

Outcome of treatment of Zygomatic bone fracture by two point fixation versus three point fixation in Mayo Hospital Lahore

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Abstract

Objective: To compare the outcome of two-point internal fixation versus three-point internal fixation for the treatment of zygoma fractures.

Methods: The quasi-experimental study was conducted at the King Edward Medical University, Mayo Hospital, Lahore, Pakistan, from April to September 2016, and comprised patients with zygomatic bone fracture who were randomly divided into two groups. In Group A, patients were treated with two-point fixation and in Group B, patients were treated with three-point fixation. All patients were treated by the same consultant. Patients were followed up on first, third and sixth week postoperatively and malar height and mouth opening were recorded at the sixth week follow-up. Data was analysed using SPSS 17.

Results: Of the 60 patients, there were 30(50%) in each of the two groups. There were 39(65%) males and 21(35%) females. The mean age in Group A was 29.56 ± 9.89 years (range: 17-50 years), while in Group-B it was 29.45 ± 8.68 years (range: 17-49 years). Mean malar height at 6th week post-operative follow up showed a significant reduction in Group B compared to Group A ($p = 0.001$). Significant improvement in mouth opening was seen in Group B compared to Group A ($p = 0.034$).

Conclusion: Three-point fixation was found to give more stable reduction compared to 2-point fixation for treating zygomatic bone fractures in terms of malar height and mouth opening.

Keywords: Zygomatic bone fractures, Three-point internal fixation, Two-point internal fixation, Mouth opening, Malar height, Malar bone. (JPMA 69: 1623; 2019). doi: 10.5455/JPMA.298939.

Introduction

Malar bone is the principal buttress of the lateral midface. In facial trauma, malar bone is easily fractured due to its prominent position. Zygoma fracture can involve any of the five articulations: zygomaticofrontal suture, infraorbital rim, zygomaticomaxillary buttress, zygomatic arch, and zygomaticosphenoid suture.¹

Significant aesthetic and functional problems are seen in displaced malar bone fractures, including limited mouth opening, significant malar flattening and diplopia.² Stable and proper reduction must be achieved to restore function and facial aesthetics. Because the zygoma may be fractured in a variety of patterns, a wide

variety of treatment recommendations have evolved: from minimal reduction manoeuvres performed without fixation to complicated types of open reduction and internal fixation (ORIF).¹

Malar bone fractures can be managed by several closed reduction techniques e.g. hook elevation, Gillies Temporal approach, and Keen's approach.³⁻⁵ The open reduction technique involves upper eyebrow incision, subciliary incision, midtarsal or infraorbital incision and maxillary vestibular incision.⁶ Compared to direct inter osseous wire fixation in malar bone fracture treatment, strong evidence of superior long-term fracture stability has been found with the use of rigid plating system rather than use of intraosseous wire.⁷

Malar bone stability after 1-, 2- and 3-point fixation with mini-plate has been compared and documented. Two-

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point fixation of malar bone fracture was routinely used in the past, but it often led to rotational movement of zygoma due to the attachment of the masseter muscle.¹

Although both types of fixations are being done, enough data is not available to draw valid conclusions. The current study was planned to evaluate the results of internal fixation of fractured malar bone with 2-point fixation and 3-point fixation, and to formulate an operative strategy which will benefit the patients, resulting in better function and cosmesis.

Patients and Methods

The quasi-experimental study was conducted at the Department of Oral and Maxillofacial Surgery, King Edward Medical University / Mayo Hospital, Lahore, Pakistan, from April to September 2016 after taking approval from the institutional ethics review board. The sample size was calculated in the light of World Health Organisation (WHO) data using 90% power of test and 95% confidence interval (CI) with expected mean malar height with two-point and three-point fixation being 3.74 ± 1.76 and 1.68 ± 1.33 respectively.⁸

Using non-probability purposive sampling technique, the sample comprised patients with zygomatic bone fracture who were randomly divided into two equal groups using EpiCalc 2000. Group A underwent 2-point fixation while Group B had 3-point fixation.

