INTRODUCTION: Zygomatic fractures constitute of 20-40% of all facial fractures. The signs and symptoms of zygomatic fractures include sub conjunctival and periorbital edema, hypoesthesia or anaesthesia in part or all of the branches of the infra orbital nerve, enopthalmos, diplopia, limitations of jaw movement because when the zygomatic arch is depressed medially, the coronoid process strikes against the depressed malar eminence thereby restricting the movement of the jaw and loss of prominence of the malar eminence. Three point of fixation is associated with extensive periosteal stripping, extreme retraction of bone edges and increased operating time. The approaches for FZ suture include lateral eyebrow incision, infra orbital rim can be approached via sub ciliary, sub tarsal, trans conjunctival or infra orbital incision.

AIM: The purpose of this study was to compare one point fixation in zygomatic buttress area and two point fixation in zygomatic buttress and frontozygomatic region in zygomatic maxillary complex fractures.

MATERIALS AND METHODS: Ten patients with zygomatic maxillary fractures were included in this prospective study with 5 patients in each group allocated randomly. The surgical treatment planned in group I patients were one point fixation at zygomatic buttress and in group II patients two point fixation at frontozygomatic and zygomatic buttress region. The inclusion criteria were fractures of zygomaticomaxillary complex. The exclusion criteria were severely comminuted fractures infected fractures, medical limitations of jaw movement because when the zygomatic arch is depressed medially, the coronoid process strikes against the depressed malar eminence thereby restricting the movement of the jaw and loss of prominence of the malar eminence. Three point of fixation is associated with extensive periosteal stripping, extreme retraction of bone edges and increased operating time. The approaches for FZ suture include lateral eyebrow incision, infra orbital rim can be approached via sub ciliary, sub tarsal, trans conjunctival or infra orbital incision.

RESULTS: All the patients underwent open reduction and internal fixation. Comparing the operating time, the treatment time in Group I patients was one hour and in Group II patients, two hours showing that one point fixation had shorter operating time.

CONCLUSION: In terms of stability, it is definitely two-point fixation which is superior. However it had its own disadvantages of longer operating time, implant palpability and unaesthetic scars. But the fixation at the ZM buttress was quicker, no scars, no implant palpability but fixation was inadequate in case of extensively comminuted or displaced fractures. We conclude that one point fixation at zygomatic buttress is a viable option for minimally displaced ZMC fracture and this one point fixation is not feasible in patients with comminuted zygomatic fractures, incomplete/unsatisfactory reduction through buccogingival incision and fixation at zygomaticomaxillary buttress.

KEYWORDS: Oral fracture, Dentistry, Zygomatic Bone
fixation in zygomatic buttress area and two point fixation in zygomatic buttress and frontozygomatic region in zygomatic maxillary complex fractures.

MATERIALS AND METHODS
Ten patients with zygomatico maxillary fractures were included in this prospective study with 5 patients in each group allocated randomly. The surgical treatment planned in group I patients were one point fixation at zygomatic buttress and in group II patients two point fixation at frontozygomatic and zygomatic buttress region. The inclusion criteria were fractures of zygomaticomaxillary complex. The exclusion criteria were severely comminuted fractures infected fractures, medically compromised patients and orbital fractures for both group I and II patients. In all the patients, the chief complaint was depression of the malar eminence and history of trauma. Pre-operative assessment of the patients in Group I/II included thorough history, clinical examination, and photographs in frontal, profile, WORM’S view and intraoral photographs. The parameters assessed in both Groups I and Group II included intraoperative time taken, unsightly scars, palpability of plates, clinical union at 4 weeks, radiographic union at 6 months, signs of wound infection or dehiscence and plate exposure and need for plate removal. Radiographic analysis included digital PNS view, CT scan in all 3 planes (axial, coronal, sagittal and 3D reconstruction).

