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Original Research Article

Three point fixation is superior to two point fixation technique for zygomatic complex fracture

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ABSTRACT

Background: Isolated zygomatic or malar bone fractures are second most common fracture among facial skeletal injuries. It has been reported that three point fixation is appropriate for isolated zygomatic bone fracture. The objective of current study was to compare the mean difference in terms of malar height outcome by using different fixation techniques (two point and three point) in patients with zygomatic complex fracture.
Methods: This randomized controlled trial was conducted at Department of Oral and Maxillofacial Surgery, MMDC, Multan, during a period of six months from 1st June 2017 to 30th November 2017. A total 182 patients of both genders were included in this study. Two point fixation techniques were used in Group-A patients. While 3 point fixation was used in Group-B patients. After 6 weeks follow-up, patients were assessed for malar height. Outcome was measured by comparing the mean difference of pre and postoperative malar height of both techniques. Data were analyzed using computer program SPSS-21. $P \leq 0.05$ was taken as significant in all analysis.
Results: Among patients in two point fixation group, the mean malar height was 67.55±2.98 mm and in three point fixation group, means malar height was 71.55±2.36 mm. The difference of malar height among two treatments was highly significant with $p<0.01$.
Conclusions: Using three point fixation results better as compared to two point fixations in terms of malar height outcome.

Keywords: Malar height, Two point fixation, Three point fixation, Zygomatic complex fracture

INTRODUCTION

Among the facial fractures, zygomatic bone is the second most common bone that is prone to fracture and may result into malar depression, ocular dystopia and enophthalmos. The fracture of zygomatic bone may be a minimally displaced simple fracture to a severely displaced fracture.[1,2] A proportionate increase has been estimated in the incidence of zygomatic complex fracture with rise in the facial bone fractures associated with the ever escalating hazards of modern transportation. Zygomatic region is involved in 42% of facial fractures and accounts for 64% of all middle third fractures.[3]

Common reasons for zygomatic complex fractures include road traffic accidents, physical assaults, fall and sports injuries. The relative contribution of these factors varies from region to region.[4,5] Fractures of the zygomatic complex appear commoner in young adult males. The zygomatic complex fractures are characterized by enophthalmos, flattening of the cheek, trismus sensory disturbances and diplopia. Zygomatic complex fractures

are diagnosed on both clinical findings and radiographic confirmation.[6-8]

In the literature and clinical practice, many surgical techniques have been recommended for the reduction of zygomatic complex fracture. Surgical incisions and reduction has been attained through Keen's approach, Gillies' approach, bicoronal scalp flap approach or the more popular Dingman's approach. Gillies' approach is widely used technique in U.K for zygomatic bone fracture and it has advantage of leaving no facial scar and is very simple to perform.[9-11]

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.[12] Open reduction and internal fixation of simple displaced fractures of the zygoma in an attempt to define the simplest method of achieving post reduction stability. In a report, the three-point fixation (FZ suture, inferior orbital rim, and zygomaticomaxillary buttress) using either miniplates alone or inter-fragmentary wiring conferred the greatest stability.[13]

It is pertinent to mention here that outcome of various surgical approaches and complications can be determined standardized protocol of management and long term follow up of the patient. As the scarce availability of data regarding success of employing two point fixation, the priority is given to the three point fixation, for zygomatic fracture, has continued to grow.[14] Considering the variation in reported data, this study was designed to compare two points internal fixation with three points internal fixation, for the better clinical results and fewer complications.

METHODS

This randomized controlled trial was conducted at Department of Oral and Maxillofacial Surgery, Multan Medical and Dental College, Multan, during a period of six months from 1st June 2017 to 30th November 2017. After approval from hospital ethical review committee, a total of 182 patients were included in this study. A written informed consent was taken from each patient.

Inclusion criteria

Inclusion criteria were displaced Isolated unilateral zygomatic bone fractures not more than 30 days old, confirmed on clinical and radiographic features (by comparing the fractured side with the normal side an obvious difference in malar height will be noticed); patients between 18 to 60 years of age of both genders

Exclusion criteria

Exclusion criteria were any other fracture of facial region; bilateral fractures of zygomatic bone; medically compromised patients; old and untreated fractures of more than one month duration.

Data collection procedure

Patients meeting the inclusion criteria, coming through outpatient department or emergency department were included in the study. Lottery method was used to allocate the patients in two groups; A and B. In Group-A, 91 patients were treated with two point fixation. In Group-B, 91 patients were treated with three point fixation. A written consent was taken from every patient. Personal details of patients including name, age, genders and hospital registration were recorded on a proforma.

Diagnosis of isolated zygomatic complex fractures was done on the basis of history, clinical examination and radio graphical evaluation. At least two radiographs, occipito-mental view 150 and sub-mento-vertex view, were taken.

