ASSESSMENT OF ANATOMIC FORM, FUNCTION, AESTHETICS IN ZYGOMATIC MAXILLARY COMPLEX FRACTURES WITH ONEPOINT FIXATION IN THE ZYGOMATIC BUTTRESS THROUGH INTRAORAL APPROACH

Dr. Anandh, Dr. Senthil Kumar, Dr. Srivatsa Kengasubbaiah, Dr. Mohamed Afradh, Dr. Gayathri Gopi

1Post Graduate, Department of oral and Maxillofacial Surgery, Thaimoogambigai Dental College and Hospital, Chennai

2Professor, Department of Oral and Maxillofacial Surgery, Thaimoogambigai Dental College and Hospital, Chennai

3Professor, Department of oral and Maxillofacial Surgery, Thaimoogambigai dental College and Hospital, Chennai

4Senior Lecturer, Department of Oral and Maxillofacial Surgery, Thaimoogambigai Dental College and Hospital, Chennai

5Senior Lecturer, Department of oral and maxillofacial surgery, Thaimoogambigai dental college and hospital, Chennai

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ABSTRACT

Objectives: The goal of treatment for zygomaticomaxillary complex fracture is to achieve stability and restore aesthetic appearance. The purpose of this prospective study is to minimize surgical therapy to obtain good esthetic and functional result in zygomatic maxillary complex fracture with single point fixation of zygomaticomaxillary fractures in the zygomatic buttress through intraoral approach with titanium miniplates and screws.

Patients and methods: The study included 20 patients who underwent 1 point fixation at zygomatic buttress for zygomaticomaxillary complex fractures without comminution of lateral orbital rim fractures. Preoperative and postoperative radiograph and photograph were obtained at 1st week, 1st month and 3rd month to evaluate anatomic form, function, esthetics, associated complications and the results were statistically analysed.

Results: After surgery, anatomic form of zygoma, function such as mouth opening and recovery from infraorbital paresthesia and esthetics such as malar symmetry is improved from preoperative which is statistically significant. Complications include plate exposure in one patient after 6 months and underwent plate removal.

Conclusion: Our findings suggest that one point fixation at zygomatic buttress provides satisfactory stability in zygomaticomaxillary complex without comminuted fractures of the lateral orbital rim.

INTRODUCTION

Since the maxillofacial region is the most exposed part of the body and more vulnerable to trauma, reports reveal that 20% to 60% of all road traffic injuries involve some form of maxillofacial injury[1]. Major causes for maxillofacial fracture as reported worldwide are interpersonal violence, traffic accidents, falls and sports injuries[2]. The Zygomatic bone is the principle buttress which transmits forces from the maxilla to the cranial vault and also it is an important anatomical structure that helps to form the lateral and inferior wall of the orbit. Zygomatico-maxillary complex fractures are the most common maxillofacial fractures next to mandibular fractures and nasal bone fractures. Increased susceptibility to fracture due to the texture of bone, convex shape and presence of maxillary sinus. No consistent approach for ZMC fractures has gained universal acceptance. Semi rigid fixation with miniplates offers most reliable methods available today for the treatment of zygomatic complex fracture[3]. One of the most important topics in maxillofacial surgery is the amount of fixation that is necessary to prevent post reduction displacement of the fractured ZMC.
This prospective study is conducted to minimize surgical therapy to obtain good esthetic and functional result in zygomatic maxillary complex fracture with single point fixation of zygomatic complex fractures in the zygomatic buttress through intraoral approach with titanium miniplates and screws.

**Study Sample**

The study sample consists of 20 subjects (18 male and 2 female), in the department of Oral and Maxillofacial Surgery, Thaimoogambigai Dental College and Hospital Chennai from the year 2017 to 2019. Age of the patients ranged from 25 to 35 years. Ethical committee approval was obtained before proceeding with the study from the M.G.R. university and research, Chennai. Informed consent was obtained from all the patients who are enrolled in this study.

