wjpmr, 2019,5(7), 164-169

SJIF Impact Factor: 4.639

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

ZYGOMATICO-MAXILLARY COMPLEX FRACTURE: TWO-POINT vs. THREE-POINT FIXATION

[1]Dr. Saurabh Jolly, *[2]Dr. Fahad Ahmad, [3]Dr. Palvi Gupta, [4]Dr. Deepinder Singh and [5]Dr. SPS Sooch

[1]MDS Dental Officer, PHC, Rajasansi, Amritsar, India.
[2]MDS, Registrar Surgeon, Department of Oral and Maxillofacial Surgery, Al- Jahra Specialty Dental Center and Hospital, Ministry of Health, Kwt.
[3]MDS Private Practice, Ontario.
[4]MDS Private Practice, Ludhiana, Punjab.
[5]MDS Associate Professor, Department of Oral & Maxillofacial Surgery, Punjab Govt. Dental College & Hospital, Amritsar, India.

***Corresponding Author: Dr. Fahad Ahmad**
MDS, Registrar Surgeon, Department of Oral and Maxillofacial Surgery, Al- Jahra Specialty Dental Center and Hospital, Ministry of Health, Kwt.

Article Received on 01/05/2019 **Article Revised on 22/05/2019** **Article Accepted on 12/06/2019**

ABSTRACT

Background: Zygomatico-maxillary complex (ZMC) fracture presents challenging diagnostic as well as reconstructive problems for Oral & Maxillofacial surgeon. Various treatment modalities are proposed for the accurate reduction and fixation of the Zygomaticomaxillary complex fracture. These treatment options are aimed at accurate fixation of the fractured Zygoma with subsequently less post-operative consequences. **Aim of the study:** The purpose of this study is to compare two-point and three-point method of internal fixation in isolated Zygomatic fracture in terms of stability, functional, esthetic outcome and radiographical evaluation of the treated Zygoma. **Materials and Method:** Twenty adult patients with isolated Zygomatic bone fracture were included in the study. They were randomly assigned to the two groups for internal fixation. Both clinical and radiographical assessment was done postoperatively after 3 months to evaluate enophthalmos, vertical dystopia, recovery of infraorbital paraesthesia, malar height and malar projection. **Results and observation:** The mean deficit in malar projection in group 1 patients was 2.80 ± 1.398 mm as compared to 1.70 ± 1.160 mm deficit in group 2 patients. The mean deficit in malar height in group 1 patients was 2.60 ± 0.966 mm as compared to 2.00 ± 0.943 mm deficit in group 2 patients. But P-values were not statistically significant. **Conclusion:** We recommend two-point fixation over three-point with titanium miniplates for the management of displaced zygomatic fractures.

KEYWORDS: Zygomatico-maxillary complex; Enophthalmos; Vertical dystopia; Rigid internal fixation.

INTRODUCTION

The prominent location of the Zygoma in the mid-face predisposed them to various traumatic injuries. The Zygomatic-maxillary complex (ZMC) fractures represent the second most common type of facial fracture, about 45% of the fractures of middle third of the face.[1] The most common etiological factor is road traffic accidents while other includes assault, falls, sports accident, gunshot injuries etc.[2] Zygomatico-maxillary complex fractures present challenging diagnostic as well as reduction problems for Oral & Maxillofacial surgeon. Patterns of Zygomatic bone fracture range from simple fracture to comminuted and from minimally displaced to severely displaced. Anatomic reduction of fractured fragment is important to re-establish facial contours and to restore normal functions. Treatment options for reduction of isolated Zygomatic bone fractures range from closed reduction without fixation to open reduction with multiple points of exposure and fixation such as one-point, two-point and three-point fixation, depending upon degree of displacement. This study was conducted to compare two-point and three-point method of internal fixation in isolated Zygomatic fracture in terms of stability, functional, esthetic outcome and radio-graphical evaluation of the treated Zygoma.

