most common midfacial fractures, ZMC fractures are usually caused by traffic accidents, especially in developing nations like India where two-wheeler accidents greatly increase the incidence of facial injuries [2]. Road traffic accidents are the leading cause of maxillofacial fractures in India, according to recent epidemiological studies, with ZMC fractures accounting for a significant percentage of these injuries [3]. The simultaneous occurrence of a complicated ZMC fracture linked to frontal bone fracture, orbital wall rupture, and crushed globe damage, which is uncommon in the literature, particularly in teenage patients, makes the current case unusual [4]. Most previously published reports describe orbital fractures or isolated ZMC fractures that did not require evisceration, as the globe injury was not irreparable [1].

The necessity of a collaborative strategy combining ophthalmologists and oral and maxillofacial surgeons for the concurrent treatment of skeletal and ocular injuries is the therapeutic importance of this case. Due to early fibrosis along with malunion at the fracture site, which made anatomical reduction more challenging, this patient's delayed presentation after one month posed a significant surgical difficulty [5]. Furthermore, severe comminution and the requirement to restore orbital volume following globe loss made orbital floor restoration difficult. Functional rehabilitation was made more difficult by the limited mouth opening brought on by zygomatic arch impingement on the coronoid process.

For the treatment of ZMC fractures, a number of methods have been described, such as computer-assisted patient-specific implants for complex orbital reconstruction, open reduction with internal fixation using miniplates, transcutaneous reduction techniques, Keen's intraoral approach, and closed reduction using Gillies temporal approach [6-9]. Autogenous bone grafts, porous polyethylene implants, resorbable plates, as well as titanium mesh have all been utilised in orbital floor defect instances [10]. Because of its strength, contour flexibility, and consistent orbital support, titanium mesh was chosen in this instance.

In a study by Rothweiler R et al., satisfactory results were achieved with open reduction and rigid fixation in displaced ZMC fractures; however, those with orbital involvement showed chronic ocular problems [11]. Kambalimath DH et al., reported successful management of zygomatic complex fractures using open reduction and internal fixation techniques, with most patients achieving satisfactory functional and aesthetic outcomes despite associated facial injuries [12]. In a similar situation, Dubois L et al., reported successful cosmetic results from orbital repair using titanium mesh in cases with complicated orbital injuries [13]. The current case was clinically unique since it needed simultaneous fracture repair, orbital reconstruction, and evisceration of a non-salvageable right globe in the setting of delayed presentation.

In order to achieve the best functional and aesthetic results in complex craniofacial trauma cases, prompt diagnosis, careful surgical planning, and multidisciplinary management are crucial. This is demonstrated by the successful restoration of facial symmetry, improved mouth opening, stable occlusion, and subsequent ocular prosthetic rehabilitation.

CONCLUSION(S)

Severe ZMC fractures associated with orbital and frontal bone involvement require prompt diagnosis and multidisciplinary surgical management. Accurate reduction, rigid fixation, and appropriate orbital reconstruction are essential to restore facial form and function. This case highlights the importance of comprehensive clinical and radiological assessment and a structured surgical approach in managing complex maxillofacial trauma.

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PARTICULARS OF CONTRIBUTORS:
1. Junior Resident, Department of Oral Maxillofacial Surgery, Sharad Pawar Dental College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Associate Professor, Department of Oral Maxillofacial Surgery, Sharad Pawar Dental College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
3. Professor, Department of Oral Maxillofacial Surgery, Sharad Pawar Dental College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Krishna Balaji Pampatwar,
Junior Resident, Department of Oral Maxillofacial Surgery, Sharad Pawar Dental College, Datta Meghe Institute of Higher Education and Research, Wardha-442004, Maharashtra, India.
E-mail: krishnapampatwar308@gmail.com

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