**Subject Inclusion Criteria**

- Patients with only zygomatic maxillary complex fracture without any other fracture of face.
- Patients with lateral and medial displacement of zygoma along vertical axis (Rowe and Williams classification).
- Patients who are more concerned about esthetic and external scars on their face.
- Patients who reported within 48 hours of injury.

Patients who fulfilling above criteria and willing to report for review of 6 months were enrolled in this study.

**Subject Exclusion criteria**

- Patients with medial and lateral displacement of zygoma along horizontal axis, zygoma en bloc displacement, comminuted zygomatic maxillary complex fracture.
- Patients with ocular conditions like restricted ocular movement, diplopia due to muscle entrapment.
- Patients with other fractures in middle third of face.
- Medically compromised patients.
- Severely infected fractures.

**Study Variables**

**Anatomic form Assessment**

- Assessed by utilizing Dolan’s lines to compare between pre-operative and postoperative PNS X-ray[4].
- Clinically, verified by palpation (lack of steps) at infraorbital, frontozygomatic and zygomatic buttress region.
- Adequacy of reduction was determined by assessing the post-operative radiograph images. Comparisons were made with the opposite side. Results were expressed as continuous or discontinuous anatomic form.

**Functional Assessment**

1. Mouth opening assessed by interincisal distance, pre operatively and post operatively at the interval of 1st week, 1st month, 3rd and 6th month[4].
2. Infraorbital Paraesthesia was assessed subjectively by inquiring the patient regarding presence and areas of numbness on 1st week, 1st month, 3rd month and 6th month post operatively[4].

**Esthetic Assessment**

- Visual malar prominence grading by Holmes and Mathew’s scale on preoperatively and post operatively on 1st week, 1st month, 3rd month and 6th month[5].
- Grade I - Excellent cosmetic result, no malar asymmetry
- Grade II - Good cosmetic result, malar asymmetry noted only on careful inspection
- Grade III - Poor cosmetic result, noticeable malar asymmetry
- Grade IV - Gross malar asymmetry.

Later the patients are followed postoperatively for 6 months and analysed for the complications such as infection, pain and plate removal.

**Surgical Procedure**

Under aseptic condition local anesthetics is infiltrated in upper buccal sulcus of the affected side. The vestibular incision is made from anterior canine to posterior first molar tooth. A heavier instrument such as Rowe’s modified zygomatic elevator can then be inserted behind the infra temporal surface of the zygoma, zygomatic bone is manipulated into its proper anatomical alignment with gentle sweeping motion while infraorbital margin and fronto-zygomatic suture are being palpated. Care is taken to avoid using anterior maxilla as point of fulcrum.

A 2mm titanium plate with a gap was fixed with 2 ×6 mm screws was used. Miniplate is usually bridging over an area of bone loss and comminution. The degree of bone loss limited the number of screws placed. Communion of anterior wall of sinus influenced number of screws applied on each side of the fracture line. Due to comminution and bone loss of anterior wall of sinus and to prevent iatrogenic injury to roots varied plates such as straight and ‘L’ plates are used.

All the patients were instructed not to lie on the operated side for a week. Chlorhexidine mouth rinses and strict oral hygiene instructions were followed.

**Observations**

![Figure 1 preoperative photograph and radiograph](image1)

![Figure 2 postoperative photograph and radiograph](image2)
Data Collection and Analysis

Data were statistical analysed using Statistical Package for Social Sciences, IBM Corporation, SPSS Inc., Chicago, IL, USA version 21 software package (SPSS). Descriptive statistics including mean, standard deviation and frequencies were computed for various parameters like age and gender. Shapiro-Wilk test was used to assess the normality of the data. Further analysis was done using non-parametric tests since the data did not follow a normal distribution. Pearson’s Chi-square test and Fisher’s exact test was used to compare the difference of proportions between pre and post-operative groups. The Mean rank differences between the groups were compared using Wilcoxon signed rank test. The level of significance in the present study was kept at p<0.05.

