Comparative Evaluation of Single Point Fixation at Zygomatic Buttress and Fronto Zygomatic Rim in Zygomatic Complex Fractures -A Prospective Study

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Abstract

Purpose: The purpose of this prospective study was to compare and evaluate functional and esthetic treatment outcome of single point fixation at frontozygomatic (FZ) suture with single point fixation at zygomaticbuttress (ZB) in patients with minimal to moderately displaced zygomatic-complex (ZC) fractures. Materials and methods: A randomized control trial was conducted on 20 patients, (10 patients in each group) reporting to FDS MSRUAS and Ramaiah Hospitals with minimal to moderately displaced ZC fractures. Group I, treated by open reduction and single plate fixation at the FZ region, and group II treated by open reduction and single plate fixation at ZB region. Parameters such as anatomic form, function, esthetics and complications were evaluated and compared pre-operatively, immediate post-op and third month post operatively. **Results:** Demographic data collected from the patients included age, sex, occupation, etiology of injury and time period elapsed from the time of injury to initialization of definitive treatment. There was no statistically significant difference in stability, function and esthetics achieved with fixation at FZ or ZB region. Although fixing at the buttress region through intraoral incision offered a few benefits over FZ region, like no scarring or palpability of plates/screws, ease of reduction and use of varied reduction instruments along with visualization of infraorbital rim and the nerve through same incision. **Conclusion:** It can be concluded that minimal to moderately displaced ZC fractures can effectively be treated and adequate stabilization achieved by single point fixation either at FZ or ZB region depending on individual merit of each case.

Keywords: Zygomatic Complex Fractures, Single Point Fixation, Two point Fixation, Miniplate

Introduction

The shape and projection of zygoma, which influences the width of the middle face, plays an important role in determining the midfacial contour.[1] The convex shape and protrusion of the zygoma, in addition to giving contour to the cheek, also makes this area of the midface more vulnerable to injury or fracture. The frontozygomatic, the zygomaticosphenoidal, and the zygomaticotemporal suture lines are the weakest of the four articulation lines and are the suture lines most often involved in fractures of the zygoma. The zygomaticomaxillary suture line is much stronger, and resists fracture to a much greater extent. Zygoma fractures generally occur on the face of the maxillary sinus from the inferior orbital rim through the infraorbital foramen to the maxillary buttress, sparing the zygomaticomaxillary suture.[2] Forty-five percent of trauma to the midface constitutes fractures of the zygomatic complex.[3] With the increasing number of cases of facial trauma due to motor vehicle accidents, assaults, and sports injuries, reconstruction of fractures of the zygomatic complex has turned out to be a challenging part

of facial fracture reconstruction. The exact reduction and rigid fixation of zygomatic complex fractures are critical to avoid esthetic and functional squealae such as flattening of the malar eminence, ocular dystopia, enopthalmos, and diplopia.[4]

Although a great volume of literature exists on the treatment of these injuries, there is no consensus. Treatments range from reduction without fixation, simple wiring to routine exposure and fixation of at least three of the four articulations. Obviously, a multitude of methods must be effective in the management of zygomaticomaxillary complex (ZMC) injuries, depending on their severity and the materials available for fixation[5]. In the 1970's, introduction of miniplate osteosynthesis for treatment of zygomatic complex fractures revolutionized its treatment. Rigid internal fixation is regarded as the treatment modality with the most reliable results, but the points of fixation, stability and exactness of the reduction are still debated with regard to the number of plates applied to the facial buttress (latero- and infraorbital rim, zygomaticomaxillary crest).[6] As reported in the literature, a 1-,2-, or 3 point fixation can be applied depending on the stability of the reduced zygoma and the typology of the fracture.[7] The philosophy of three point fixation stresses wide visualization and accurate reduction to precisely approximate the fractured segments. It is felt that this more aggressive therapy will improve functional and esthetic results with fewer complications[8].

