Original Article

The outcome of Endoscopic Assisted versus Conventional transbuccal approach for Open Reduction and Internal Fixation of Mandibular angles Fractures using two miniplates osteosynthesis. Comparative study

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ABSTRACT

Purpose: the current study aimed to compare between the outcomes of using endoscopic assisted versus conventional for trans-buccal open reduction and internal fixation (ORIF) of mandibular angle fracture using two miniplates osteosynthesis.
Methods: the current study included 12 unilateral mandibularangle fractures either isolated or accompanied with other mandibularfractures. Those patients were randomly divided into two equal groupaccording to treatment technique into;(group A) treated by transbuccal endoscopicaly assisted open reduction and internal fixation (EAORIF) or (Group B) treated by transbuccal conventional open reduction and internal fixation (CORIF). patients were evaluated clinically and radiographically pre- operative and post-operative at different consequences period in relation to pain, edema, facial nerve injury, malocclusion, operation time and radio-density at the fracture lines from one week to six months postoperatively for some parameters.
Results: our results showed there were significant difference between the two groups regarding operation time & post-surgical edema.
Conclusion: EAORIF show more time saver & rapid post-operative edema regression than those patients managed by CORIF.

Key Words: mandibular angle fracture, Endoscopic Assisted, Transbuccal, Open Reduction and Internal Fixation, miniplates, conventional.

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INTRODUCTION

The mandible is the largest and strongest facial bones and is the one of the most fractured bones of the maxillofacial skeleton because of its position and prominence. [1, 2] meanwhile the angular fracture also is the one of most common fractured areas of the mandible. The main reason for angular fractures may be attributed to a thinner cross-sectional area relative to the neighboring segments of the mandible and the presence of third molars especially if it was impacted, which weakens the region.[3- 6]Untreated or malunion of mandibular angle fractures cause impairment of occlusion, temporomadibular disorder (TMD), obstructive sleep apnea (OSA). [7]

Although the literature contains numerous reports of various techniques to treat these fractures over the past decades, there has been a lot of debate about the ideal method of treatment, which varies from closed reduction to open reduction and internal fixation.[8,9 - 12]

Various open reduction techniques for mandibular angle fixation had been used; choice of extraoral or intraoral or transbuccal approaches. The traditional one was an extra-oral approach which involves making a skin incision outside the mouth and concealed in the submandibular shadow, which has a possible disadvantage according AO/ASIF (Association of Osteosynthesis/ Association for Study of Internal Fixation) philosophy such as a non-cosmetic scar and the risk of injury to the facial nerve. Maxillofacial surgeons scramble to find a way to counteract these disadvantages and turned to an alternative method called the transoral, or intraoral approach. [13]

The limited accessibility of the intraoral approach prompted surgeons to find an alternative method, namely the transbuccal approach which results in minimal external scarring with direct visualization of the bone plates and ease of surgical drilling and screw insertion which decrease operation time [14- 15] This technique that combines the advantages of ORIF via extra oral approaches and avoids its associated complications is preferred. (EAORIF) has emerged intra-orally for more hopefully perfection of ORIF through that approach. [16]

The current study aimed to compare between the outcome of using endoscopic assisted versus conventional for transbuccal open reduction and internal fixation of twelve mandibular angular fracture fixed by double mini-plates and screws.

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PATIENTS AND METHODS

The current study conducted on twelve patients of age between 1827- years suffering from unilateral angle fractures. The protocol of the study was approved by the ethical committee of the Faculty of Dentistry Minia University. All patients selected from the Department of Oral and Maxillofacial Surgery, and the management procedures were performed at Minia University Dental Hospital (MUDH). Treatment plan and surgical procedures and possible complications were thoroughly explained to the patients followed by signed an informed consent. The patients enrolled in this prospective study were randomly divided into two equal groups based on the use of the endoscope as an adjuvant device in fracture fixation procedures into group A (EAORIF) and group B (CORIF). Patients who had systemic or localized pathologic lesions which interfere with bone healing process were excluded. All patients diagnosed on the basis of clinical and preoperative radiographic evaluation by panoramic and CT scans.(Figure 1)

