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MANAGEMENT OF MANDIBULAR ANGLE FRACTURES USING THREE-DIMENSIONAL STRUT PLATE: A COMPARISON BETWEEN TRANSORAL AND TRANSBUCCAL APPROACHES

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ABSTRACT

Aim: To compare between transoral and transbuccal approaches in the management of mandibular angle fractures using 3d-strut plates.

Materials and methods: Ten patients with unilateral mandibular angle fracture with an age range 18-56 years were included in our study. The patients were divided into two groups based on the approach for the 3d strut plate placement and fixation. Group A included 5 patients undergoing open reduction and internal fixation (ORIF) via transoral approach and group B included 5 patients undergoing ORIF via transbuccal approach. Patients were followed up clinically at 1 week, 1 month and 3 months postoperatively and radiographically at 1 week and 3 months postoperatively.

Results: In the transbuccal group patients, extraoral scar evaluation revealed 3 patients (60%) with invisible scar, 2 patients (40%) with barely visible scar after 3 months postoperatively. The mean time of the surgical procedure starting from the first incision till the last suture was 38.4±6.5 minutes for group A and 41.1±5.2 minutes for group B patients. None of the patients in both groups was introduced with malocclusion, facial nerve affection, segmental mobility, wound dehiscence, infections or parathesia during different follow up periods. Radiographic evaluation didn't reveal any kind of hardware failures in the terms of plate fracturing or screws loosening and there was no statistically significant difference in the mean bone density along the fracture line between both groups.

Conclusion: The use of 3d strut plates in angle fractures through transoral or transbuccal approaches resulted in excellent results with no significant difference clinically or radiographically between both approaches. However, The transbuccal approach was our preferred technique due to ease of use, negligible necessity for plate bending and easy placement of the plate in the neutral mid-point region.

KEYWORDS: 3d-strut plates, Transoral, Transbuccal.

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INTRODUCTION

The most common mandibular fracture is the angle fracture which accounts for 30% of all mandibular fractures. [1] The thin cross area at the angle together with the curvatures of the bone and presence of third molar teeth accounts for the high incidence of angle fractures.[2] The most common etiological factors for mandibular angle fractures are road traffic accidents, falls, assaults and sport injuries. [3]

Various treatment modalities have been introduced for the management of angle fractures including inter-maxillary fixation, wire osteosynthesis, single superior border miniplate, single inferior border rigid plate, double miniplates and lagscrews; however, the ideal treatment modality remains a controversial. [4-7]

Three-dimensional (3d) strut miniplates have been recently introduced in the management of various mandibular fractures.[8] The term three-dimensional is a misnomer because the plate itself is not three-dimensional, but it resists the forces over the fracture line in three dimensions including torsional, shearing and bending forces. [9]

Several studies reported many advantages for the 3d-strut plates compared to standard miniplates and rigid reconstruction plates.[10, 11,12,13,14] Less time and costs are associated with the 3d-strut plates due to fewer number of plates and screws used for fracture fixation compared to the rigid plates.[15] The 3d-strut plate provides better bending stability and better resistance to the torsional forces compared to the conventional miniplates.[16] The 3d-strut plate is easy to adapt over the fractured segments because of its malleability which requires little or no additional contouring.[11]

The traditional approach for plate fixation was the extraoral approach. Although this approach provides better visualization of the surgical field with direct application of the plates and screws, it results in an unaesthetic skin scar and an increased risk of facial nerve injury.[17]

To overcome the disadvantages of the extraoral approach, two alternative approaches were introduced for plates and screws fixation. The transoral approach through an intraoral mucosal incision[18] and the transbuccal approach through intraoral mucosal incision plus small extraoral skin incision which allows the insertion of a transbuccal trocar.[18, 19, 20]

MATERIALS AND METHODS

Ten patients with unilateral mandibular angle fracture with an age range 18-56 years were included in our study. The patients were divided into two groups based on the approach for plate and screws fixation. Group A included 5 patients undergoing open reduction and internal fixation (ORIF) via transoral approach and group B included 5 patients undergoing ORIF via transbuccal approach.

Patients with unilateral mandibular angle fractures not associated with any other mandibular fractures were included in our study. Patients with uncontrolled systemic conditions, medically compromised patients, patients with displaced fracture segments more than 5mm and those presented with infections or comminuted fracture were excluded from our study.