However further studies concluded that stable fixation and immobilization of isolated ZMC fractures can be achieved with two point fixation at frontozygomatic and zygomatic buttress region. According to Manson et al the zygomatic buttress can be effectively used to align the fractured fragments, whereas the frontozygomatic suture region is a favourable site for rigid fixation of fracture. The infraorbital rim may not be preferred choice for minibone plate osteosynthesis as there are no functional loads in this area and though compact, the bone at the infraorital rim is so thin that only few threads of screws can be anchored.[9]

Nevertheless with 'minimization' being the watchword in today's surgical practice opinions still differ on how many points of fixation are ideal for achieving a clinically acceptable result.[10] Also changing trends in treatment of ZMC fractures have showed that treatment of an isolated zygomatic bone fracture according to aesthetic and functional requirements may be achieved by insertion of a single miniplate at the lateral rim of the orbit, or at the zygomatic buttress. In general, stable fixation is achieved by at least 1 miniplate and incorporation of the frontozygomatic suture line as one of the point of fixation. 9 The upper buccal sulcus technique was originally described by Keen in 1909 and has been used successfully.[11]

The purpose of this prospective study was to compare and evaluate functional and esthetic treatment outcome of single point fixation at frontozygomatic suture with single point fixation at buttress in patients with minimal to moderately displaced zygomatic complex fractures.

The aims of the study are:

- To evaluate the restoration of anatomic form, function and esthetics with single point fixation of non-comminuted minimal to moderately displaced zygomatic complex fractures
- To compare this outcome between single point fixation at frontozygomatic suture with single point fixation at the buttress region

Materials and Methods

This study was approved by the institutional review board of our hospital. Patient data were analyzed after consent was obtained from all participants.

To address the research purpose, a randomized control trial was conducted on 20 patients fulfilling the inclusion criteria, who were further divided into two groups of 10 patients each. Group I patients were treated by open reduction and single point fixation at the FZ region (Fig 1 and 2) and group II patients were treated by open reduction and single point fixation at the ZB region (Fig 3 and 4). All the patients included in

the study were randomly allotted in either of the two groups which is according to every other patient who presented.

Fig. 1 Intra-operative photograph – fracture reduction and miniplate fixation at FZ region

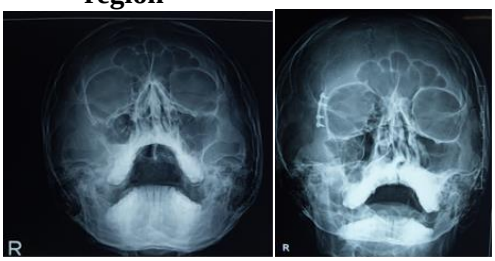

Fig. 2 Pre-operative and post-operative radiograph

Fig. 3 Pre and Post-operative clinical photograph

Fig. 4 Intra-operative photograph – miniplate fixation at buttress region

The study population was composed of patients presenting to Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, MSRUAS and Ramaiah Hospitals for evaluation and management of minimal to moderately displaced zygomatic complex fractures, during the study period September 2009 to July 2011. Patients were diagnosed to have minimally or moderately displaced zygomatic bone fracture based on clinical and radiographic examination. Patients diagnosed with unilateral minimal to moderately displaced zygomatic complex fractures with or without other facial bone fractures. Patients having associated head injuries were also included following neurosurgery clearance. Patients requiring definitive treatment with open reduction and internal fixation were included in the study. Isolated zygomatic arch fractures, Bilateral zygomatic complex fractures, Comminuted fractures of zygomatic complex and Blow out or blow in fractures of orbit, were excluded from the study.

Neurological and ophthalmological examination and assessment was done, and fitness obtained for required patients. Although paranasal sinus (PNS) was the standard radiograph used for pre and post-operative radiographic assessment, computed tomography (CT) scans were also used in few patients associated with head injury. PNS radiographs were taken to assess the reduction and symmetry of Zygomatic complex post-operatively.

Patients were instructed not to lie on the operated side for a week. Chlorhexidine mouth rinses and strict oral hygiene instructions were given to the patients in group II .For all patients in group I, sutures were removed after one week, in group II suture removal was done after 10 days. Patients were evaluated and compared pre operatively, during immediate post operative period and third month post operatively for anatomic form, function, esthetics and complications if any.

The following parameters were assessed based on:

Anatomic Form - was assessed by utilizing Dolan's lines (orbital, zygomatic & maxillary lines) to compare between pre and post-operative PNS X-ray (Refer fig- 5).

Clinically it was verified by palpation (lack of steps at infraorbital rim, frontozygomatic or zygomatic buttress region).

Function - Orbital signs and symptoms, mouth opening and infraorbital paresthesia were assessed pre-operatively and post-operatively in

both the groups to evaluate the functional form. Orbital signs and symptoms like subconjunctival hemorrhage, circumorbital ecchymosis and edema were subjectively assessed and visually verified.