Surgical procedure: after the regular preoperative patients preparation; all cases were operated under general anesthesia with nasotracheal intubation. The surgical fields were scrubbed and the patients were draped using the standard technique of maxillofacial surgery. In both groups (A, B). Any accompanied mandibular fractures were first reduced and fixed primarily by the assistance of maxillo-mandibular fixation (MMF) in centric occlusion. Definitive fixation of those fractures had been accomplished by osteosynthesis titanium plates.

Open reduction and internal fixation of both study groups (A, B); an intraoral incision was planned extending from the anterior border of the ascending ramus at the level of the maxillary occlusal plane. The incision was then carried down just along the lateral portion of the anterior ramus and continued forward approximately 5 mm from the junction of the attached mucosa and vestibule to extend anteriorly to the level of the mandibular first molar. The mucoperiosteal flap was then reflected and the fracture site was exposed and was reduce manually.

Maxillo-mandibular fixation (MMF) was placed again and a secondary extraoral port was made for transbuccal approach, the location of the extraoral stab incision was guided by the location of the fracture line and the position of the facial vessels and marginal mandibular facial nerve branch. The trocar was advanced into the operative site with blunt dissection through this stab incision, perforating the periosteam in the area planned for plate fixation followed by the insertion of the transbuccal cannula. The cheek retractor was applied to stabilize the trocar assembly during movement towards and away from the fracture site. Fractured segments were reduced under direct vision then a drill bit was inserted through the drill guide to drill the screw holes. (Figure .2)

In case of group A (EAORIF): After achieving sufficient dissection as described above, the endoscope was introduced intra-orally to visualize and monitor the fracture segments during reduction and fixation procedures. Endoscopic equipment: 30o angle 2.4 mm diameter of Karl Storz scope (Tuttlingen, Germany). (Figure .3)

For both groups; the first titanium plates (2mm mini non-compression plates) were adapted intraorally at the superior border of angular area and fixed with 4 monocortical screws intraorally. While the second titanium plates (2mm mini non-compression plates) were adapted intraorally above the inferior border and fixed with 46- bicortical screws through a transbuccal trocar. After plates fixation of all cases; the intermaxillary fixation was then released and occlusion was rechecked. The intraoral wound was closed with 3(0) interrupted absorbable sutures and the trocar assembly was removed and the stab incision was closed using 5(0) polypropylene.

Post-operative care:

Postoperative antibiotics, analgesics, and anti-inflammatory, medication was prescribed for one-week post-surgery. The patients were strictly advised and simulated to perform a gentle range of motion exercises, vertically and horizontally, to improve maximal interincisal distance and translator movements of the affected angular of the mandible. On the 7th day, all skin and/or intraoral sutures were removed.

Post-operative clinical follow up:

Post-surgical pain was followed up according to the visual analogue scale (VAS- 0= no pain, 1= mild pain, 2= moderate pain, 3= severe pain, 4= very severe pain, 5= unbearable pain). [17] (Table 1), where the patient determines the intensity of pain he suffered in one, two and three weeks after the surgery. Edema was assessed by a modification of 3 line measurements using fixed points on the surgical side of the face and finding the average. The fixed points used were; A) The most posterior point at the midline on the tragus, B) Lateral canthus of the eye, C) the most lateral point on the corner of the mouth, D) soft tissue pogonium which is the most prominent point at the midline on the chin, E) most inferior point of the angle of the mandible. The three lines were AC, AD, and BE [18]. A baseline measurement was carried out just before the surgery and similar measurements were carried out on one, three weeks and three month post-surgery and correlate with the preoperative measurements in both groups. (Figure. 4) Functions of the facial nerve in the form of muscle weakness will be evaluated postoperatively at one, two and three weeks. Evaluation of patient dental occlusion: to determine whether a fair postoperative occlusion was achieved compared with preoperative occlusion; the patient was evaluated one, two and three weeks post-surgery. The operative time taken for the surgery was recorded as commencing with the intra-oral incision and ending with the completion of wound closure. This excluded the time to place MMF or treat other fractures. Radiographic follow up: Multi-Slice Computerized Tomography Scans (CT) were obtained at 3 and 6 months postoperatively for both groups for: (1) Compare between both groups for a definition of reduction in means of bone density, (2) compare adequacy of reduction in mandibular angle fracture for both groups.[19]The data were collected and statistically compared using IBM SPSS 20.0 statistical package software.