MATERIALS AND METHOD

Subjects for the study were selected amongst the patient who reported to the department of Oral and Maxillofacial surgery, Punjab Govt. Dental College and Hospital, Amritsar. Twenty adult patients with isolated Zygomatic bone fracture were selected at random. Informed consent was taken from all the patients selected for the study. Patients with displaced fracture of Zygoma, as evidenced on radiograph (Waters view), presenting within two weeks of sustaining trauma were included in the study. Whereas patients with bilateral displaced fractures of Zygoma and associated injuries who were likely to delay

early open reduction and fixation, were excluded from the study. A detailed history was taken and a thorough clinical examination was done. Radiological examination includes PA view of maxilla in 'Waters' position and Computed Tomography (Axial and Coronal CT scan) of mid face. It was performed to assess the displacement of Zygoma.

Patients were divided randomly into two groups:
Group I: Fixation was done at two points i.e. at Frontozygomatic suture and Zygomatic buttress.
Group II: Fixation was done at three points i.e. at Frontozygomatic suture, Zygomatic buttress and infraorbital margin.

Open reduction and internal fixation with non-compression titanium miniplates and screws was planned for patients in both the groups. Before performing surgery, the hair in the temporal region of the scalp was shaved off. An incision about 2.5 cm long was marked above and parallel to the anterior branch of the superficial temporal artery within the hair line. Surgery was carried out under local anesthesia (2% xylocaine with adrenaline 1:2,00,000) after proper premedication. Proper anatomic reduction at fracture site was achieved and fixed with 1.5 mm non-compressible titanium miniplates at two points in group I and at three points in group II. Patients were followed up, on 3rd day followed by 7th day for suture removal, later followed up on 2nd week and a monthly follow up thereafter. Outcome of open reduction of Zygoma was assessed after completion of three months.

Following parameters were assessed for all the patients
Vertical Dystopia: It was measured by using photograph of the patient in frontal profile.[3] A mid-pupillary lined was drawn from each side of the pupil and extended up-to adjacently placed centimeter ruler (Fig 1). The deficit between two lines was recorded which reveals the amount of vertical dystopia of affected eye. Discrepancy of more than 3mm was considered abnormal.

Cheek sensations: At the time of examination, the subjects were questioned about altered sensation on the injured side. If no alteration in the sensation was reported, the patient was considered having normal sensation. However, if altered sensation was present, it was evaluated using cotton wisps. Any diminution or absence of soft touch on affected side was recorded.

Photographic Evaluation: Frontal, Lateral and Basal views of the patients were taken to assess malar depression and globe abnormalities.
Grade 1: Excellent cosmetic result, no malar asymmetry,
Grade 2: Good cosmetic result, malar asymmetry on careful inspection,
Grade 3: Fair cosmetic result, noticeable malar asymmetry,
Grade 4: Gross malar asymmetry.[4]

Enophthalmos: It was measured by taking paraxial longitudinal computed tomography scan.[5] A baseline was drawn extending from the Zygomatico-frontal process of one side to the contralateral side and then a line was drawn from the baseline to the posterior surface of the lens in each orbit, enophthalmos being the normal eye distance minus the traumatized eye distance which was measured (Fig 2). Discrepancy of more than 3 mm was considered abnormal.

Radiological Evaluation: Post reduction displacement of Zygoma was assessed by performing CT scan of midface after 3 months of fixation. The parameters recorded were Zygomatic complex projection and height.