Preoperative panoramic radiographs and CT scans (Fig.1) were performed for all the patients. Complete lab investigations were performed and Erich arch bars was applied for the maxillary and mandibular teeth one day before surgery.

Surgical procedure was performed under general anesthesia with nasotracheal intubation. In group A, after administration of local anesthetic 4% Articaine hydrochloride with epinephrine 1:100,000 at the surgical site, an incision was performed starting from the anterior border of the ramus and extending anteriorly above the level of the junction between

the attached mucosa with the vestibule by 5mm to end at the mandibular first molar area. The mucoperiosteal flap was then elevated exposing the fractured bony segments (Fig.2)

Reduction of the fractured segments was performed visually followed by establishing adequate occlusion and holding it in place via intermaxillary fixation (IMF). Extraction of teeth in the fracture line was performed whenever indicated. The fractured segments were fixed using a 4 holes, 2.0mm 3d-strut plate secured in place with monocortical screws (Fig.3, 4).

After plate fixation, the IMF was released and reproducible occlusion was checked. The surgical field was irrigated followed by suturing of the flap using 3.0 vicryl sutures.

In group B patients, in addition to the intraoral incision, a small extraoral skin incision guided by the location of the fracture line and the facial nerve was performed. The transbuccal trocar was inserted through the skin incision and advanced with blunt dissection until it perforates the periosteum at the proposed area of plate fixation (Fig.5). The same procedure for reduction of the fracture was carried out as in group A patients. Drilling of the holes and fixation of the screws was performed through the drill guide of the transbuccal trocar followed by removal of the trocar and suturing the skin using 5-0 polypropylene sutures.

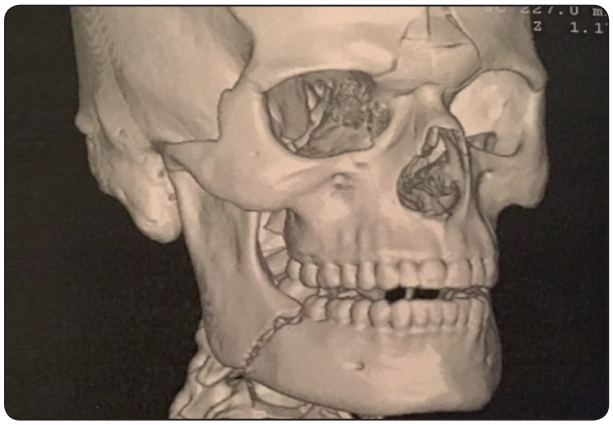

Fig. (1) 3d CT scan showing unilateral mandibular angle fracture with less than 5mm displacement between fractured segments.

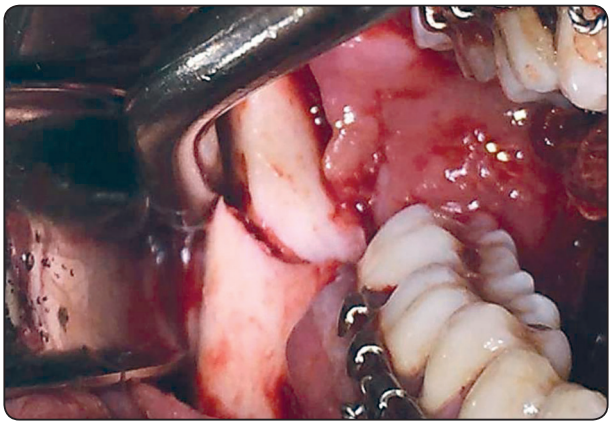

Fig. (2) Showing exposure of mandibular angle fracture

Fig. (3) Showing 4 holes 2.0mm 3d strut plate.

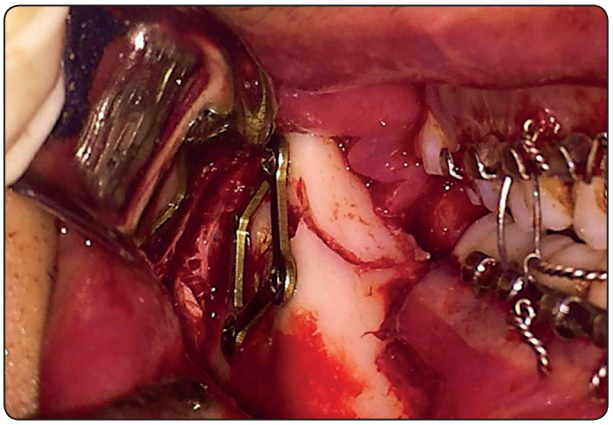

Fig. (4) Showing fixation of the angle fracture using 3d-strut plate.

