



## SPECTRUM AND MANAGEMENT OF ISOLATED ZYGOMATICOMAXILLARY COMPLEX FRACTURES- A RETROSPECTIVE REVIEW FROM A TERTIARY CARE HOSPITAL IN PUNJAB, INDIA.

**Dr. Sheerin Shah**

Associate Professor, Department of Plastic & Reconstructive Surgery, Dayanand Medical College, Ludhiana, Punjab.

**Dr Rajinder Mittal**

Professor & Head, Department of Plastic & Reconstructive Surgery, Dayanand Medical College, Ludhiana, Punjab.

**Dr Ramneesh Garg**

Professor, Department of Plastic & Reconstructive Surgery, Dayanand Medical College, Ludhiana, Punjab.

**Dr Karan Singh**

Mch Resident, Department of Plastic & Reconstructive Surgery, Dayanand Medical College, Ludhiana, Punjab.

### ABSTRACT

**Introduction** - Zygoma forms a centrolateral bony prominence of midface. The contour of the cheek, midface width and height are attributed to the normal anatomy of this bone along with its articulation with surrounding bones. Injury to zygoma is common and its management has various options. We planned to retrospectively study the spectrum of zygomatic fractures presenting to our tertiary care hospital and to enumerate the various types of treatments given to them. **Material and methods**- This study was retrospectively planned to study the epidemiology of patients who presented to hospital from January 2015 to December 2019 and were diagnosed with isolated Zygomaticomaxillary Complex (ZMC) fractures. The type and clinical features of zygoma fractures, CT findings, Indications, Surgical or Non Surgical treatment given to them and timing of surgery were enumerated. Post operative complications like enophthalmos, diplopia, scarring were recorded. **Results**- A total number of 320 patients were found to have isolated Zygoma fractures during the duration of these 5 years. Males outnumbered females in this study group. Road traffic accident was the most common etiology followed by assault. Tetrapod fracture was reported in 288 patients ( $p < 0.005$ ). Most of the surgeries were done between 3 to 7 days of injury. Most common surgical procedure done was Open reduction and internal fixation with titanium miniplates. Post operative residual enophthalmos was seen in 10 patients, diplopia in 5 patients, scleral show in 4 patients. There was not a single plate infection reported and 92.5 % patients were satisfied with the aesthetic recovery. **Discussion**- Clinical features, radiological findings along with intraoperative findings play an important role in deciding fracture management of different parts of ZMC fracture. Besides isolated arch fracture and undisplaced low velocity ZF fractures, all other sites need open reduction and internal fixation for maintaining strong lateral midface buttress and orbital anatomy. **Conclusion**-We concluded that surgical management and approach should be customized for each patient, the decision of which can be reached following a stair case approach pre and intra operatively.

**KEYWORDS** : ZMC fractures, Zygoma fractures, ORIF Zygoma, Stair case approach zygoma

### INTRODUCTION-

Zygomatic bone also known as malar bone is quadrilateral shape with four processes. It has strong attachment with maxilla and frontal bone and weaker attachment with sphenoid and temporal bone. It also forms lateral and inferior part (floor) of orbit. Its prominent lateral location on midface makes it susceptible to injury during road traffic accident, fall and assault. Consensus about most commonly fractured facial bone is not clear, yet zygomatic complex fractures account for as high as 40 % of total facial fractures<sup>(1,2)</sup>. Many studies suggest it as second to nasal fractures in frequency<sup>(3)</sup>. A patient coming with history of injury over cheek area with periorbital edema, lateral subconjunctival haemorrhage, parasthesia in medial cheek area, enophthalmos, malocclusion or double vision should be looked for zygomatic complex fractures. History of Loss of consciousness or seizures etc should also be taken to rule out concomitant head injury as all facial bones especially midface have high chances of transferring all traumatic forces to skull through various craniofacial buttresses.

The diagnostic investigation in midface fracture is 2 Dimensional Computed Tomography<sup>(4)</sup>. It is also always advised to get CT Head along with, so as to look for any intracranial injury.

Preoperative ophthalmology consult is a must for all zygoma fracture patients. Rare clinical presentations like retrobulbar haematoma, foreign body in orbit, optic nerve injury and cavernous fistula should always be kept in mind before operating.

Zygoma fracture with no displacement can be treated without

surgical intervention. Isolated arch fractures with cheek depression or trismus are usually treated by closed reduction via Gillies approach. Displaced zygomatic fractures with cheek deformity or orbital deformity, enophthalmos, diplopia needs open reduction and internal fixation. Many options are available for approaching these fractured bones. Already existing lacerations, lateral eyebrow incision for ZF, subciliary or subtarsal incision for orbital rim and floor and intraoral gingivobuccal incision for ZM buttress are few of the preferred approaches.