- **Zygomatic complex projection:** It was recorded using axial section of computed tomography.[3,6] This entails marking of line corresponding to anterior and posterior Zygomatic complex width. The distance between two lines was measured and compared with opposite side so as to document any difference if present.
- **Axial midline:** It was drawn from the vertical plate of the Ethmoid bone extending posteriorly upto the midline of the clivus on the skull base or the midline of the foramen magnum (whichever was most easily identified).
- **Marking 1 or A** (Posterior Zygomatic Complex Width): It was drawn from the midline to the most lateral aspect of the curve of the Zygomatic arch (Fig3).
- **Marking 2 or B** (Anterior Zygomatic Complex Width): A point was marked on the most anterolateral aspect of the Zygomatic complex. This point was established by the intersection of a line perpendicular to the axial midline extending laterally and through the depth of the concavity of the frontal process of the maxilla and a line parallel to the axial midline extending anterior from the most lateral aspect of the Zygomatic arch. A bisecting line from the intersection of these 2 lines was drawn to the outer surface of the Zygomatic arch (Fig 3).
- **Marking 3 or C** (Zygomatic Complex Projection): The distance between the 2 points established on the Zygomatic arch i.e. between marking 1 and 2 or A and B were measured which reflects the Zygomatic complex projection. The value of one side was compared to another normal side and any deficit if present was noted (Fig 3).
- **Zygomatic complex height:** Zygomatic complex height measurement requires coronal section of computed tomography.[3,6] The horizontal reference line and a line extended from the most lateral aspect of curved surface of Zygomatic complex was drawn and compared with opposite normal side.
- **Coronal midline and reference line:** The midline was drawn through the most superior aspect of the suture joining the nasal bones and the midline crest of the maxilla. A second line, perpendicular to the

first, was aligned through the most superior aspect of the superior orbital rims. This was referred to as the horizontal reference line.

- **Marking A or A'** (Zygomatic complex height): The most lateral aspect of the curved surface of the Zygomatic complex was identified. Measurement A or A' was the distance between the horizontal reference line and the point present on most lateral aspect of the Zygomatic complex (Fig 4). This measurement was compared with normal side and any deficit if present was recorded.

Fig. 1: Measurement of vertical dystopia. Black line drawn from the center of pupil of the affected side. Red line drawn from the normal side of the eye.

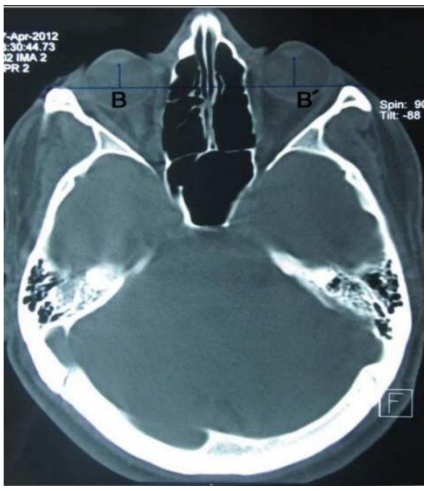


Fig. 2: Measurement of Enophthalmos. Horizontal line represents baseline i.e. extending from one side of Zygomatico-frontal process of one side to another side. Vertical line perpendicular to baseline was drawn from the posterior attachment of lens.

Fig. 3: Zygomatic complex projection. Marking 1or A (Posterior Zygomatic Complex Width), Marking 2 or B (Anterior Zygomatic Complex Width), Marking 3 or C (Zygomatic Complex Projection). It represents the distance present between anterior and posterior Zygomatic complex width line.

Fig. 4: Zygomatic complex height. Horizontal reference line was drawn from superior orbital margin of one side to another side, Perpendicular to this reference line another line was drawn extending up to the most lateral curved surface of Zygomatic bone.