Patients aged 14-60 years and having isolated zygomatic bone fracture not associated with other mid-facial fractures determined on clinical and radiographic findings (Waters' view, Caldwell's posterior-anterior view) were included, while those having comminuted fractures, medically compromised, fracture more than 15 days old or with orbital floor fracture were excluded. After taking informed consent from the patients, they were randomly divided into the two groups using lottery method. Preoperative data, like name, age, gender, was recorded. All patients were treated by the same consultant and data was collected by researchers. Patients were followed up on first, third and sixth week postoperatively and malar height and mouth opening were checked clinically and recorded on the proforma as the study variables. Mouth opening was measured in mm using scale as maximum the inter-incisal distance. For the measurement of malar height, a single reference point A (intersection point of midsagittal line with intercanthal line) was taken, and the second point B was taken at the maximum height



Figure-1: Measurement of Malar height.
Point A (Intersection point of midsagittal line with intercanthal line)
Point B (Maximum height of Malar region)

of the malar region by taking view from the vertex view of the patient and the distance was measured between the two points (Figure 1). The fractured side was compared with the normal side.

Data was analysed using SPSS 17. Quantitative variable like age was presented by using mean $\pm$ standard deviation (SD). Qualitative variable like gender was presented by using frequency and percentages. Repeated measures analysis of variance / Friedman test were used to compare the malar height and mouth opening in both groups during follow-up. Independent sample t-test / Mann Whitney U test were used to find out the difference in malar height and mouth opening before and after treatment in both the groups. $P \leq 0.05$ was taken as significant.

Results

Of the 60 patients, there were 30(50%) in each of the two groups. There were 39(65%) males and 21(35%) females. The mean age in Group A was 29.56 ± 9.89 years (range: 17-50 years), while in Group-B it was 29.45 ± 8.68 years (range: 17-49 years). Preoperative malar height in Group A was 61.30 ± 4.61 and in Group B it was 61.40 ± 4.28 . Preoperative mouth opening in Group A

Table-1: Descriptive statistics for Pre-operative Malar Height and Mouth Opening in Treatment Groups.

	Group-A		Group-B	
	Affected side (n=30)	Normal side (n=30)	Affected side (n=30)	Normal side (n=30)
Preoperative Malar height				
Mean	61.30±4.617	59.23±5.09	61.40±4.288	57.94±4.43
Min	54	50	54	50
Max	72	66	70	65
Preoperative Mouth opening				
Mean	11.43±3.901		11.47±4.083	
Min	5		4	
Max	20		19	

Table-2: Descriptive statistics for Malar Height in Treatment Groups on 1st, 3rd & 6th week Postoperatively.

	Group-A (n=30)	Group-B (n=30)
1st Week		
Mean	56.67±4.452	56.57±3.848
Min	50	50
Max	66	65
3rd Week		
Mean	57.80±4.552	57.17±3.931
Min	51	50
Max	67	66
6th Week		
Mean	58.07±4.608	57.20±3.960
Min	51	50
Max	68	66