The main objective of this study was to retrospectively study the epidemiology, radiological finding, management (where we follow a stair case approach) and complications of these fractures in 5 years duration in our hospital which is the largest tertiary care hospital of Punjab, India.

### MATERIAL AND METHODS-

A retrospective study was designed to study all isolated zygomatic fractures, admitted through emergency or out patient department from Jan 2015 to Dec 2019 in Department of Plastic and Reconstructive Surgery, Dayanand Medical College & Hospital, Ludhiana, Punjab. Patients with other facial bones fractures, head injury, optic neuropathy and retrobulbar haematoma, age more than 75 years, medically unfit and not giving consent for surgery were excluded from study. All suspected cases had undergone CT face (axial, coronal and sagittal views). The data was collected from file record. The epidemiological profile along with cause of injury was recorded. Detail Fracture assessment of each case was analyzed as per CT scan. The timing of surgery and procedure performed was documented. Usual approach chosen for

Closed reduction of isolated arch fracture was Gillies approach. Apart for preexisting lacerations, the ZF fractures were approached by lateral brow incision, ZM mattress from upper gingivobuccal degloving incision and rim from subtarsal/subciliary incision. The fractures were fixed with miniplates following all fracture fixation principles. Postoperatively X ray PNS (water's view) was done in all patients. Outcome along with any post operative complications were recorded. Check CT was done only in patients presenting with complications. The data thus collected about type of fracture and management given, apart from demographic profile was compiled and percentage occurrence was calculated. Statistical calculation of mean values and other variables was done using chi square test.

**RESULTS-**

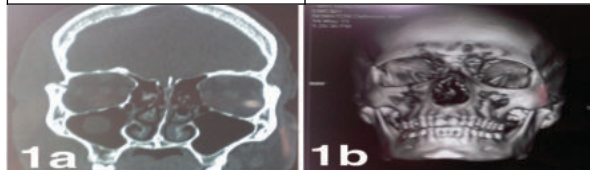
There were a total number of 320 cases included in this retrospective study. The most effected age group was 30-45 years, mean age being 32.3 years. Male predominance was noted (218/320). A significantly higher number of patients had cause of fractures attributed to road side accident (p<0.001) (table 1). In all cases, we analysed 2 dimensional axial, saggital and coronal CT images along with 3D reconstruction of these patients to enumerate the site and number of fractures (picture 1 and 2). Fracture of all the processes of zygoma (also called as tetrapod fracture) was most common (288) followed by isolated arch fracture (32). Right side was affected more than left side. Management analysis showed that 40 patients were given non surgical conservative treatment where as 280 patients underwent surgery. Timings of surgery in 212 patients were 3-7 days, mean day being 5<sup>th</sup> day (table 2). Early surgical treatment (<3 days) was done in 30 patients. 22 cases of isolated arch fracture were reduced by closed reduction via Gillies approach. 2 patients had undergone open zygomatic arch plating. Graph 1 shows the various parts of zygoma where open reduction and internal fixation was done with miniplates. Single plate at ZF was put in 22 patients. 2 point fixation was done in 97 patients and 3 point fixation was done in 139 patients. Orbital floor was reduced and plated with titanium mesh in 69 patients among these 139 patients. Picture 3 shows a patient where 3 point fixation of ZMC was done along with floor repair. Table 3 depicts the post operative complications. Residual Enophthalmos was seen in 10 patients and early diplopia was seen in 5 patients. Check CT was done in all these 5 patients which did not show any inferior rectus entrapment or injury. 4 of these patients had complete resolution of diplopia in 15 days with steroids and anti-inflammatory. 1 patient had a developed a permanent diplopia owing to inferior rectus damage coz of small glass particles found in it after trauma. 6 patients had some early scleral show at the subtarsal incision line retraction which resolved in 6 weeks with lid massage and silicon gels.