RESULT

The current study was included twelve patients suffering from unilateral mandibular angle fractures treated by open reduction and internal fixation through transbuccal approaches with endoscopic assisted (groups A) or conventional (groups B). In this study the mean age of the patients was 22.4±2.6 years (range, 18-27 years), which showed male predominance (n=9-75%). All patients reported mild pain within the first week postoperatively and complete pain relief after three months postoperatively with no statistically significant difference regarding the progression of pain between both groups along follow up period. (Table 1)

At the first-week postoperatively patients of both groups showed ipsilateral facial swelling, while after three weeks postoperatively; all patients in group A had mild edema while in group B five patients (83.3%) had moderate edema which show a statistically significant difference (*P*= 0.015). while after three months there was no statistically significant difference in the assessment of edema between the two groups. (table2) In both groups at the 1st week postoperatively; 50% of patients had a mild muscular weakness, 33.3% had moderate weakness and 16.7% had a severe weakness with no statistically significant differences in the distribution of grades of nerve function between both groups. (Table 3) Patients of both groups regained their normal occlusion at one week postoperatively without a statistically significant difference between the two groups. (Table4) In group A, median bone density after three months post-surgery was 624.5 and increased to 1027 at six months post-surgery (P= 0.028).In group B, median bone density after three months post-surgery was 605.5 and increased to 988.5 at six months post-surgery (P= 0.028). There were no significant differences in post-operative bone density between the two groups. (Table 5)
However regarding operating time, it was dramatically reduced in endoscopically assisted approach the median being 128.5 versus 263.5 minutes with the conventional group which was statistically significant *P*= 0.004.
(Table 6)

Table (1): Assessment of post-operative pain in both study groups

Pain	Group A (n=6)	Group B (n=6)	p value
1w post-operative			1.00
No pain	0 (0.0%)	0 (0.0%)	
Mild pain	6 (100.0%)	0 (0.0%)	
Moderate pain	0 (0.0%)	6 (100.0%)	
Severe pain	0 (0.0%)	0 (0.0%)	
Very severe pain	0 (0.0%)	0 (0.0%)	
Unbearable pain	0 (0.0%)	0 (0.0%)	
3w post-operative			
No pain	6 (100.0%)	0 (0.0%)	
Mild pain	0 (0.0%)	6 (100.0%)	
Moderate pain	0 (0.0%)	0 (0.0%)	
Severe pain	0 (0.0%)	0 (0.0%)	
Very severe pain	0 (0.0%)	0 (0.0%)	
Unbearable pain	0 (0.0%)	0 (0.0%)	
3m post-operative			
No pain	6 (100.0%)	6 (100.0%)	
Mild pain	0 (0.0%)	0 (0.0%)	
Moderate pain	0 (0.0%)	0 (0.0%)	
Sever pain	0 (0.0%)	0 (0.0%)	
Very severe pain	0 (0.0%)	0 (0.0%)	
Unbearable pain	0 (0.0%)	0 (0.0%)	