The surgical procedure in GROUP I patients included a vestibular incision in relation to maxillary first molar and elevation of mucoperiosteal flap and the fracture site at zygomatic buttress was exposed and reduced and fixed with 2mm 'L' plate or 2mm four-hole miniplate and 2X6mm screws and the wound was sutured with 3-0 vicryl (Figure 1a, 1b&1c.) In GROUP II patients a lateral eyebrow incision was given, layer wise dissection was done, periosteum was incised. The fracture site was exposed and zygoma fracture was elevated through Rowe’s zygoma elevator and fracture site at frontozygomatic region was reduced and fixed with 2mm two hole miniplate and 2X6 mm screws sutured with 3-0 vicryl and 3-0 prolene layer wise and the zygomatic buttress fracture was addressed in a
similar manner as GROUP I patients (fig 2a, 2b, 2c).

RESULTS
10 patients, 5 in each group (Group I and Group II), all male patients with a mean age of 35 years (20-45 years) diagnosed with zygomatico maxillary complex fractures were included in the study. All the patients underwent open reduction and internal fixation. Alteration of occlusion was present in one patient; however it did not correlate with zygomatico maxillary complex fracture. There was depression of malar eminence in all the patients and paraesthesia of infra orbital nerve in 50% of patients. There was diplopia in one patient and restricted mouth opening in 40% of the patients. The other symptoms seen were oedema, ecchymosis, subconjunctival haemorrhage in 70% of the patients. There was associated mandibular fracture in only one patient. Remaining 90% of the patients had isolated zygomatic maxillary complex fractures (table 1).

In Group I patients’ one point fixation was done in the zygomatic buttress with 2 mm “L” plate and 2X6 mm screws. In Group II patients, two-point fixation was done in the zygomatic buttress with 2mm ‘L’ shaped plate and 2X6 mm screws and frontozygomatic fixation was done using 2mm two hole mini plate and 2X6 mm screws. In 60% patients, right side was more commonly involved. The follow-up period was one year in Group I and Group II patients. Post-operatively patients were evaluated graphically by pre and postoperative radiographs (Digital Paranasal Sinus View) to assess the alignment and approximation of fracture fragments as seen in figures 3a, 3b & 4a, 4b) However the reduction was very stable in all patients. Clinically the prominence of the malar eminence,
infection, wound dehiscence, foreign body reaction neurological deficit, palpability of the implant was considered. In Group I patients, there was persistent paraesthesia of the infra orbital nerve even after six months in one patient and in one patient there was comminution of the zygomatic buttress which made the fixation difficult. However there was no incidence of wound infection or dehiscence or foreign body reactions or palpability of plates in any patients. In one patient the fixation at one point was unstable and there was bony movement at frontozygomatic region. In Group II patients, there was no paraesthesia in any patient there was no evidence of wound dehiscence or foreign body reactions. However two patients complained of palpability of plates and unsightly scars in frontozygomatic region. Comparing the operating time, the treatment time in Group I patients was one hour and in Group II patients, two hours showing that one point fixation had shorter operating time. (Table 2 and Table 3).

DISCUSSION
Zygomatico maxillary complex fractures are more common in the 2\textsuperscript{nd} and 3\textsuperscript{rd} decade of life. In the current study, the age of patient ranged from 20-45

![Table](image)

**Table 1.** Demographic Details of the Study Population

| S.no | Age | Sex | Side | Orbital symptom | Depression of malar prominence | Mouth opening | Clinical displacement | Radiological displacement |
|------|-----|-----|------|-----------------|-------------------------------|---------------|----------------------|--------------------------|
| 1.   | 31  | M   | Rt   | No              | Yes                           | 40mm          | f-z region & buttress region |
| 2.   | 29  | M   | Lt   | No              | Yes                           | 20MM          | F-z region & buttress region |
| 3.   | 46  | M   | Lt   | No              | Yes                           | 38mm          | F-z region |
| 4.   | 29  | M   | Lt   | No              | Yes                           | 20mm          | Buttress region |
| 5.   | 42  | M   | Lt   | No              | Yes                           | 40mm          | Buttress region |
| 6.   | 40  | M   | Lt   | No              | Yes                           | 20mm          | F-z region & buttress region |
| 7.   | 29  | M   | Rt   | No              | Yes                           | 42mm          | Buttress region |
| 8.   | 19  | M   | Rt   | No              | Yes                           | 25mm          | F-z region & buttress region |
| 9.   | 22  | M   | Rt   | Yes             | Yes                           | 40mm          | Buttress region |
| 10.  | 27  | M   | Lt   | No              | Yes                           | 35mm          | F-z region & buttress region |