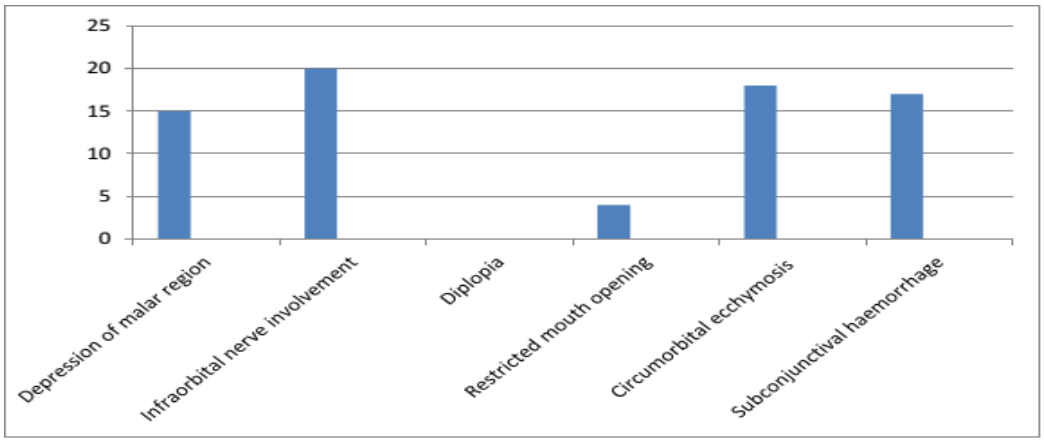
RESULTS

A total of 20 patients were included in the study. The age of patients ranged from 20 to 48 years (mean age being 29.3 years). The male patients predominated as regards the incidence of fracture with ratio being 4:1. The road traffic accidents were responsible for majority (70%) of the fractures. 80% of the patients were treated within 10 days of injury, while remaining patients were treated within 11-14 days of injury. On clinical examination, depressed cheek leading to loss of malar prominence was present in 75% cases and post-traumatic infraorbital nerve paraesthesia in all cases. Four cases of Zygomatic bone fracture showed restricted mouth opening but no diplopia was found in any case post-traumatically.

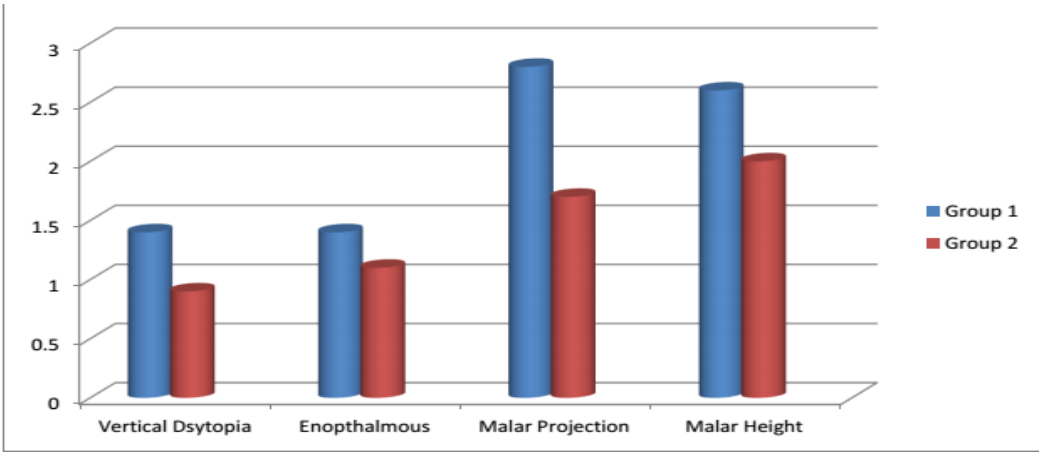
Periorbital ecchymosis was observed in 90% cases. Subconjunctival haemorrhage was present in 17 out of 20 of cases. [Graph 1] All the data was tabulated and analyzed statistically using 'Pearson Chi -Square test' for evaluation of aesthetic assessment and recovery of cheek sensation while student 't' test was used for evaluation of vertical dystopia, enophthalmos, deficit in malar projection and for deficit in malar height. Measurements of mean vertical dystopia for patients in group 1 and group 2 were 1.40 ± 1.350 mm and 0.90 ± 0.738 mm respectively. Similarly, measurements of mean enophthalmos for patients in group1 and group 2 were 1.40 ± 1.075 mm and 1.10 ± 0.876 mm respectively. The mean deficit in malar projection in group 1 patients was 2.80 ± 1.398 mm as compared to 1.70 ± 1.160 mm deficit in group 2 patients. [Graph 2] The mean deficit in malar height in group 1 patients was 2.60 ± 0.966 mm as compared to 2.00 ± 0.943 mm deficit in group 2, as the 'p' value was found >0.05 for malar projection and malar height, which was not statistically significant. Besides clinical and radiological assessment, photographic assessment was also a part of this study. In group 1, 50% patients had grade-**I** malar asymmetry while in group 2, 70% patients had grade-**I** malar asymmetry. Recovery of the cheek sensation was also assessed in this study. In group 1, eight (80%) patients had normal recovery of infraorbital nerve function at three months of surgical intervention. In group 2, all the patients (100%) had normal recovery of infraorbital nerve function after three months post- surgery. (Post-operative Complications; Table-1).