Malar height problems were identified preoperatively by measuring the malar height and comparing with the opposite non fractured side. All the relevant information was recorded on a proforma. Patients were kept on six weeks follow-up. At the time of 6 weeks follow-up patients were assessed for malar height.

Postoperative assessment

Patients were examined at sixth week of follow up and were assessed for malar height by an experienced independent clinical investigator who was blind to the type of fixation method used. Postoperative malar height was measured by the same method as the preoperative malar height on vertex view. Outcome was measured by comparing the mean difference of pre and post-operative malar height of both techniques i.e. two point and three point fixation.

Statistical analysis

The data were entered and analyzed on SPSS version 17.0. The variable analysis were include demography, (age, gender), duration of fracture treatment, common site involvement. Standard deviation was calculated for age, duration of fracture treatment and pre and post-operative malar height of both techniques i.e. 2 point and three point fixation. A t test was applied to compare the mean difference of both techniques. $P \leq 0.05$ was taken as significant.

RESULTS

Among 182 patients, there were 126 males and 56 females. The frequency distribution of gender is presented in Table 1.

The overall mean age of study subjects was 43.13±10.90 years, with range of 38 (22–60) years (Table 2). Among patients in two fixation group, the mean age was 43.11±10.94 years, with range of 38 (22–60) years. Among patients in three fixation group, the mean age was 43.15±10.91 years, with range of 36 (24–60) years.

Table 1: Frequency distribution of gender (n=182).

		Frequency (N)	Percentage (%)
Overall	Male	126	69.2
	Female	56	30.8
	Total	182	
Two point fixation	Male	67	73.6
	Female	24	26.4
	Total	91	
Three point fixation	Male	59	64.8
	Female	32	35.2
	Total	91	

Table 2: Descriptive statistics of age (n=182).

	Age (years)	Two point fixation (n=91)	Three point fixation (n=91)
Mean±SD	43.13±10.90	43.11±10.94	43.15±10.91
95% CI (LB–UB)	41.54–44.73	40.83–45.39	40.88–45.43
Median (IQR)	42.0 (17)	42.0 (17)	42.0 (17)
Min-Max	22–60	22–60	24–60
Range	38	38	36

Table 3: Descriptive statistics of preoperative malar height (mm) (n=182).

	Overall (n=182)	Two point fixation (n=91)	Three point fixation (n=91)
Mean±SD	71.49±2.52	71.42±2.67	71.55±2.36
95% CI (LB–UB)	71.12–71.86	70.87–71.98	71.06–72.04
Median (IQR)	70.84 (3.06)	70.79 (2.92)	71.02 (3.17)
Min-Max	66.32–77.78	66.32–77.78	66.97–77.11
Range	11.46	11.46	10.14

Table 4: Descriptive statistics of postoperative malar height (mm) (n=182).

	Overall (n=182)	Two point fixation (n=91)	Three point fixation (n=91)
Mean±SD	68.69±2.91	67.55±2.98	69.84±2.35
95% CI (LB–UB)	68.27–69.12	66.92–68.17	69.35–70.33
Median (IQR)	68.34 (4.08)	66.79 (3.73)	69.37 (3.26)
Min-Max	61.93–75.06	61.93–74.78	65.30–75.06
Range	13.13	12.85	9.76

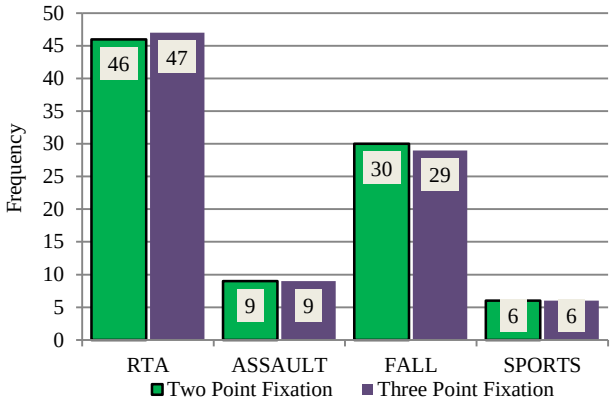

Figure 1: Frequency of duration of etiology of fracture according to groups (n=182).

The result of etiology showed that overall 93 (51.1%) patients had fracture due to RTA, 59 (32.4%) due to fall, 18 (9.9%) due to assault, and 12 (6.6%) due to sports. In patients treated with two point fixation 50.5% had fracture due to RTA, 33.0% due to fall, 9.9% due to assault, and 6.6% due to sports. In patients treated with three point fixation 51.6% had fracture due to RTA, 31.9% due to fall, 9.9% due to assault, and 6.6% due to sports (Figure 1).

