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Clinical Outcomes of Mandibular Angle Fractures Treated by Single-Versus Double Miniplates

Mustafa Rasul Muhammed[(1)]

ABSTRACT

Background: Angle fractures represent the highest percentage of mandibular fractures. The purpose of this study was to compare the effectiveness of two miniplates fixation versus one plate fixation in the treatment of angle fractures.

Material and Methods: The present study was carried out on 40 patients with fractures of the mandible angle region treated by open reduction and internal fixation with 2.0mm standard conventional mini plates. Subjects were selected and randomly assigned to one of the 2 groups, 20 patients for each. Group I, patients were treated by single miniplate at superior border of mandible by intraoral approach; Group II , patients were treated by one miniplate like in group I, plus another plate at the lateral aspect of angle, trans buccally by trocar and cannula. The patients were evaluated for duration of surgery, post operative infection, wound healing, neurosensory disturbance, occlusion, malunion, and hardware failure.

Results: The complications were more in group 2 than in group 1. Disturbed occlusion was noted in 2 patients in group 2 and 3 patients of group 1. Infection occurred in 1 patient in group 1 and 2 patients in group 2. Preoperative/postoperative anesthesia was reported in 4/6 patients in group 1 and 5/7 patients of group2. No wound breakdown was seen in both groups. Screw loosening, necessitates removal of the plate, was noted in 3 patients of group 1 and one patient of group 2. Two patients' group 1 showed delayed union and none of the patients in group 2 develop such complication. The difference in the complications between the two groups was not significant.

Conclusions: There was no difference between the single- and double plate fixation regarding disturbed occlusion, infection, wound break down, lip paresthesia, hardware failure and malunion.

Keywords: Angle Fractures, Double plate, Mandible fracture, Miniplate, Single plate, Trans buccal approach.

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Affiliation Info

[(1)]Erbil Medical Institute , Polytechnic University, Erbil, Kurdistan Region, Iraq.
Corresponding Author: Mustafa Rasul Muhammed
email: mustafa.mohammed@epu.edu.iq

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INTRODUCTION

The mandibular angle fracture (MAF) is defined as a fracture line that begins where the anterior border of the mandibular ramus meets the body of the mandible and extends inferiorly through the inferior border or posteriorly toward the gonial angle.[1] The clinicalangle is the junction between alveolar bone& ramus of mandible at the origin of internal oblique line. The junction between the mandibular body and the ramus at origin of external oblique line is called surgical angle.[2] MAFsare the most common mandibular fractures, accounting for the highest percentage of mandibular fractures in many studies.[3]

The reasons why the angle of the mandible is commonly associated with fractures are referred to two main proposed factors, The first reason is that this area has a thinner cross-section compared to adjacent parts of the mandible.[4] The second reason is the presence of impacted third molars, which further weakens the region.[5,6]

Managing these fractures is challenging due to the complex biomechanics of the mandibular angle, where masticatory muscles attach and apply forces in various directions, having a thin cross-sectional area, the abrupt change in curvature, and the presence of third molars[7] The treatment of these fractures have gained valuable significance since it deals with the aesthetics and facial contour, and failure to treat will lead to a life with secondary deformity and that of poor quality.[8] Although there is widespread agreement concerning the demand for quality of surgical reduction and fixation of a MAF, a variety of different kinds of treatment philosophies have been described.[9,10]

The primary source of contention over the years has revolved around the optimal treatment for MAFs, specifically the choice between using a single miniplate or two miniplates. Some investigations have indicated a reduction in complication rates when employing a single miniplate,[11,13] while others argue that the use of two miniplates provides a more secure fixation method with reduced stress at the fracture site.[14] In contrast, Schierle et al.[15] found no discernible difference in outcomes between using one or two miniplates for MAFs. Furthermore, conflicting perspectives exist, asserting that employing two plates represents a superior management approach, and that using a single miniplate is associated with a higher incidence of complications.[16]

This study was conducted to assess the outcomes and complications of one miniplate versus two miniplates in the treatment of MAFs.

MATERIALS AND METHODS

The participants of this randomized clinical trial were recruited from individuals who sustained nondisplaced isolated unilateral MAF. Approval for this study was secured from the Ethical Committee of our institution. Every participant in the study provided informed consent after receiving a detailed explanation of the benefits involved.