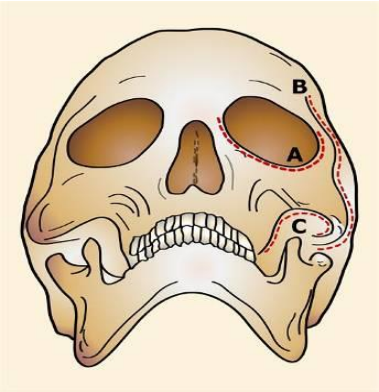

Fig. 5 Dolon's Line (A-orbital line, B-zygomaticline, C-maxillary line)

Mouth opening less than 30 mm was considered as inadequate and more than 30 mm was thought to be adequate. Infraorbital paresthesia was assessed subjectively by inquiring the patient regarding presence and areas of numbness and objectively by light touch at every visit.

Esthetics - Facial symmetry and malar prominence were assessed pre-operatively and post-operatively in both the groups to evaluate the esthetics. Facial symmetry was subjectively assessed and visually verified. To assess the outcome for malar prominence, Homes and Matthews grading scale was utilized[12]

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.

Data analysis - The patients in both the groups were evaluated and compared pre operatively, immediate post operative period and third month post operatively for anatomic form, function, esthetics and complications. The following methods of statistical analysis have been used in this study. The proportion was compared using Chi-square test of significance. The student't' test was used to determine whether there was a statistical difference between Group s in the parameters measured. In the above study the "p" value of less than 0.05 was accepted as indicating statistical significance. Data analysis was carried out using Statistical Package for Social Science (SPSS, V 10.5) package.

Results

Demographic data collected from the patients included age, sex, occupation, etiology of injury and time period elapsed from the time of injury to initialization of definitive treatment. The mean age of the patients in group I was 34.60+/-11.94 yrs and 32.50+/-14.26 yrs in group II. There were 19 male (95.0%) and one female (5.0%) patient in the study. In group I, 9 (90.0%) patients met with road traffic accident (RTA) and 1 (10.0%) patient had self fall. In group II, 4 (40.0%) patients had self fall and 6 (60.0%) patients had history of RTA.

Discontinuity was present in the orbital line pre-operatively in all 10 (100%) patients within both the study groups, which was restored post-operatively in all 10 (100%) patients within both the study groups. Discontinuity of Zygomatic line was present in 6 (60.0%) patients within group I and was restored in 5 (55.6%) patients post-operatively. It was present in 6 (60.0%) patients within group II also and was restored in 7 (77.8%) patients post-operatively. It couldn't be assessed in one (10.0%) patient. The mean difference between group I and group II was not significant ($p>0.05$), (Refer Tables 3 & 4). Discontinuity of maxillary line was present in 5 (50.0%) patients within group I and was restored in 5 (55.6%) patients post-operatively. Discontinuity of maxillary line was present in 9 (90.0%) patients within group II and was restored in 8 (88.9%) patients post-operatively. The mean difference between group I and group II was not significant ($p>0.05$) (Refer Tables 5 & 6). In both the groups orbital signs and symptoms were present in all patients pre-operatively and first week post operatively.

In group I orbital signs and symptoms were

present only in 2 (22.7%) patients during one month follow up visit, whereas it was present in one (11.1%) patient in group II.

It was absent in all patients in both the groups during the third month follow up visit. The mean difference was significant ($p<0.05$) within each group between pre and post-op period. However the mean difference between group I and group II was not significant ($p>0.05$) (Refer Table 1).

In group I mouth opening was inadequate in 5 (50%) patients, in group II it was 3 (30%) patients. During the immediate post-op week it was inadequate in 4 (40%) patients in group I and 1 (11.1%) patient in group II.

Mouth opening was adequate in all patients in both the groups during third month follow up visit. The mean difference between pre and post op visit was significant ($p<0.05$) in group I. However the mean difference between group I and group II was not significant ($p>0.05$) (Refer Table 2).

In group I paresthesia was present in 4 (40%) patients , in group II it was present in 6 (60%) patients. During immediate post-op week it was present in 4 (40%) patients in group I and 5 (55.6%) patients in group II.

Paresthesia was absent in all patients in both the groups during third month follow up visit.

The mean difference was significant ($p<0.05$) within each group between pre and post-op period. However between group I and group II it was not significant ($p>0.05$) (Refer Table 3).