The overall preoperative mean malar height of study subjects was 71.49±2.52 mm, with range of 11.46 (66.32–77.78) mm. Among patients in two fixation group, the mean malar height was 71.42±2.67 mm, with range of 11.46 (66.32–77.78) mm. Among patients in three fixation group, mean malar height of study subjects

was 71.55±2.36 mm, with range of 10.14 (66.97–77.11) mm (Table 3).

The overall postoperative mean malar height of study subjects was 68.69±2.91 mm, with range of 13.13 (61.93–75.06) mm. Among patients in two fixation group, the mean malar height was 67.55±2.98 mm, with range of 12.85 (61.93–74.78) mm. Among patients in three fixation group, mean malar height of study subjects was 71.55±2.36 mm, with range of 10.14 (66.97–77.11) mm (Table 4).

The mean of overall malar height (mm) of contralateral non fracture side was 69.19±2.93 mm, with range of 13.55 (62.28–75.83) mm. This mean for patients treated with two points fixation group was 68.05±2.96 mm and for patients treated with three points fixation group was 70.33±2.43 mm (Table 5).

Table 5: Descriptive statistics of malar height (mm) of contralateral non fracture side (n=182).

	Overall (n=182)	Two point fixation (n=91)	Three point fixation (n=91)
Mean±SD	69.19±2.93	68.05±2.96	70.33±2.43
95% CI (LB–UB)	68.76–69.62	67.43–68.67	69.83–70.84
Median (IQR)	69.03 (4.26)	67.38 (3.66)	69.98 (3.31)
Min-Max	62.28–75.83	62.28–75.30	65.79–75.83
Range	13.55	13.02	10.04

Table 6: Pre and postoperative mean difference in malar height (mm) (n=182).

	Mean±SD	P value
Two point fixation	67.55±2.98	0.000*
Three point fixation	69.84±2.35	

Independent sample t-test was applied. P≤0.05 considered as significant. *****Significant at 0.01 level.

The difference between malar height of the two treatments was calculated and significance of the results was also calculated by applying t-test considering p≤0.05 as significant. The results showed that mean malar height of three point fixations was more than two point fixation. It was also found that this difference is highly significant with p<0.01 (Table 6).

DISCUSSION

Among prominent bones of the facial skeleton, zygomatic bone occupies the most notable position and it not only act as major buttress of the mid face, but also plays important role in facial width determination.[15,16] Considering this important part of the facial skeleton, a more proactive approach had been adopted for the reduction methods of zygomatic complex fractures during the last two decades.[17] Our study was aimed to evaluate the efficacy of the two treatments i.e. two point and three point fixations.

A study carried out for investigating the biomechanics of the facial skeleton, reported that fractured, fractured zygomatic segment has six possible directions of motion: translation across x, y and z axis; rotation about x, y and z axis.[18] For complex zygomatic fractures, open reduction with three point fixation can achieve good results and these point should not be collinear. Similar type of findings had been reported in another study. Researchers in that study were of the opinion that it is necessary to reposition the zygomatic bone at a minimum of three points for three dimensional eposition of the bone.[19]

An experimental study had reported that after analyzing the different combinations of miniplates in human skuls, a good stabilization can be achieved by fixation at three points as compared to two points at fronto-zygomatic suture; inferior orbital rim and zygomatico-maxillary buttress.[20] The reported results of a biophysical study were also in line with the current study, three points fixation was proved to be superior technique in that study as well.[21] Despite these experimental studies, there were no prospective clinical studies. The difference studies that were conducted to show that one point fixation and two point fixation also show good results, were primarily aimed to reduce the scar mark of incision.[22]

In the present study, there was no displacement of the zygoma after fixation at the frontozygomatic suture using a miniplate as it gives stability in three planes and the facial symmetry was corrected in all 17 cases except for two cases where the patient did not follow postoperative instructions. Other studies concluded that there was no displacement of zygoma after fixation at frontozygomatic suture, using a miniplate, as the bone plate gives stability in three planes, three- or four-point fixation of zygoma is not necessary except for complex and comminuted fractures.[23-26]

The post reduction displacing role of masseter muscle in zygomatic complex fractures has been observed clinically and reported in the literature because this muscle has attachments along the inferior surface of the zygomatic arch. This masseter muscle is able to confer inferiorly directed force that may be sufficient to cause movement of fractured zygomatic bone, even after surgical insertion

of fixation devices. This postoperative displacement of zygmoa due masseter muscle pressure has been extensively studied and surgeons prefer using three- or four-point fixation instead of one- or two-point fixation as it offers more accurate reduction and less postsurgical displacement.[27-31]

CONCLUSION

It can be concluded from the findings of present study that the three point fixation using miniplates is superior to two point fixations in terms of achieving optimal malar height

Limitations of this study

The present study includes a single-center experience that it was conducted with small sample size and in urban environment. Therefore, the results might not be generalizable to larger populations.

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