Patients meeting the selection criteria were those with dentate, aged between 18 and 60 years, for whom open reduction with internal fixation (ORIF) was deemed the most suitable treatment. Exclusions comprised individuals with confirmed local sepsis, comminuted fractures necessitating rigid fixation, or those requiring extraoral access, or a combination of both. Additionally, patients with multiple trauma, maxillary fractures, or those in need of intensive care unit admission were not included.

Participants were assigned randomly to either the single- or two- four holes miniplate groups. All surgical procedures were carried out by the same surgeon following a standardized protocol. In the single-miniplate group, a 2 mm titanium plate was intraorally positioned at the external oblique ridge, secured with two screws on each side of the fracture line. For the two-miniplate group, participants underwent the insertion of a second plate transbuccally, positioned as close as feasible to the mandibular border.

A standardized surgical protocol was uniformly applied to all patients, who underwent the procedure under general anesthesia. Employing stringent aseptic measures, a transbuccal approach was utilized to access the fracture site. When deemed necessary, the third molar along the fracture line was extracted. The fracture site was located and realigned to achieve proper occlusion using maxillo-mandibular fixation (MMF).. Fixation was achieved by either a single miniplate in accordance with Champy's principles (group 1) or with an additional plate positioned transbuccally as close to the lower border as feasible (group 2). A drill bit was introduced transbuccally through the drill guide, with holes drilled perpendicular to the cortex under saline irrigation. The transbuccal trocar system

facilitated the placement of monocortical screws to secure the plate to the fractured bony segments. Following confirmation of occlusion and attainment of proper hemostasis, the wound was closed and the operation time was calculated. Next, MMF was released while the arch bars remained in place for heavy gauge elastics. MMF was used in all of our patients for 2 weeks.

Patients were seen at 1 week, 2 weeks, 1 month, 3 months, 6 months, and 12 months after surgery. The patients were examined for malocclusion, infection, malunion, non-union, delayed union,wound break down, numbness of the lip, loosening of the screws and the need for removal of plates.

Statistical analysis: Statistical Package for Social Sciences, version 25.0 was used. Paired t test, and Fisher exact tests were used. Statistical significance level was considered at $P<0.05$.

RESULTS

Out of the 40 patients, there were 8 females, and 32 males, with a mean age of 27.48 year (±8.57 year). The age group of 18-28 year was mostly affected (22/40, 55%), followed by the 29-39 years (10/40, 25%), the 40-50 years (7/40, 17.5%), and > 50 years (1/40, 2.5%). table (1). Road traffic accident was the most common cause of fracture (26/40, 65%), followed by personal violence (8/40, 20%), sport accidents (4/40, 10%), and fall from height (2/40, 5%), table (2).

The outcomes and complications of surgery in both groups are shown in table (3). The duration of surgery was significantly greater in group 2 than in group 1, 62.4(±12.8) minutes vs. 40.3 (±16.7)minutes (($p< 0.0001$)9t=4.69). The complications were more in group 2 than in group 1. Disturbed occlusion was noted in 2 patients in group 2 and 3 patients of group 1 . Infection occurred in 1 patients in group 1 and 2 patients in group 2. Preoperative/postoperative anaesthesia was reported in 4/6 patients in group 1 and 5/7 patients of group2. No wound breakdown was seen in both groups. Screw loosening ,necessitates removal of the plate, was noted in 3 patients of group 1 and one patient of group 2. Two patients group 1 showed delayed union and none of the patients in group 2 develop such complication. The difference in the complications between the two groups was not significant.

Table 1: Age and sex distribution of the sample

Age groups, years	Sex	Total, No.(%)
18-28	Male: 18 Female: 4	22(40)
29-39	Male: 7 Female: 3	10(25)
40-50	Male: 6 Female: 1	7(17.5)
50-60	Male: 1 Female: 0	1(2.2)
Total, No.(%)	Male: 32(80) Female: 8(20)	40(100)

Table 2: Causes of angle fracture.