**Table 1 - Etiology Of Various ZMC Fractures**  
**Etiology Of ZMC Fractures**

Cause	Number of patients
Road side accident	258
Assault	42
Fall	12
Others	8

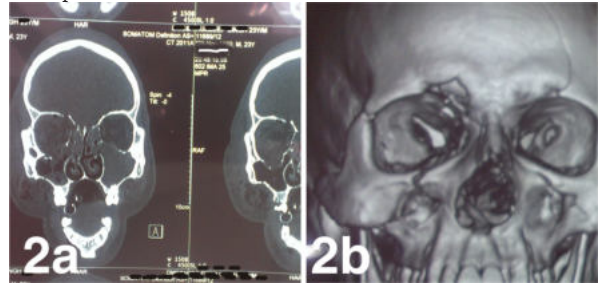
**Type Of Fracture**

Fracture	Number of patients
tetrapod	288
Zygomatic arch	32



**picture 1 - (a) 2D coronal and(b) 3D CT Images showing right**

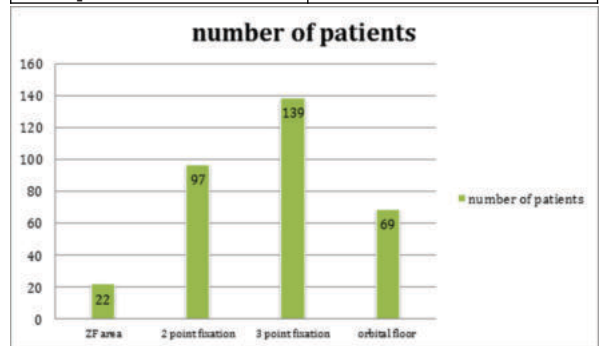
undisplaced fracture of ZF suture and Rim



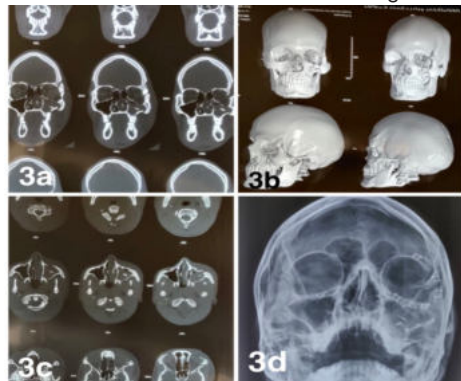
**Picture 2 - (a) 2D Coronal And (b) 3D CT Images Showing Right Displaced Fractures Of ZF Suture , Rim And Herniation Of Orbital Content Through The Floor Fracture.**

**Table 2 - Timing Of Surgery From The Day Of Injury**  
**Time Of Surgery**

Timing	Number of patients
< 3 days	30
3-7 days	212
>7 days	38



**Graph 1- Fracture Sites Where ORIF With Plating Is Done**



**Picture 3 - (a)2D coronal, (b) 2D axial , (c) 3D image showing tetrapod fracture of left ZMC and (d) X ray PNS (Waters's view) showing post operative result after 3 point fixation and orbital floor reconstruction with mesh .**

**Table 3 Post Operative Complications**

<b>Enophthalmos</b>	<b>10 patients</b>
Post operative early diplopia	5 patients
Plate infection	0
Early Scleral show	4 patients
Late Hypertrophied scar ( lateral eyebrow)	4 patients

**DISCUSSION -**

From the prospective of a Maxillo facial surgeon, addressing zygomatico maxillary complex (ZMC) fractures means addressing either of the following clinical features for management:

- 1- Diplopia at rest and in upward gaze or any restriction of movement of eye ball.
- 2- Enophthalmos/hypoglobus
- 3- Trismus

4- Aesthetically deformed cheek prominence (depressed or raised)  
 In view of all these criteria to treat, it is important that we carefully choose the patients for surgical or non surgical management. We lay great emphasis on the importance of 2D CT images in ZMC fractures, for accurate preoperative and intraoperative decisions. Various articles in literature also have highlighted the same <sup>(4)</sup>. Any patient who has undisplaced ZMC fractures on CT and has none of the above mentioned complaints, should be managed non operatively with instruction of non chew diet for 4-6 weeks. They should be monitored weekly in outpatient for any displacement. Out of 320 total patients in last 5 years, we managed 40 of them, nonsurgically. T S Jensen et al <sup>(5)</sup> suggested the same for undisplaced ZMC fractures. Isolated Zygomatic Arch fractures causing either cheek asymmetry or trismus can be dealt with closed reduction via Gillies approach <sup>(6)</sup> or Keens approach <sup>(7)</sup>. We preferred Gillies approach avoiding intubated intra oral route. We have plated 2 patients with zygomatic arch fractures in our study group. In low velocity trauma, where only ZF suture was displaced, we preferred putting a single miniplate on ZF fracture only and advised non-chew diet to patients. We observed no complications, on later follow up, in these patients. Hwang et al <sup>(8)</sup> also demonstrated good results with this technique. Some surgeons suggest single plate fixation at ZM buttress <sup>(9,10)</sup>. We have done so, only in patients who had pan facial fractures or had other surgical emergencies like bleeding or head injury where prolonged surgery was to be avoided. Such patients were not included in this study group. In our study, 258 patients were operated by open reduction and internal fixation. This high number of isolated ZMC fractures is attributed to high velocity trauma on face in male population during automobile road traffic accident. Similar demographic profile has been seen in Bhasker et al <sup>(11)</sup>, Schnelzer et al <sup>(12,13)</sup>.