| S.no | Wound Infection/Dehiscence | Scar | Palpapity of plates | Sign of Clinical and radiological union | Operating time |
|------|-----------------------------|------|--------------------|----------------------------------------|---------------|
| 1.   | no                          | no   | no                 | yes                                    | 45 mins       |
| 2.   | no                          | no   | no                 | yes                                    | 1 hr          |
| 3.   | no                          | no   | no                 | no                                     | 55 mins       |
| 4.   | no                          | no   | no                 | yes                                    | 1 hr 10 mins  |
| 5.   | no                          | no   | no                 | yes                                    | 40 mins       |

**Table 2.** Showing different characteristics in Group I

International Healthcare Research Journal 2018;2(9):229-234.
years and 100% of the patients were male and 80% sustained fracture in the right side. The most important principle in the treatment of zygomaticomaxillary complex fractures is proper reduction. But the treatment of the patients in the reported study did not use the 3-point fixation proposed by Karlan M, Cassisi. In the present study as far as the stability is concerned, two point fixation was more stable compared to the one point fixation at the zygomatic buttress similar to the study by Davidson et al. who stated that one point fixation produced unstable fixation in their in vitro studies and proposed that the two point fixation provided a degree of stability compared to three point fixation regardless of the site at which they were fixed. But it was seen that when the fracture was not comminuted, the one point fixation at zygomaticomaxillary buttress was stable confirming the studies of Fujioka et al. The technique of fixation at zygomaticomaxillary buttress has some advantages such as no palpability of the implant, shorter operating time, no facial scars, re-operating for a infected implant is also easier. On the contrary in case of extensively comminuted and mal-aligned fractures, one point fixation at zygomatic maxillary buttress area always resulted in poor stability as reported by Chuong R and Kaban.

Another complication with the fixation at the zygomatic maxillary buttress is most of the times the zygomatic maxillary buttress pillar is the most comminuted and fixation becomes difficult according to Ellis E 3rd and Kittidumkerng and similar difficulty had been encountered in the current study.

According to Manson et al. the zygomatic buttress can be effectively used to align the fractured fragments whereas the frontozygomatic suture region is favourable site for rigid fixation of the fracture. In the present study in the Group II patients, this concept of Manson have been used however fixation has been done both at frontozygomatic and zygomatic maxillary buttress regions. In spite of the excellent stability against rotation and correct alignment to pretraumatic state provided by the two point fixation and though the scars were hidden in eyebrow, 2 patients complained of unsightly scar in the lateral eyebrow region and postoperative swelling was more in Group II patients because of severed muscle and soft tissue in frontozygomatic region. Operating time was also more and two patients complained of palpability of plates.

The results of studies by Zingg et al., Markowitz and Manson showed that the greater wing of sphenoid is a key area in determining the final result in the treatment of zygomaticomaxillary complex fractures. Undetected axial rotation of zygoma at the greater wing of sphenoid is often the reason for an unsatisfactory outcome. But in the reported study, no attempt has been made for fixation in this suture area.