Fisher's exact test for qualitative data
: Significance level at P-value < 0.05

Table (2): Assessment of postoperative edema in both groups

Edema	Group A (n=6)	Group B (n=6)	p value
1w post-operative			0.545
Sever edema	3 (50.0%)	5 (83.3%)	
Moderate edema	3 (50.0%)	1 (16.7%)	
Mild edema	0 (0.0%)	0 (0.0%)	
No edema	0 (0.0%)	0 (0.0%)	
3w post-operative			0.545
Sever edema	0 (0.0%)	0 (0.0%)	
Moderate edema	0 (0.0%)	5 (83.3%)	
Mild edema	6 (100.0%)	1 (16.7%)	
No edema	0 (0.0%)	0 (16.7%)	
3m post-operative			1.00
Sever edema	0 (0.0%)	0 (0.0%)	
Moderate edema	0 (0.0%)	0 (0.0%)	
Mild edema	0 (0.0%)	1 (16.7%)	
No edema	6 (100.0%)	5 (83.3%)	

Table (3): Assessment of post-operative neural affection in both groups

Neural affection	Group A (n=6)	Group B (n=6)	p value
1w post-operative			1.00
No affection	0 (0.0%)	0 (0.0%)	
Mild muscular weakness	3 (50.0%)	3 (50.0%)	
Moderate muscular weakness	2 (33.3%)	2 (33.3%)	
Sever muscular weakness	1 (16.7%)	1 (16.7%)	
3w post-operative			1.00
No affection	3 (50.0%)	3 (50.0%)	
Mild muscular weakness	2 (33.3%)	2 (33.3%)	
Moderate muscular weakness	1 (16.7%)	1 (16.7%)	
Sever muscular weakness	0 (0.0%)	0 (0.0%)	
3m post-operative			
No affection	6 (100.0%)	6 (100.0%)	
Mild muscular weakness	0 (0.0%)	0 (0.0%)	
Moderate muscular weakness	0 (0.0%)	0 (0.0%)	
Sever muscular weakness	0 (0.0%)	0 (0.0%)	

Fisher's exact test for qualitative data
*: Significance level at P-value < 0.05

Table (4): Assessment of post-operative occlusion in both groups

Occlusion	Group A (n=6)	Group B (n=6)	p value
1w post-operative			0.455
Sever disturbed	0 (0.0%)	0 (0.0%)	
Moderate disturbed	1 (16.7%)	1 (16.7%)	
Minimal disturbed	5 (83.3%)	5 (83.3%)	
Occlusion corrected	0 (0.0%)	0 (0.0%)	
3w post-operative			0.455
Sever disturbed	0 (0.0%)	0 (0.0%)	
Moderate disturbed	0 (0.0%)	0 (0.0%)	
Minimal disturbed	1 (16.7%)	1 (16.7%)	
Occlusion corrected	5 (83.3%)	5 (83.3%)	
3m post-operative			
Sever disturbed	0 (0.0%)	0 (0.0%)	
Moderate disturbed	0 (0.0%)	0 (0.0%)	
Minimal disturbed	0 (0.0%)	0 (0.0%)	
Occlusion corrected	6 (100.0%)	6 (100.0%)	

-Fisher's exact test for qualitative data
-*: Significance level at P-value < 0.05

Table (5): Comparison of bone density between study groups

		Group A (n=6)	Group B (n=6)	p value
Normal bone density	Median (IQR) Mean±SD	1086.5 (1061-1126) 1096.7±45.9	1108 (1057-1139) 1105.5±67.2	0.749
After 3 months	Median (IQR) Mean±SD	605.5 (573-653) 605.2±46.5	624.5 (589-756) 648.2±96.3	0.521
After 6 months	Median (IQR) Mean±SD	988.5 (921-1052) 986.5±80.3	1027 (982-1042) 1029±77.5	0.522
P value (After 3m vs normal bone)		0.028*	0.028*	
P value (After 6m vs normal bone)		0.046*	0.028*	
P value (After 3 m vs 6 months)		0.028*	0.028*	

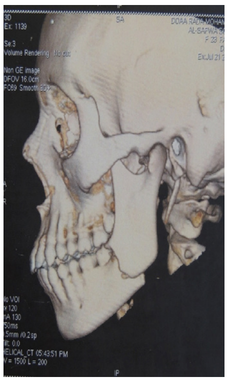
Mann-Whitney U test for comparison of bone density between groups,
Wilcoxon Signed rank test for comparison of bone density within groups
*: Significance level at P-value < 0.05