Many studies are published suggesting surgical sequence to address these fracture sites <sup>(14)</sup>. After exposing both sites and reducing them, we preferred plating ZF suture first and then ZM buttress. We followed a staircase approach to go further. In patients with no preoperative ocular symptoms, if after fixation of ZF and ZM Buttress, the rim was found to have an undisplaced, single and stably aligned fracture and CT showed no floor defect we did not plate it. We believe in preserving natural soft tissue around that area, to avoid surgical incision, iatrogenic deformities and complications. We advocate Ellis and Perez et al's "less is more" approach in such situations <sup>(9,15)</sup>. We did 2 point fixation in 31.7% of our patients.

In situations where rim had either comminuted fracture with or without displacement or floor showed fracture defect on 2D saggittal and coronal images, we explored it via subarsal or subiliary incision. We did 3 point fixation in 131 patients. Similar protocol is advocated by Birgfeld et al <sup>(16)</sup> and Davidson et al <sup>(17)</sup>.

Climbing up the stair case, we found that we explored orbital floor only in following situations:

- Preoperative ocular clinical features.
- 2D coronal and sagittal images showing rounding of Inferior Rectus muscle <sup>(18)</sup>, tear drop sign <sup>(18)</sup> or floor defect > 1cm <sup>(19)</sup>
- intraoperative forced duction test as positive.

We repaired 69 orbital floors with titanium Mesh. We repaired all orbital floor after reduction of other fractures of ZMC. Like Farber et al <sup>(15)</sup>, we believe that orbital floor volume decreases after proper reduction of all other zygomatic fractures. Similar findings, have been suggested by Yab et al <sup>(19)</sup>.

We have no experience in using absorbable plates, intraoperative navigation or other methods of orbital floor repair. Facilities like orbital volume calculation during the surgery will cause tremendous improvement in results. Our experience in primary bone grafting is also limited in these cases.

Residual Enophthalmos was observed in 14.4% of total orbital floors we operated. We reason out this to increase orbital volume and fat atrophy. Similar result and etiology, was suggested by Clauser L et al <sup>(20)</sup>. Secondary Corrective surgeries with autogenous bone graft or patient specific implant to restore orbital volume are the few options suggested in literature <sup>(21)</sup>. 4 out of 5 patients having post operative diplopia got cured with anti inflammatory drugs and steroids. The lower lid retraction resolved with scar massages in a mean time of 6 weeks from surgery in all 4 patients.

Though we agree that increasing the number of points of fixation, increases the stability of ZMC fractured areas but we still advocate stair case approach (figure 1) minimizing iatrogenic deformities, ectropion and scars. summarizes our surgical protocol in isolated ZMC fracture.

**STAIR CASE APPROACH**

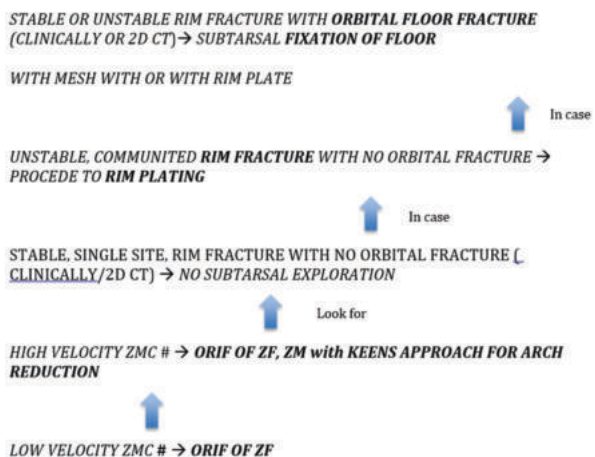


Figure 1

**CONCLUSION**

In this retrospective study, we found that surgical sequence and technique in dealing with ZMC fractures has to be customized as per individual patient's clinical and CT findings. It is quite challenging and gratifying to operate these fractures choosing the correct management protocol following a stair case approach.

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