In both the groups facial symmetry was absent in all patients pre-operatively. Symmetry was restored in 2 (20.0%) patients in group I and 3 (33.3%) patients in group II during immediate week post-op. Facial symmetry was restored in all patients in both the groups during third month follow up visit.

The mean difference was significant ($p<0.05$) within each group between pre and post-op period. However between group I and group II it was not significant ($p>0.05$).

In both the groups malar prominence was depressed in all patients pre-operatively.

Grade I was observed in 9 (90.0%) patients and grade II in one (10.0%) patient in group I, where as grade I was noted in 7 (70.0%) patients and grade II in 3 (30.0) patients in group II post operatively.

The mean difference was significant ($p<0.05$) within each group between pre and post-op period. However it was not significant ($P>0.05$) between the groups (Refer Table 4).

In both the groups, minor complications like partial ptosis, hematoma, palpability and pain on chewing was present in 3 (30.0%) patients in immediate post-operative period. It was absent in all patients in both the groups during third month follow up visit. The mean difference between group I and group II was not significant ($p>0.05$).

7 (70.0%) patients in group I and 5 (50.0%) patients in group II had additional fractures of body (fracture of cranial base, humerus, tibia) including associated facial bone fracture (ramus, angle, parasymphysis, zygomatic arch). 2 (20.0%) patients in group I and 3(30.0%) patients in group II had facial soft tissue injuries (superficial abrasions and cut lacerated wound).

Discussion

Changing trends in treatment of zygomaticomaxillary complex fractures have showed that treatment of a minimal to moderately displaced zygomatic bone fracture according to esthetic and functional requirements may be achieved by insertion of a single miniplate either at the frontozygomatic or zygomaticomaxillary buttress region. However there are no prospective studies which compare the treatment outcome of single point fixation at frontozygomatic suture with that of single point fixation at buttress region. Our study aimed to compare and evaluate functional and esthetic treatment outcome of single point fixation at frontozygomatic suture with single point fixation at buttress in patients with minimal to moderately displaced zygomatic complex fracture.

Table 1. Distribution of Orbital Signs and Symptoms between group I and group II

Group	Visit	Orbital S & S				Chi-Square Value	'p' - value
		Present		Absent			
		n	%	n	%		
Pre op	Group 1	10	100.00	00	-	-	-
	Group 2	10	100.00	00	-		
Ist Week	Group 1	10	100.00	00	-	-	-
	Group 2	10	100.00	00	-		
1st Month	Group 1	02	22.20	07	77.80	0.40	0 .52
	Group 2	01	11.10	08	88.90		
3rd Month	Group 1	00	-	09	100.0	-	-
	Group 2	00	-	09	100.0		

Table 2. Distribution of mouth opening between group I and group II

Group	Visit	Mouth Opening				Chi-Square Value	'p' - value
		Adequate		Inadequate			
		n	%	n	%		
Pre op	Group 1	05	50.00	05	50.00	0.83	0.36
	Group 2	07	70.00	03	30.00		
Ist Week	Group 1	06	60.00	04	40.00	2.03	0.15
	Group 2	08	88.90	01	11.10		
1st Month	Group 1	08	88.90	01	11.10	0.00	1.00
	Group 2	08	88.90	01	11.10		
3rd Month	Group 1	09	100.00	00	-	-	-
	Group 2	09	100.00	00	-		

Table 3. Distribution of paresthesia between group I and group II

Group	Visit	Paresthesia				Chi-Square Value	'p'- value
		Present		Absent			
		n	%	n	%		
Pre op	Group 1	04	40.00	06	60.00	0.80	0.37
	Group 2	06	60.00	04	40.00		
Ist Week	Group 1	04	40.00	06	60.00	0.46	0.49
	Group 2	05	55.60	04	44.40		
1st Month	Group 1	00	-	09	100.00	1.05	0.30
	Group 2	01	11.10	08	88.90		
3rd Month	Group 1	00	-	09	100.00	-	-
	Group 2	00	-	09	100.00		

Table 4. Distribution of malar prominence between group I and group II

Group	Visit	Malar prominence						Chi-Square Value	'p' value
		Depressed		Grade I		Grade II			
		n	%	n	%	n	%		
Pre op	Group 1	10	100.00	00	-	00	-	-	-
	Group 2	10	100.00	00	-	00	-		
Ist Week	Group 1	00	-	09	90.00	01	10.00	1.25	0.26
	Group 2	00	-	07	70.00	03	30.00		
1st Month	Group 1	00	-	08	88.90	01	11.10	1.28	0.25
	Group 2	00	-	06	66.70	03	33.30		
3rd Month	Group 1	00	-	08	88.90	01	11.10	1.28	0.25
	Group 2	00	-	06	66.70	03	33.30		

A total number of 20 patients with minimal to moderately displaced zygoma fracture were selected and randomly categorized into two groups with 10 patients in each group. The follow up period was three months for all patients with exception of two patients (one in each group) who were lost to follow up after one month.