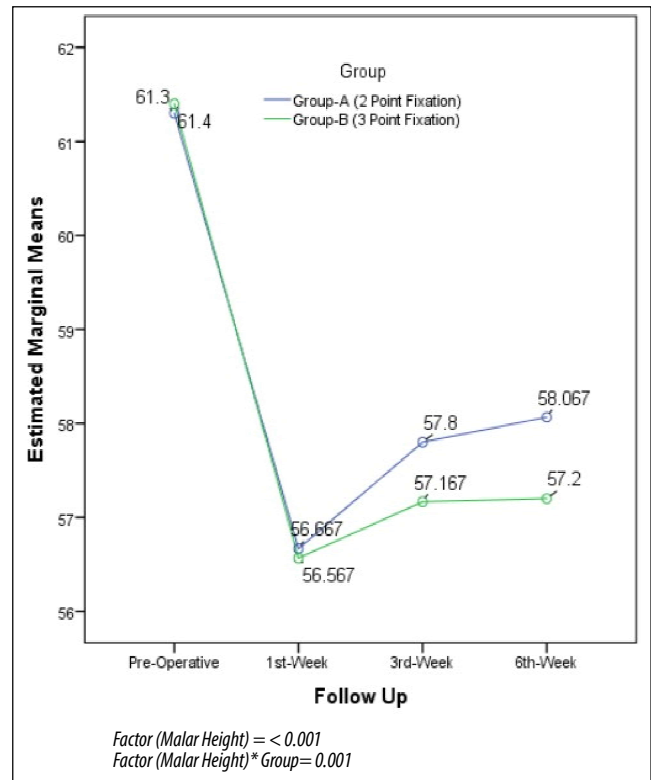
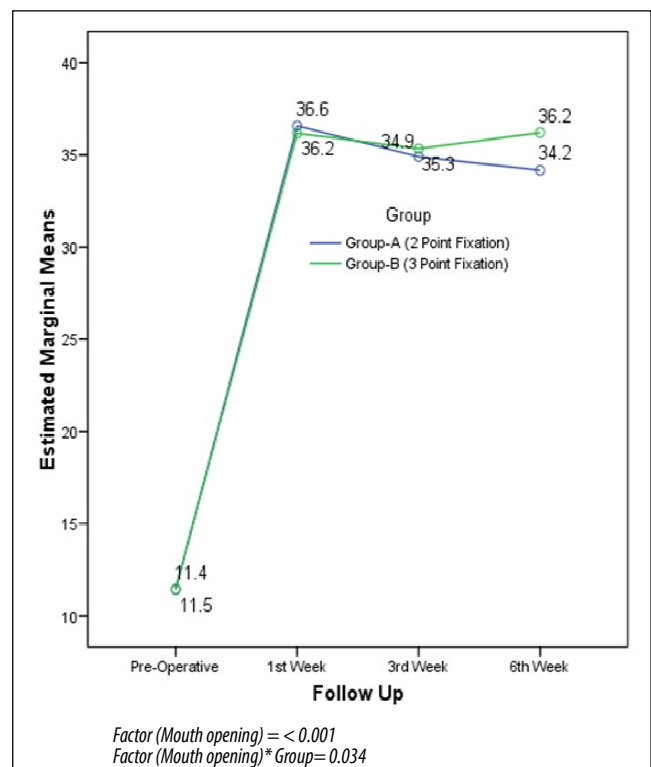
Group-A= 2-point fixation, Group-B= 3-point fixation.

Table-3: Descriptive statistics for Mouth Opening in Treatment Groups on 1st, 3rd & 6th week Postoperatively.

	Group-A (n=30)	Group-B (n=30)
1st Week		
Mean	36.57±1.654	36.17±1.177
Min	35	35
Max	40	39
3rd Week		
Mean	34.90±1.373	35.33±1.184
Min	33	33
Max	38	38
6th Week		
Mean	34.17±1.315	36.20±1.375
Min	32	33
Max	37	39

Group-A= 2-point fixation, Group-B= 3-point fixation.

was 11.43±3.9 and in Group B it was 11.47±4.08 (Table 1). At postoperative 1st week, mean malar height in Group A was 56.67±4.45 and in Group B it was 56.57±3.84. At 3rd week, mean malar height in Group A and Group-B was 57.80±4.55 and 57.17±3.93, while at the 6th week it was 58.07±4.60 and 57.20±3.96 respectively (Table 2).

**Figure-2:** Malar height in treatment groups during the course of follow-up.**Figure-3:** Mouth Opening in treatment groups during the course of follow-up.

At postoperative 1st week, mean mouth opening in Group A was 36.57 ± 1.65 and in Group B it was 36.17 ± 1.17 . At 3rd week, mean mouth opening in Group A and Group B was 34.90 ± 1.37 and 35.33 ± 1.18 , and at the 6th week it was 34.17 ± 1.31 and 35.53 ± 1.22 respectively (Table 3).