RESULTS

Prevalence

The sample included 18 males (90%) and 2 females (10%), with mean age of 28. Road traffic accidents accounted for 90% of fractures, followed by assault (10%). The percentage of right or left side of the Zygomatic complex fractures was 70% and 30%.

Anatomic Reduction Assessment Results

All patients had a good quality plain radiographs that was taken at the 4th postoperative week which on comparing with the immediate postoperative defines the stability of the fixation. ZMC was well positioned at least within the limits of the assessment criteria used. ‘p’ value is 0.054 which is statistically significant.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pre OP radiograph * post OP radiograph Cross tabulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post op infraorbital paresthesia</td>
<td>Adequate</td>
</tr>
<tr>
<td>Adequate</td>
<td>Count: 13</td>
</tr>
<tr>
<td>Inadequate</td>
<td>Count: 0</td>
</tr>
<tr>
<td>Total</td>
<td>Count: 13</td>
</tr>
<tr>
<td></td>
<td>% of Total</td>
</tr>
</tbody>
</table>

Functional Assessment Results

Mouth Opening

Three of the patients had transient postoperative trismus that improved gradually on follow up. All patients had marked improvement immediately after surgery and attained full mouth opening at postoperative follow up. Wilcoxon Signed Ranks Test is negative and statistically p value is less than 0.05 which is highly significant.

Infra Orbital Paresthesia

2 patients had an altered sensation in the infraorbital region following surgery. 12 patients recovered from infra orbital paresthesia by 4th week of postoperative period which is statistically significant.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Pre-op infraorbital paresthesia * post op infraorbital paresthesia Cross tabulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post op</td>
<td>Infraorbital</td>
</tr>
<tr>
<td>infraorbital</td>
<td>Count</td>
</tr>
<tr>
<td>paresthesia</td>
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</tr>
<tr>
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<td>2</td>
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<tr>
<td>2</td>
<td>60.0%</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
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</tbody>
</table>

Esthetic Assessment Results

No patient had Ectropion and increased scleral show, since procedure does not allow infra orbital rim manipulation directly. In 1st postoperative period all the patients had grade II malar symmetry due to edema and swelling. 14 patients had grade I malar symmetry and 3 patient had grade II malar symmetry in 4th week postoperative period. Grade I malar symmetry is statistically significant than grade II malar symmetry.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Pre - op malar symmetry * post - op malar symmetry Cross tabulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressed</td>
<td>Count</td>
</tr>
<tr>
<td></td>
<td>Count</td>
</tr>
<tr>
<td>% Of total</td>
<td>Count</td>
</tr>
<tr>
<td>Pre - op malar symmetry</td>
<td>0</td>
</tr>
<tr>
<td>% of Total</td>
<td>0</td>
</tr>
<tr>
<td>Grade 1</td>
<td>Count</td>
</tr>
<tr>
<td>% of Total</td>
<td>0%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>Count</td>
</tr>
<tr>
<td>% of Total</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

All the patients are followed for 6 months. Only one patient had plate exposure at 6th postoperative month and plate removal done under local anesthesia.

DISCUSSION

Re-establishment of the facial malar contour, position of the eye globe, dental occlusion as well as a normal mandibular range of motion is essential in the treatment of zygomatic complex fractures. Early reconstruction avoids soft tissue shrinkage, stiffness and scarring of soft tissues in non-anatomic positions. It also prevents displacement and remodeling of fragments by scarring which may also lead to residual deformity [6]. All patients are treated early, within 48 hours of injury to overcome this complication. The four most important considerations in treating ZMC fractures are proper reduction, adequate stabilization, adequate orbital reconstruction (when necessary) and adequate handling and positioning of peri-orbital soft tissues [7].