Reasons for minimizing treatment include the avoidance of multiple surgical approaches, consequent potential infections, additional scars and nerve palsy.[6] The infraorbital rim may not be preferred choice for minibone plate osteosynthesis as there are no functional loads in this area and though compact, the bone at the IOR is so thin that only few threads of screws can be anchored.[10] Yonehara et al suggested that inferior orbital rim fixation with a miniplate or microplate could be avoided whenever possible to prevent postoperative scarring and sensory disturbances.[7] Kovacs and Ghahremani,[6] Mohammadinezhad,[9] Hwang [14] have reported satisfactory outcome with single point fixation at the FZ region while Tarabichi,[15] Courtney,[11]Kim et al [13] have supported single point fixation at the zygomaticomaxillary buttress region in selected patients with tripod fractures.In the minimal to moderately displaced ZMC fractures included in our study, we had no difficulty in obtaining adequate stabilization with either single miniplate placed across FZ or single miniplate at the buttress. However there were some advantages during intraoperative period while fixing at the buttress which included better control, ease of disengagement and manipulation of central body of zygoma. Also greater force could be applied during reduction through this approach as compared to reduction through lateral brow incision, where zygomatic hook was used in four cases. In addition, upper buccal sulcus approach allowed us to use varied reduction instruments ranging from periosteal elevator and bristow's elevator, to the handle of the maxillary anterior extraction forceps, while only broad periosteal elevator could be used through FZ incision. As mentioned in literature it was possible to directly visualize the infraorbital rim and the nerve during reduction which was not likely when lateral brow incision was used. It is noteworthy to mention that the mean difference of all the clinical and radiological parameters were significant ($p<0.05$) within each group between pre and post-operative period. However it was not significant ($p>0.05$) between the groups.

Among facial fractures, ZMC fracture is the second most frequent to occur, with a 6:2:1 ratio compared with mandibular and maxillary fractures, respectively.[16] Most studies indicate a male predilection, with a ratio of approximately 4:1 over females. Most authors also agree that the peak incidence of such injuries occurs around the second and third decades of life.[17]Consistent with these reports, in the present study, 19 patients were male and one patient was female. The mean age was 34.6 yrs in group I and 32.5 yrs in group 2. Comparable to literature, in the present study, road traffic accident was the most common cause of injury in both the groups (90% in group I and 60% in group II), followed by self-fall. However, it is noteworthy to mention that there were no fractures caused due to assault or sports injury. The right side was fractured in 12 patients, left side was involved in remaining 8 patients. This disparity in etiology of injury can be attributed to the geographical variation and difference in population groups being studied.

Symptoms of zygomatic fractures include those produced by hemorrhage and edema; subconjunctival and periorbital hemorrhage are almost always present (with exception of isolated fractures of the zygomatic arch). Bleeding occurs from the ipsilateral nose because of hemorrhage within maxillary sinus.[18] Comparable to literature all patients in both the groups presented with subconjunctival and circumorbital edema and ecchymosis with history of bleeding from the ipsilateral nose. In group I orbital signs and symptoms were present only in 2 (22.7%) patients during one month follow up visit, whereas it was present in one (11.1%) patient in group II. They resolved spontaneously in all patients by the end of the third month follow up period.

Acute loss of sensory function of the infraorbital nerve following ZMC fractures is often seen, as it passes through the infraorbital sulcus in the floor of the orbit to exit through the infraorbital foramen. Traumatic injury to the infraorbital nerve may be due to compression, oedema,

ischaemia or laceration. According to the literature, the incidence of sensory disturbances in ZMC fractures in the immediate post-trauma period varies from 24% to 94%.[19] In our study variable degrees of infraorbital nerve paresthesia was noted on the affected side. Paresthesia was assessed subjectively by inquiring the patient regarding presence and areas of numbness and objectively by light touch. It was present in 4 (40.0%) patients in group I and 6 (60.0%) patients in group II pre-operatively. By the end of follow up period it was absent in all patients in both the groups.