Mean malar height in both groups reduced, but in Group B it was significantly lower than that of Group A at 6th week follow-up ($p < 0.001$) (Figure 2).

Mean mouth opening in both groups reduced, but in Group B it was significantly higher than Group A at 6th week follow-up ($p < 0.001$) (Figure 3).

Discussion

The treatment of zygomatic complex fractures is challenging because of the complex bone anatomy. Aesthetics and function can even be compromised from fractures that have minimal displacement. Restoration of the complex anatomy presents a unique challenge and requires accurate diagnosis, adequate planning, appropriate surgical exposure and reduction. Management may be difficult even in the hands of the most experienced surgeons.⁹

Traditionally, the management of malar bone fracture involved visual exposure of all processes of the malar bone, precise reduction and non-yielding internal fixation using plates and screws. The operator should aim at achieving functional, aesthetic outcome that is stable in the long term.¹⁰

The number of plates required for adequate fixation remains controversial. The decision on how many plates to use is based largely on the degree of displacement and the presence of comminution.^{11,12}

Moreover, the trend in literature is for surgeons to minimise soft tissue disruption and exposure because of postoperative complications. Some studies argue the need for at least 2- or 3-point fixation of the zygomaticomaxillary complex (ZMC) to prevent inferior displacement and / or rotation due to the pull of the masseter muscle.^{13,14}

The fracture of the zygomatic bone can result in restricted mouth opening due to impingement on the coronoid process. Disruption of the malar bone position also carries psychological, aesthetic and functional significance, causing impairment of ocular and mandibular function. Therefore, for both cosmetic

and functional reasons, it is mandatory that zygomatic bone injury be properly diagnosed and adequately managed.^{15,16}

The current study observed that mean malar height at 6th postoperative week showed significant reduction in malar height in patients who had 3-point fixation (Group B) compared to those with 2-point fixation (Group A). Also, significant improvement in mouth opening was seen with 3-point fixation compared to 2-point fixation.

A local study from Jamshoro recently reported that three-point fixation provides better stability following reduction of fracture of zygomatic bone. It reported that 95% (19/20) cases had limited mouth opening before operation and 30% (6/20) cases had limited mouth opening after operation.¹⁷ Results of that study are consistent with our findings in terms of mouth opening.

A study tested combinations of wire and plates for treatment of ZMC fractures, and found that three-point fixation with mini-plates or wires offered equal stability while plate fixation was superior to wire fixation with two-point and one-point fixations.¹³ Results of the current study are in line with such findings.

A study recommended three-point rigid fixation of fractured zygoma after accurate reduction so as to maintain adequate stabilisation against masticatory forces during the fracture-healing phase. The deficit in the malar projection and malar height was more in the two-point fixation group. Their findings were also statistically significant. The findings of photographic assessment also revealed better malar symmetry and less globe position abnormalities in the three-point fixation group.¹

Another study¹⁸ observed that the fixation at zygomatic buttress could provide acceptable stability of the zygomatic complex, but in highly unstable fracture, two- or three-point fixation was additionally done to fix the fracture at infraorbital and frontozygomatic line. Studies^{19,20} have observed that three-point fixation maintained better stability at the fracture site, resulting in decreased incidence of dystopia and enophthalmos, with better malar projection and malar height as measured radiographically, when compared with two-point or one-point fixation. These findings support the results of the current study for 3-point fixation. One study reported that decreased malar height and

vertical dystopia was more common in patients who were treated by two-point fixation than those who were treated with three-point fixation.²¹ Similar result for malar height was obtained in the current study.

Conclusion

Three-point fixation was found to be more stable compared to 2-point fixation for treating zygomatic bone fractures in terms of malar height and mouth opening. Three-point fixation should be used to provide better stability against masticatory forces during the healing phase.

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