Table 1: Comparison of post-operative complications in the two groups.

Sign and Symptoms	Group 1	Group 2
Restricted mouth opening	00	00
Plate prominence Over Lateral orbital rim	02	01
Plate prominence over infraorbital rim	00	01
Infection	00	00
Swelling	00	01
Wound dehiscence	00	00
Diplopia	00	00



Graph 1: Major symptoms observed in both groups.



Graph 2: Comparison of Vertical dystopia, Enophthalmos, Malar projection and Malar height after 3 months of reduction.

DISCUSSION

The Zygomatico maxillary complex fracture is tripod or tetrapod fracture with disruption at its four articulating processes.[7] Treatment options are aimed at the accurate reduction and fixation. However, fixation should be done at all the fracture site or not is still a controversy. The Zygoma fractures are vulnerable to secondary displacement due to rotational forces around longitudinal and horizontal axis even after some kind of fixation. These forces must be overcome by optimal fixation at fracture sites. As the orbital process of Zygomatic bone forms the orbital floor, any secondary displacement of Zygoma can result in delayed development of vertical dystopia, enophthalmos and obvious malar asymmetry.[3]

The present study was designed to compare two different methods of internal fixation for the management of Zygomatico-maxillary complex fracture. In group 1, patients underwent two-point fixation and in group 2, patients underwent three-point fixation. Most common clinical finding in our study was sensory disturbance of infraorbital nerve at the time of presentation which was present in all cases (100%). Iqbal & Chaudhry also detected sensory disturbance of infraorbital nerve in (94.2%) of their cases.[8]

The photographic assessment was done in the study but it showed no statistically significant difference in the two groups. This can be attributed to the facts that photographic assessment was a subjective assessment by a single observer and bony deficit in malar projection could have been incompletely projected on aesthetic assessment because of thickness of skin and subcutaneous tissue.

In the present study, three-point fixation resulted better malar projection and malar height as revealed by data with respect to their mean value; however; it was not statistically significant. The recovery from infraorbital paraesthesia was 100% in both the groups indicating that addition of third miniplate at infraorbital rim does not play any role for this parameter. Nevertheless, three-point fixation was associated with some disadvantages like more periosteal stripping and extreme retraction of bone edges, longer operative time, presence of more hardware and increase in cost of surgery. There are certain comparative studies which have explained the stability of Zygomatic fractures after performing different methods of internal fixation. The analysis of these studies shows that two-point fixation provides sufficient stability provided that fracture has been stabilized by miniplates. Rinehart et al conducted a biophysical study in which they observed that three miniplates were best able to withstand the load, however, the application of double miniplates fixation across the orbital rim of simulated non-comminuted Zygoma fractures were sufficient to withstand static and oscillating loading similar to physiologic masticatory forces.[9] Zingg et al recommended two-point fixation over Frontozygomatic region and Zygomatic-maxillary region in cases of complete monofragment Zygomatic fracture and multifragment Zygomatic fracture.[10] They further emphasized that application of miniplates in certain areas such as the Zygomatic arch, infraorbital rim, orbital floor, and the anterior wall of the maxilla should be avoided as these areas did not experience any significant functional loads once fixation of the buttresses were achieved. Chattopadhay & Chander prefered two-point fixation over three-point and four-point fixation as they did not achieve any extra benefits from these approaches in relation to reduction and stabilization points of view.[11] Thus equal level of stability was achieved with either of these techniques.

Although all these literature support the idea of two-point fixation over three-point, there are few clinical studies which quote that three-point method of internal fixation is better than two-point in the management of Zygomatic fractures. These studies do not favor the results of our study; however; these studies differ from our study regarding site of fixation as well as quantitative aspects i.e no. of patients included in the study. Parashar et al conducted a study which differs from our present study in one major aspect as two-point fixation was done over Frontozygomatic and inferior orbital region.[3] As Zygomatico-maxillary buttress which was left untreated in this study might result in post-surgical displacement of Zygoma secondary to the action of masseter muscle.