According to a study conducted on 52 patients with ZMC fractures, all patients had depression of bony prominence and trismus was present in only 21.1% of cases.[6] Similarly in our study all patients in both the groups had depressed malar prominence. However in few patients it was partially concealed by the soft tissue swelling. Malar eminence was restored in 2 (20.0%) patients in group I and 3 (33.3%) patients in group II during the first post-operative week, in the remaining patients restoration of malar eminence was not appreciable due to the presence of post-operative edema. The prominence appeared restored in all patients in both the groups during third month follow up visit.

Trismus was noted in 5 (50.0%) patients in group I and 3 (30.0%) patients in group II at the time of presentation. Restriction in mouth opening due to displaced zygoma, was difficult to assess in 2 patients (associated lefort 2 & ramus fracture) in group I and 3 patients (associated zygomatic arch, angle ,parasymphysis ,) in group II due to associated facial bone fractures. However, it was adequate in all patients in both the groups during third month follow up visit.

Plain radiographs and CT are often used in various studies for assessing the symmetry and status of ZMC post reduction and fixation. Dolan & Jacoby[20] describe three lines for evaluating the occipitomental projections which can be used as an adjunct. They are maxillary line, zygomatic line and orbital line. These are collectively referred as Dolan's lines (Refer Fig 13). [20] In the present study we used these lines for radiologic evaluation along with clinical verification.. 5 patients in group I and 2 patients in group II had associated head injury. 3 patients in group I and 1 patient in group 2 had associated orthopedic injury, in these cases pre-op PNS radiograph was not taken as prone positioning of these patients was not possible. Hence CT scan was used to examine the fracture lines.

The best treatment time is generally considered to be as early as possible for fractures of the midface.[6] Based on a 10 year period review, orbitozygomatic fractures can be repaired up to 21 days post injury using primary reduction and fixation techniques. In our study the time from trauma to treatment was in the range of few hours to 7 days. All patients reported to us within 48 hours of injury with exception of one patient who reported 4 days later. Nevertheless, on an average all patients in both the groups were operated within 4.5 days time.

There is scant evidence in favour of the prophylactic use of antibiotics for simple fractures of the ZMC. An audit of the use and outcomes of antibiotic prophylaxis for surgery of fractures of the zygoma was undertaken in four hospitals. Antibiotics prescribed were Cefuroxime 750 mg, Augmentin 1.2 g, Metronidazole 100mg/500ml. This data highlighted the wide variation in the prescription of prophylactic antibiotics. [21] In our study all patients in both the groups were started on IV Ceftriaxone 1 gm and IV Metronidazole 100 ml pre operatively and the same was continued for three days post operatively. There was no evidence of surgical site infection in any of the patients.

In literature several incisions have been considered acceptable in approaching zygoma fractures which includes the intraoral (Keen), temporal (Gillies), brow incision, bicoronal flap techniques, the modified lateral canthotomy approach [22], transconjuctival approach,[23] and supratarsal fold approach.[24] In the present study, lateral eyebrow incision and existing cut lacerated wound near eyebrow was utilized to expose the FZ area, whereas gingivobuccal incision was used to expose the buttress region. Using human dry skulls, Davidson et al analyzed the postoperative stability between the different

methods of internal fixation after reduction of simple displaced fractures of the zygoma. The result was that the 3-point fixation provided the best stability, but at least 1 miniplate fixation of only the FZ suture was also acceptable in providing stability of the fractured zygoma. Hwang 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 this simple 1-point fixation procedure is not indicated in patients who have ocular conditions such as diplopia or enophthalmos.[14] Thus in the current study patients with ocular conditions like restricted ocular movement, diplopia due to muscle entrapment were excluded. The advantages of this method are shortening of operative time, minimum facial scars, and less swelling postoperatively compared with the conventional 3-point open reduction and rigid internal fixation.[14] But generally, fixation at FZ through lateral brow incision may leave scars, palpability of plates and risk of penetration into the anterior cranial fossa. In contrast, fixation at the zygomaticomaxillary area does not cause palpability of plates/screws or leave external scars in spite of repeat incisions, at instances when plate removal is contemplated. Also it is thought that 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.[13]

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 , simplified antral bone harvest if required and simple mucosal closure.[11] Another most advantageous feature of this incision is visualization of infraorbital rim and nerve through the same incision.[2] None of the group I patients had esthetic problems related to external scars, however one patient complained of palpability of plate at the FZ. Except for this one patient in group I , there were no symptoms associated with the presence of the miniplate, either at FZ or buttress in any of the patients during the 3 month follow up time.