Table (6): Comparison of operating time between study groups

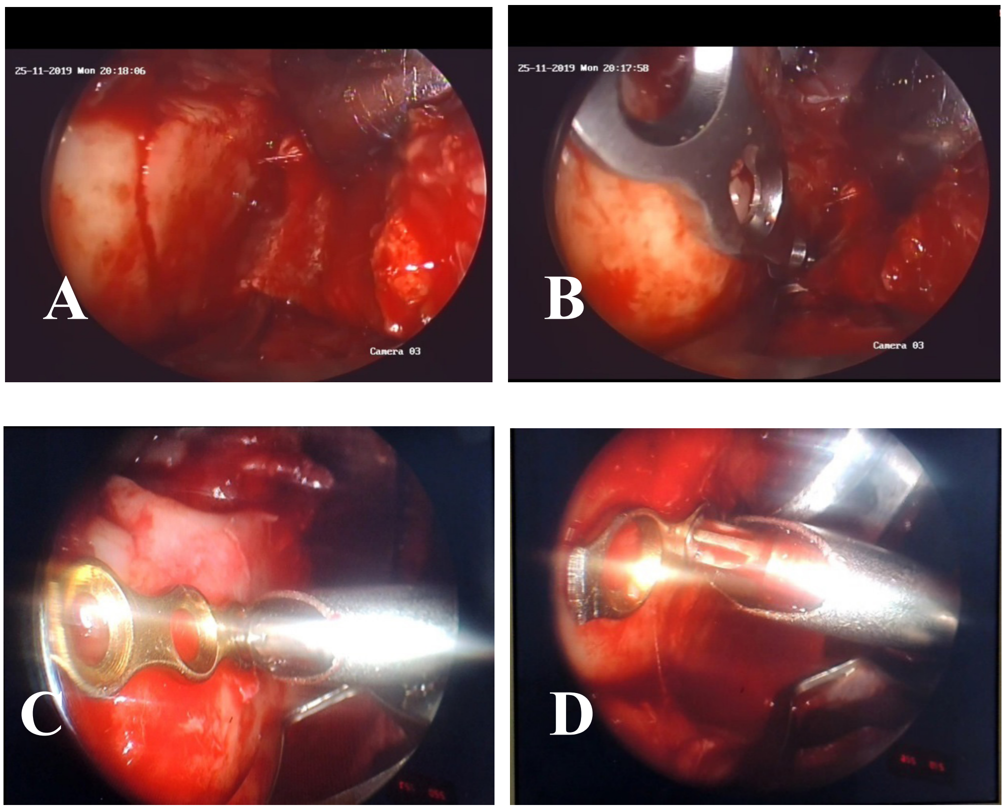
	Group A (n=6)	Group B (n=6)	p value
Operating time Median (IQR) Mean±SD	128.5 (121-131) 127.7±6.9	263.5 (259-270) 261.7±12.1	0.004*

ZMWU,Z value of Mann Whitney U test
*: Significance level at P-value < 0.05

Figure (1): preoperative 3D image computed tomographic of left mandibular angle fracture.



Figures (2): A photos showing ORIF of the mandibular angle fracture in group A.



Figures (3): A photos showing ORIF of the mandibular angle fracture in group B.