Further, Rana et al supported three-point fixation over two-point[12] and in their study two-point fixation was done at Frontozygomatic and Zygomatico-maxillary buttress region which was similar to our study. However, post-operative measurement of malar height was done clinically. Thus the contribution of soft tissue thickness to this measurement might lead to variation in the results of their study but in our present study malar projection and malar height were measured using computed tomography scan measurements. Analysis of the data in present study suggested that three-point fixation was associated with lesser incidence of vertical dystopia and enophthalmos. Additionally, it gave better malar projection and malar height when seen radiologically but the difference between the two groups with regards to all the above mentioned parameters was found not to be statistically significant.

CONCLUSION

We recommend two-point fixation i.e.at Frontozygomatic suture and Zygomatic buttress over three-point fixation with titanium miniplates for the management of displaced Zygomatic fractures. Nevertheless, there is need for a larger study to substantiate the results of present study. Additionally, three-point fixation should be considered if preoperative CT scan shows significant infraorbital rim defects or when there is doubt intra-operatively regarding the reduction of infraorbital rim or persistence of step defect over the orbital rim after the reduction of Zygoma fractures at other sites.

ACKNOWLEDGEMENT

Authors are very grateful and would like to thank **Dr. Gaurav Verma** for his invaluable contribution in data collection and providing technical help for this study.

Financial Support – None.
Conflicts of Interest – None.

REFERENCES

1. Gandi et al. Prospective blind comparative clinical study of two point fixation of zygomatic complex fracture using wire and mini plates. Head & Face Medicine, 2012; 8: 7.
2. Gomes PP, Passeri LA, Barbosa JRA: A 5-year retrospective study of zygomaticorbital complex and zygomatic arch fractures in Sao Paulo state. Brazil J oral Maxillofac Surg, 2006; 64: 63-7.
3. Prashar A, Sharma RK, Makkar S. Rigid internal fixation of zygoma fractures: A comparison of two-point and three-point fixation. Indian J Plast Surg, 2007; 40: 1.
4. Holmes KD, Matthews BL. Three-point alignment of zygoma fractures with miniplate fixation. Arch Otolaryngol Head Neck Surg, 1989; 115: 961-3.
5. Whitehouse RW, Batterbury M, Jackson A, Noble JL. Prediction of enophthalmos by computed tomography after 'blow out' orbital fracture. Br J Ophthalmol, 1994; 78: 618-20.
6. Furst IM, Austin P, Pharoah M, Mahoney J. The use of computed tomography to define zygomatic-complex position. J Oral Maxillofac Surg, 2001; 59(6): 647-54.
7. Pau CY, Barrera JE, Kwon J, Most SP. Three-Dimensional Analysis of Zygomatic-Maxillary Complex Fracture Patterns. Craniomaxillofacial Trauma & Reconstruction, 2010; 3: 3.
8. Iqbal HA, Chaudhry S. Choice of operative method for management of isolated zygomatic bone fractures; evidence based study. J Pak Med Assoc, 2009; 59(9): 615-8.
9. Rinehart GC, Marsh JL, Hemmer KM, Bresina S. Internal fixation of malar fractures: an experimental biophysical study. Plast Reconstr Surg, 1989; 84(1): 21-5.
10. Zingg M, Laedrach K, Chen J, Chowdhury K, Vuillemin T, Sutter F, RavehJ. Classification and treatment of zygomatic fractures: a review of 1,025 cases. J Oral Maxillofac Surg, 1992; 50 (8): 778-90.
11. Chattopadhyay PK, Chander, M. Management of Zygomatic Complex Fracture in Armed Forces. MJAFI, 2009; 65: 128-30.
12. Rana M, Warraich R, Tahir S, Iqbal A, Von See C, Eckardt AM, Gellrich NC. Surgical treatment of zygomatic bone fracture using two points fixation versus three point fixation--a randomised prospective clinical trial. Trials, 2012; 12: 1-10.