**SUMMARY AND CONCLUSION**

In the prospective study, it is seen that in terms of stability, it is definitely two-point fixation which is superior. However it had its own disadvantages of longer operating time, implant palpability and unaesthetic scars. But the fixation at the ZM buttress was quicker, no scars, no implant palpability but fixation was inadequate in case of extensively comminuted or displaced fractures. On the basis of careful and detailed pre-operative and post-operative observations, we conclude that one point fixation at zygomatic buttress is a viable option for minimally displaced ZMC fracture and this one point fixation is not feasible in patients with comminuted zygomatic fractures, incomplete/unsatisfactory reduction through buccogingival incision and fixation at

---

**Table 3.** Showing different characteristics in Group I

| S.no | Wound Infection/Dehiscence | Scar | Palpapility of plates | Sign of Clinical and radiological union | Operating time |
|------|-----------------------------|------|-----------------------|-----------------------------------------|----------------|
| 1.   | no                          | no   | no                    | yes                                     | 1 hr 30 mins   |
| 2.   | no                          | no   | yes                   | yes                                     | 1 hr 45 mins   |
| 3.   | no                          | yes  | no                    | yes                                     | 1 hr 15 mins   |
| 4.   | no                          | yes  | no                    | yes                                     | 1 hr 55 mins   |
| 5.   | no                          | no   | yes                   | yes                                     | 1 hr 20 mins   |
zygomaticomaxillary fractures, fractures with orbital complications. In such cases two or three point fixation is better alternative. Therefore an individualistic approach is required for deciding the treatment plan for ZMC fractures based on extent and amount of displacement rather than fixed protocol.

CONFLICT OF INTEREST
No potential conflict of interest relevant to this article was reported.

REFERENCES
1. Gassner R, Tuli T, Hachi O, Rudisch A, Ulmer H. Craniofacial trauma: A 10 year review of 9,543 cases with 21,067 injuries. J Craniomaxillofac Surg. 2003;31(1):51-61.
2. Gomes PP, Passeri LA, Barbosa JR. A 5 Year retrospective study of zygomatic orbital complex and zygomatic arch fractures in Sao Paulo state. Braz J Oral Maxillofac Surg 2006; 64: 63-7.
3. Rowe NL, Killey HC. Fracture of the Facial Skeleton. 2nd edition Edinberg E. & S. Livingstone,1970
4. Rudderham RH. Biomechanics of facial skeleton. Clin Plast Surg 1992;19:11-29.
5. Pearl RM. Treatment of Enophthalmus. Clin Plast Surg. 1992;19:99-111.
6. Sergio Olate MS, Sergio Monterio Lima. Surgical Approaches and Fixation Patterns in ZygomaticComplex Fractures. J Craniofac Surg 2010;21:1213-7.
7. Karlan M, Cassisi N. Fractures of the zygoma: a geometric, biomechanical and surgical analysis. Arch Otolaryngol. 1979;105:320-7.
8. Davidson J, Nickerson D, Nickerson B. Zygomatic fractures: comparison of methods of internal fixation.1990. Plast Reconstr Surg 86:25-32
9. Fujioka M, Yamanoto T, Miyazato O, Nishimura G. Stability of one-plate fixation for zygomatic bone fracture. Plast Reconstr Surg 2002; 109:817-8.
10. Chuong R, Kaban LB. Fractures of the zygomatic complex J Oral Maxillofacial Surg. 1986;44:283-8.
11. Ellis E 3rd, Kittidumkerng W. Analysis of treatment for isolated zygomaticomaxillary complex. Fracture. J Oral Maxillofac Surg. 1996; 54: 386-400.
12. Manson PN, Crawley WA, Yaremchuk MJ, Rochman GM, Hoopes JE, French JH Jr. Midfacial fractures: advantage of immediate of extended open reduction and bone grafting Plast Reconstr Surg.1985; 76:1-12.
13. Zingg M, Laedrach K. Chen et al. Classification and treatment of zygomatic fractures of 1,025 CASES. J. Oral Maxillofac Sur. 1992;50:778-790.
14. Manson P, Markowitz B, Mirvis S. Towards CT based facial fracture treatment. Plast Reconstr Surg. 1990; 85: 202.