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. Invariably one identifies a significantly comminuted fracture line specifically through the anterior wall of the maxillary sinus. Neutral 2-mm (holes) adaption miniplate is applied, usually bridging over an area of bone loss and comminution that could extend up to 1.5 cm. The size of the miniplate needed as well as the degree of bone loss might limit the number of screws applied to one on each side of the fracture line. Therefore it is important to position the miniplate as laterally as possible on the zygomaticomaxillary buttress.[15] In our study we had a similar experience. Comminution of anterior wall of sinus was often noted and this would influence the number of screws applied on each side of the fracture line. In one patient a longer L-plate was utilized to bridge the gap of bone loss. On the contrary, lateral orbital rim was rarely comminuted and served as a stable point of fixation. Also, at instances when fracture line was too low near buttress, we had to be cautious while fixing the plate to avoid iatrogenic injury to the roots of the molar teeth. 2 mm titanium miniplates, and 2x6 mm screws were used in all patients in both the groups. In group I straight plates were used in all patients .In group II, L-plate was used in six patients, whereas 3D plate was used in two patients and straight plates were utilized in two patients. The reason for varied use of plates in group II being comminution and bone loss of anterior wall of sinus, as well as to avoid iatrogenic injury to the molar roots.

Complications of ZMC fracture and repair range from limited mandibular range of motion, lack of malar projection, diplopia, enopthalmos [8] to life threatening hemorrhage from branches of maxillary artery 25 and anterior ethmoidal artery. 26 All patients in both the groups had pain and swelling around the operated site postoperatively for around 3-4 days which subsided within a week except for one patient in group 2 who had developed hematoma which took almost three weeks to resolve. One patient in group I developed partial ptosis of right eye which resolved spontaneously within two weeks. Two patients in group II complained of pain while chewing for about 10 days which was absent in

group 1 patients. During the post-operative period, one patient in group I and two patients in group II developed seventh nerve palsy due to associated head injury. Nonetheless this was not related to our procedure. None of the patients had infected implants, development of new-onset paresthesia of the infraorbital nerve, secondary dipopia nor any ocular motility disturbance postoperatively.

Pre and post-operative maintenance of oral hygiene was necessary in group II patients because of presence of intraoral sutures. This point should be borne in mind while choosing to fix at buttress, as patients with poor oral hygiene may not be good candidates to undergo an intraoral procedure. There was no difficulty in obtaining adequate stabilization with either single miniplate placed across FZ or at buttress region. However we noted that fixing at the zygomaticomaxillary buttress region through intraoral vestibular incision offered a few advantages over frontozygomatic region, like no scarring or palpability of plates/screws, ease of reduction and use of varied reduction instruments along with visualization of infraorbital rim and the nerve through same incision. Zygomaticomaxillary buttress plays a key role in withstanding contraction of the masseter muscle and supporting zygoma, rigid fixation at the zygomaticomaxillary buttress is important in the treatment of tripod fractures.[27] In vivo studies showed that one point fixation at the zygomaticomaxillary complex gives three point alignment and sufficient rigidity when the fractures are not comminuted.[28]

On the other hand, the drawbacks of this study are as follows. One of the notable shortcomings of this study includes a small sample size. A larger sample size will allow a more complete evaluation of the treatment outcome with statistically significant results, thus eliminating errors like false positive and false negative. Also exclusion of the patients with head injury and associated facial bone fractures is essential for the correct assessment of trismus, facial symmetry and other signs and symptoms.

Conclusion

It can be concluded that minimal to moderately displaced zygomatic complex fractures can be sufficiently treated by single point fixation either at frontozygomatic or zygomatic buttress region. Additional plates are indicated only in cases where zygomatic bone cannot be stabilized by single location fixation such as in severely displaced or comminuted fractures. In the current study, there was no difference in stability, function and esthetics achieved with fixation at FZ or buttress. Therefore one can choose the single point of fixation depending on the individual merit of each case. However further studies with larger sample size can provide with statistical significant results.

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