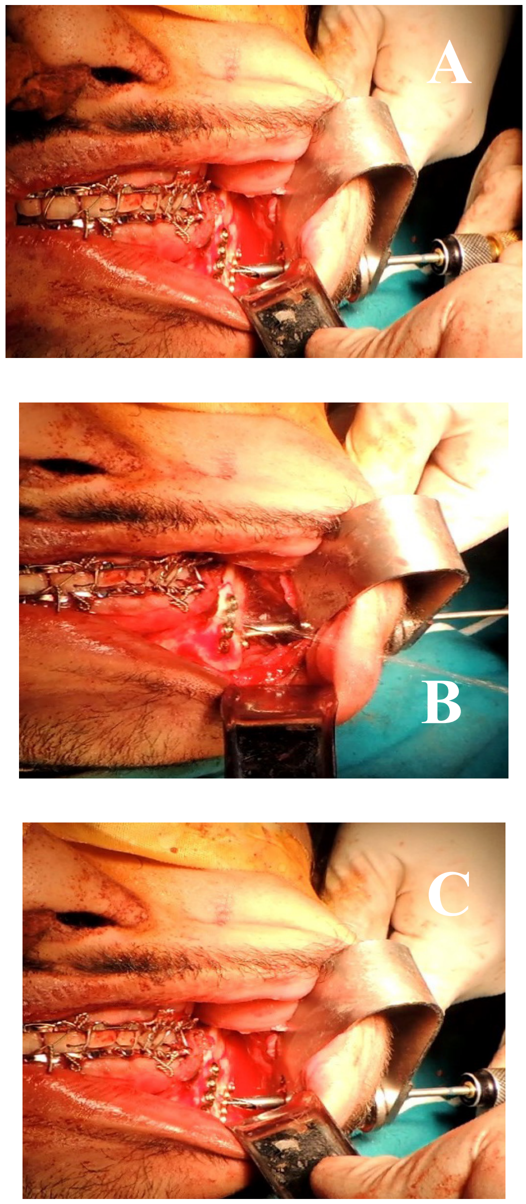
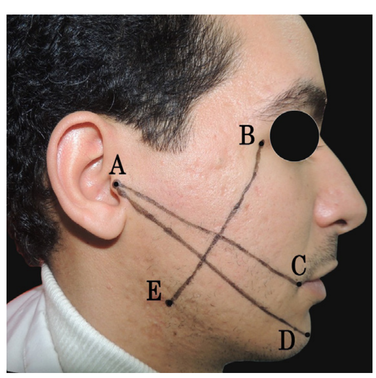


Figure 4: clinical photograph showing 3 line measures of edema



DISCUSSION

Mandibular angle fractures represent a common fracture site that occurs in a wide range of incidence about (25 to 33%) of cases. the forces between the muscles of mastication and the supra-hyoid group of muscles resulting resulting in unstable rotation of distal and proximal fragments of the mandibular angle.

The optimal treatment approach for repair of mandibular angle fractures continues to be a topic of debate and research.[20] Untreated or improperly managed mandibular angle fractures can result in serious consequences in terms of poor occlusion, neural affection, and reduced mouth opening. Early recovery of mandibular function is a clear benefit in the treatment of mandible fractures.[21] Randomized controlled trials (RCT) were very limited in the literature. Thus we planned our study to compare the reliability and out come of (EAORIF) versus CORIF approach in the management of mandibular angle fractures in a randomized controlled manner. [22]

ORIF ensures that immediate function, restoration of mandibular vertical dimension, facial symmetry and improved mandibular mouth opening as immediate anatomic restoration. There are many techniques for ORIF either extra oral approach or transbuccal one. The most common complications related to extra oral approaches are facial scars and the risk of facial nerve injury. The single biggest concern remains facial nerve damage To counteract these disadvantages, an alternative method called the transbuccal approach was proposed. [21 - 23] that technique facilitated the introduction of the plating system to fixate fracture segments. At the same time, it allowed a more esthetic outcome, with little or no risk of facial nerve affection and less strain on the soft tissues during treatment. However, that technique was proved to be valuable in most mandibular angle fractures cases. It is quite challenging regarding visibility during the reduction of fractured segments.

The current study tried to standardize the research methods to our best effort. Considering the randomization technique, the study was conducted on 12 patients randomly divided into two equal groups. Therefore we used the scaled envelope method as an effective randomization technique. [17] The study who found through a meta-epidemiological approach that sealed envelopes with some form of enhancement (opaque, sequentially numbered, and so forth) may give adequate concealment when compared with more sophisticated methods of allocation concealment.