All the patients in both groups received intravenous antibiotics from admission until discharge followed by prescribtion of oral antibiotics for 4 days. Patients were dismissed without IMF and were instructed to be on liquid diet for 1 week followed by soft diet for further 4 weeks.

Patients were followed up clinically at 1 week, 1 month and 3 months postoperatively in terms of; Wound dehiscence, infection, trismus, occlusion and segmental mobility.

Radiographic examination was performed with CT scans 1 week postoperatively (Fig.6) to assess any hardware failure and with panoramic radiographs [Orthotomograph OT100, Instrumentarium Imaging, GE corporation, Finland] after 1 week and 3 months postoperatively (Fig. 7) to measure the bone density at the fracture line.

The software of the digital panorama was used to calculate the mean grey values along the fracture line between two fixed points. The mean grey value along each line was determined and the total mean bone density for all the patients in each group was calculated and included in the statistical analysis.

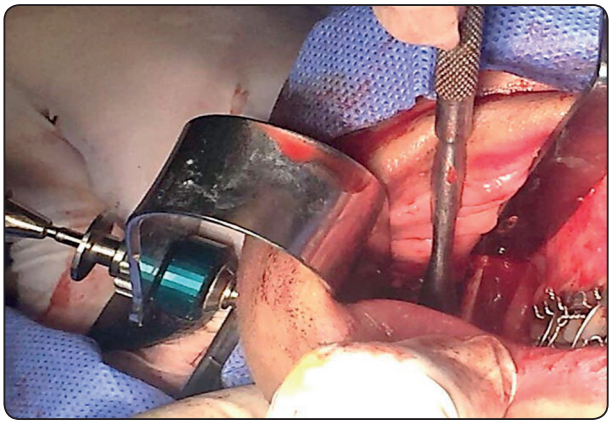

Fig. (5) Showing the transbuccal trocar

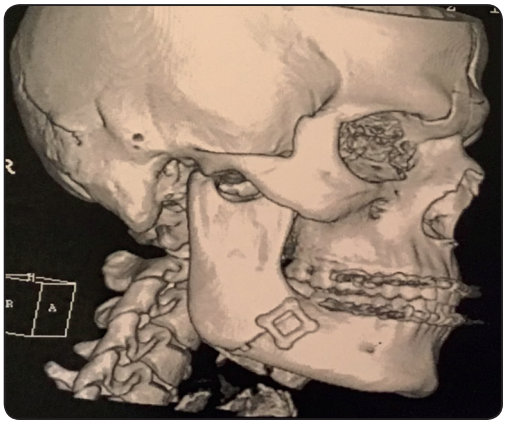

Fig. (6) 3d CT scan showing fixation of angle fracture with 4 holes 3d-strut plate one week postoperatively without any hardware failure.

Fig. (7) Panoramic radiograph showing fixation of angle fracture with 4 holes 3d-strut plate.

RESULTS

Ten patients (7 males and 3 females) divided into 2 groups were included in our study. Group A included 4 males and 1 female with a mean age of 29.1±4.2 years and group B included 3 males and 2 females with a mean age of 35.8 ± 3.7 years.

The mean time from the trauma till the admission was 5.4±2.7 days for group A and 4.1±3.5 days for group B patients.

Five patients in both groups had a tooth in the line of fracture preventing adequate reduction. Three lower wisdom teeth were extracted in group A patients while two wisdoms were extracted in group B patients.

The mean time of the surgical procedure starting from the first incision till the last suture was 38.4±6.5 minutes for group A and 41.1±5.2 minutes for group B patients. There was no statistically significant difference between the two groups.

In the transbuccal group patients, extraoral scar evaluation revealed 3 patients (60%) with invisible scar, 2 patients (40%) with barely visible scar after 3 months postoperatively.

The mean maximum mouth opening (MMO) for the patient in each group was measured and there were no significant difference between both groups during different follow up periods (Table.1).