Balasubramaniam proved that in the intra oral approach, the access to any point along the arch is quite satisfactory and simple [8]. Zygomaticomaxillary approach offers
advantages such as closer and more precise application of force by the operator, placement of bone plates at the buttress possible through the same incision, minimal bleeding and simple mucosal closure. Another most advantage is, modification of this incision allows visualization of infra orbital rim and nerve through the same incision.

In this study, all the cases were reduced by intra oral approach and seemed to be satisfactory. While using vestibular approach herniation of fat from the buccal fat pad is encountered on occasion but does not usually prove to be much of a technical problem. Precautions should be taken while placing incision, not to cross the first molar tooth to avoid herniation of buccal fat

Rinehart et al [9] and Nicholas Zachariades et al [10]reported that the rigid miniplate fixation provides consistently better zygomatic and symmetry of globe than interosseous wires, and deforming forces of this magnitude required at least 2 miniplates. The treatment depends on the type / classification of ZMC fracture.

Seon Tae Ki et al in 2011[11]reported that open reduction and internal fixation has been used as the standard method for treating zygomaticomaxillary complex fractures. Depending on the stability of reduced zygoma, 1, 2, or 3-point fixations have been applied. Several incisions for the treatment of zygomatic fractures have been considered acceptable, but concern about incisions has been recognized by both patients and surgeons.

In cases of simple tripod fractures, many surgeons have used 1-point fixation through a lateral eyebrow incision. Hwang[12] in his study of 14 cases experienced that the 1-point fixation method through lateral brow incision was satisfactory in holding the reduced zygoma fracture. However, 1-point fixation in the Fronto-zygomatic area through a lateral eyebrow incision usually leaves external scars, palpability of plates, and swelling resulting from severed muscle and soft tissue. Because soft tissue overlying the Fronto-zygomatic area is very thin, so thin plates must be used to prevent visibility, sensibility, palpability and risk of penetration into the anterior cranial fossa.[13] As time goes by, more patients may undergo surgery for plate removal and repeated lateral eyebrow incisions may leave further unsightly scars in the same area[14].

One-point fixation in the buttress area having advantage of not leaving external scars or palpability of plates or screws. Stability after reduction depends on both the nature of the fracture and the method of fixation. Fractures that are incomplete at the fronto-zygomatic suture are relatively stable, whereas comminuted fractures and those that are displaced laterally are the least stable. Dolan’s lines were drawn on postoperative to look for reduction and stability of fractured segments, all patients had acceptable reduction of fractured segments. Very minimal deformity or derangement was not apparent in the facial photographs. This indicates that some imprecision in reduction and stability may be tolerable and clinically insignificant depending on the magnitude, location, and soft tissue masking of the fracture. The classification / type of fractures also plays an important role in deciding the number of fixation sites sufficient to prevent displacement[15]. In our study we treated only non comminuted fractures with mild displacement of fronto-zygomatic suture.

Earlier literature [16,17,18,19] have reported that on comparing with the affected side and normal side at the postoperative period of sixth month, there was no significant difference in anatomic form, function and esthetics which was similar to our current study. The advantage of 1-point fixation through a buccogingival incision is avoidance of external scars and plate palpability in the Fronto-zygomatic area as well as shorter operation time.

**SUMMARY AND CONCLUSION**

As far as the fixation methods are concerned, even in the fractures that are well aligned and stable after indirect reduction, some point of fixation is mandatory since there is always a risk of displacement post operatively. Though single point fixation in fronto-zygomatic region gives same results but has limitation of external scar and plate palpability but one point fixation in zygomatic buttress results in adequate stability. Additional plates are indicated only in severely displaced or comminuted fractures. Limitations of the study are small samples. However further studies with larger sample size will provide reliable results.

**Declarations**

**Ethics Approval**

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Dr. M.G.R Educational and Research Institute (Dr.MGRMU/TMDCH/2017-18/0109201703, Date: 01.09.2017).

**References**


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