Our study showed that utilization of this minimally invasive technique is beneficial to patients due to decreased soft tissue strain, faster recovery, and discharge from the hospital, less visible scars with smaller incisions, direct visualization with excellent illumination of the field and reduced complications such as neural affection.

We didn't use 90 degrees screwdriver instead of puncturing the skin to obtain a port for the drilling and screw placement because of limited accessibility in the angular region which was provided by the transbuccal trocar. There were no statistically significant differences in the distribution of grades of nerve function between both groups and the neural affection resolved in all patients at three month post-surgery. all patients experienced mild to moderate pain within the first week postoperatively in group A and group B respectively, but these pains began to decline to become mild pain after three weeks of surgery in group B and no pain in group A, While 100% of all patients reported complete pain relief after three months of surgery.

So endoscopic assisted for transbuccal approach would result in minimal pain than the conventional technique. [20] Facial edema is a common sequelea of most oral and maxillofacial surgeries that should be considered. Discovery of a significant difference between the two treatment groups can offer an advantage of the EAORIF over the CORIF represented another cause to measure post-operative edema. There are several methods used in literature to methods we adopted the 3 lines method to assess facial edema. The simplicity and reliability of this method prompted us to elect it from the other sophisticated techniques. This technique was quoted from another study that compared postoperative edema in dentoalveolar surgery. [18]

In our study there were rapid resolution of facial edema at patients treated by EAORIF over the CORIF at three weeks postoperative and it was statistically significant; the reason for this result may be less strain on the soft tissues and manipulation during reduction intra-operatively as the endoscope aid in visualization and management Dental malocclusion was determinant at the time of clinical examination. One week post-surgery the dental occlusion returned to normal in all patients of both groups which was considered as an indicator of the anatomical reduction of the fractured angular segment in both groups. When measured bone density by the Hounsfield unit with using CT program for bone density measure; fixed one point at the follow-up and period by using a normal structure as a reference point for each patient. Bone density after three and six months of surgery was statistically significant from the density of the normal bone in both groups

In group A, median bone density after three months post-surgery was 605.5 and increased to 988.5 at six months post-surgery (p= 0.028). In group B, median bone density after three months post-surgery was 624.5 and increased to 1027 at six months post-surgery (p= 0.028). There were no significant differences in post-operative bon density between the two groups. Timing consideration of the current study was encountered in terms of time elapsed between clinical and radiographic diagnosis and surgery and duration of the surgery itself. Regarding the timing of surgery, patients of both groups were operated two to eight days after the day of the clinical presentation with an average of 4.5 days for the first group and 5.7 days for the second group. This interval times were similar to most of the studies. While the duration of surgery came in favor of fractures that treated by EAORIF. This result was comparable to those reported in similar studies [22]. Endoscopic-assisted (group A) was fast than a conventional technique (group B). Using endoscopy allowed several advantages over the traditional ORIF. The greatest benefit of this technique is the ability to eliminate any compromise in the reduction of the fracture and the placement of hardware.

This is because the element of working in a dark and small access site is eliminated. Also, the entire operating room staff can have their full attention on the monitors. This keeps the staff attentive and provides the ability to predict the instrument needs efficiently. The positioning of the hardware is the most difficult aspect in the repair of an angle fracture. The challenge of placing the inferior border plate in the correct position is often compromised in the CORIF group without using an endoscope to visualize this. By using an endoscope, visualization of the fracture is obvious and clear. The surgeon can ensure that plate placement is accurate, and the screw placements can be drilled at an angle without compromise. Using this technique, little counter pressure is placed on the bone while drilling or screwing, and the amount of retraction on the soft tissue is minimal because visualization is by way of the LED screen. [20]

CONCLUSION

From the current study, we can conclude that two techniques are comparable regarding healing at 3 and 6-month yield realizes results. However, EAORIF can speed up the operation time and facilitate the precise placement of plates and screws. It can decrease edema at 1 week to 1-month postoperatively.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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