Cause of fracture	No(%)
Road traffic accident	26(65%)
Personal violence	8(20)
Sport accidents	4(10)
Fall from height	2(5)
Total	40(100)

Table 3: Outcomes of angle fracture treatment

Outcome	Group 1	Group 2	Sig.
Duration of surgery (minutes) Mean(±SD)	40.3 (±16.7)	62.4(±12.8)	<0.0001
Disturbed occlusion	3	2	1
Infection	1	2	1
Preoperative/postoperative anaesthesia	4/6	5/7	1/1
Screw loosening	3	1	0.6
Malunion	2	0	0.4

*Fisher's exact test

DISCUSSION

The highest incidence of mandible angle fracture in the current study was in the second and third decades of life, with a clear predilection for men and a male: female ratio of 4:1.

The results of our study is similar to that of Fox and Kellman[17] who found that angle fractures are more common in males in their second decade of life. Similarly Patel et al[18] and Adebayo et al[19] found a higher male predilection for MAF. However, in contrary Olson et al[20] and Chaurasia and Katheriya[21] showed that there was a higher incidence of angle involvement in patients with mandibular trauma in females than males.

In the current study the most common cause of angle fractures was road traffic accidents and personal violence. The same conclusion was reached by Singh et al[22] who found that RTA is the main aetiology of angle fractures (74%). However, Guy et al.[23] found that the most common mechanism of injury was aggravated assault (77%) followed by motor vehicle crash (14%).

In this investigation, the proximity of the angle region to the inferior alveolar nerve bundle raises the likelihood of post-trauma paresthesia, as well as postoperative paresthesia or altered sensation resulting from nerve damage or injury. The current study documents four patients in group 1 and 5 patients in group 2 experiencing post-traumatic paresthesia. Post-operatively, the number increased to 6 and 7, respectively.

In this present study, three patients in group 1 and two patients in group 2 were observed to have postoperative occlusal derangement. Danda[24] conducted a study that compared complication rates between patients treated with a single noncompression miniplate and those treated with two noncompression miniplates for MAFs. They found no significant statistical difference between using one plate versus two plates, and our study

yields similar results.

The issue of postoperative infection in the context of MAFs has been extensively discussed and is a significant complication associated with angle fracture treatment. Ellis[25] concluded that employing a single miniplate at the superior border effectively addressed these fractures, highlighting a substantial increase in infection incidence with the use of two plates. In contrast, conflicting reports in the literature suggest no significant difference in infection rates between one- and two-plate techniques.[26] Mehra and Haitham[27] emphasized that employing fewer plates reduces periosteal stripping, potentially minimizing blood supply disruption and operating time, consequently lowering postoperative infection rates. A prospective study on MAFs indicated that using a strut plate at the angle resulted in relatively fewer or no postoperative complications compared to other techniques.[28] However, the present study found no statistically significant correlation between the type of fixation and the rate of postoperative infection. Variations in infection rates across studies may be attributed to inherent differences in the patient population under examination, encompassing socioeconomic status, tobacco and alcohol usage, nutritional status, and other.

At the present study the surgery time was significantly less in patients who were given one mini compression plates as compared to two (p = 0.0001). The results of the present study were disimilar to Rai et al[29] who observed that the average time in patients treated using a single compression plates was more (78.33 min) than two compression plates (73.50 min). The results obtained by Choi et al[14] and Singh et al,[30] were aslo different from the current study results. They reported reduced operating time when using two mini plates. This difference in the duration of operative time between our study and the studies above may be attributed to the extra time needed to place a second mimiplate by intraoral transbuccal approach, while in the previous studies,[14,29,30] the fractures were exposed by extraoral approach which allows for better vision and control of the fracture fragment, allowing for early reduction and fixation.

Although the complications in both the groups showed no statistical significant difference, fractures treated two miniplates had less complications. The findings were in accordance to the studies of Levy et al,[16] Danda et al,[24] Rai et al.[29] They also came to the conclusion that for fixing, two plates were preferable to one.

Strong elevator muscles action on the mandibular ramus direct impact to the mandibular body, therefore fixation must retain stiffness with functional stress, according to Choi et al.'s[14] advocacy of two-plate fixation. Therefore, enough stress neutralization produced on functional loading is required in internal fixation for mandibular angle fractures.

CONCLUSIONS

The use of single miniplate to treat mandibular angle fracture significantly reduced the operative time as compared to double plates fixation technique. There was no difference between the single- and double plate fixation regarding disturbed occlusion, infection, wound break down, lip paraesthesia, hardware failure and malunion.

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