TABLE. (1) Showing the mean maximum mouth opening for the patients in group A compared to group B during different follow up periods.

	Group A Mean MMO in mm	Group B Mean MMO in mm
Preoperatively	17.6±3.1	19.4±5.7
1 week	24.5±4.6	22.4±6.1
1 month	38.9±3.2	36.5±4.5
3 months	39.3±2.2	38.8±3.6

None of the patients in both groups was presented with any signs of malocclusion, facial nerve affection, segmental mobility, wound dehiscence, infections or parathesia during different follow up periods.

Radiographic evaluation didn't reveal any kind of hardware failures in terms of plate fracturing or screws loosening. There was no statistically significant difference in the mean bone density along the fracture line between both groups after 1 week and 3 months postoperatively; however there was statistically significant difference in the bone density within each group from 1 week to 3 months postoperatively (Table.2).

TABLE. (2) Showing the mean bone density between group A and group B after 1 week and 3 months postoperatively.

	Group A mean bone density	Group B Mean bone density
1 week	109.9±21.3	115.4±33.5
3 months	137.2±26.8	144.6±39.7

DISCUSSION

In the present study, a total of five wisdom teeth were present in the fracture line and were extracted in order to achieve adequate reduction of the bone segments. This agrees with the finding of Barry et al [21] reporting that the presence of impacted third molars in the fracture line may interfere with ideal fracture reduction and may lead to postoperative infection and nonunion.

In our study, none of the patients in the transbuccal group suffered from facial nerve palsy. This is in agreement with Wan et al [18] and Sugar et al [22] reporting that no incidents of facial nerve palsy was recorded following transbuccal approach for plate fixation. However, this disagrees with the findings of Gear et al [23] reporting that the use of the transbuccal approach is not a preferable technique

due to the presence of theoretical risk of damage to the facial nerve.

In this study, the mean age of the patients in the transoral group was 29.1±4.2 years and in the transbuccal group 35.8 ± 3.7 years. A total number of 7 males and 3 females were included in the study. These findings were found to be in agreement with the results of Kumar et al [24] reporting that the highest incidences of fractures occur in the second and third decades of life. Our results also agrees with Meisami et al [25] reporting that angle fractures was found to occur more in male patients and most commonly occur during the 3rd decade of life.

There was no statistically significant difference between the transoral and the transbuccal approaches concerning the mean time of the surgical procedure starting from the first incision till the last suture. This result contradicts the findings of Sugar et al [22] and Gear et al [23] who reported a significant increase in the surgical time with the transbuccal approach compared to the transoral approach.

In the present study, no wound dehiscence or infection was present in any patient in both groups. This is in agreement with other studies [26, 11, 27, 28, 29] reporting that less wound dehiscence and infection were associated with the 3d plating systems when compared to other plating systems and attributed the occurrence of dehiscence to the proximity of the plate to the incision line which doesn't occur with the 3d-strut plates as it is placed at the buccal cortex of the mandible and covered with the masseter muscle away from the incision line.

In our study, no malocclusion was observed in any patient after fracture fixation with 3d-strut plate through transoral or transbuccal approaches. This coincides with the findings of Singh et al [28] and Goyal et al [30] reporting that 3d plating systems are associated with high chances of achieving good occlusion compared to single miniplate techniques which are associated with up to 20% of malocclusion.

In the transbuccal group patients, extraoral scar evaluation revealed 3 patients (60%) with invisible scar, 2 patients (40%) with barely visible scar after 3 months postoperatively. This agrees with Wan et al [18] reporting that only one patient out of 227 patients was presented with hypertrophic scar following transbuccal approach. Also our results agree with Sugar et al [22] reporting that no incidence of unsatisfactory facial scarring occurred in 84 patients treated through transbuccal approaches.

In this study, no radiographic evidence of plate fracture was observed in any patient in both groups. This coincided with the findings of Farmand and Dupoirieux [15] reporting that in 95 cases of body fractures fixed with 3d-strut plates, only one plate fracture was recorded. The fracture resistance of the 3d plates was attributed to its better bending stability, better torsional forces, malleability and easy adaptaion which require little or no additional contouring.

This study compared between the bone densities following fracture fixation with 3d-strut plate through transoral or transbuccal approaches to evaluate fixation stability and there was no statistically significant difference in the mean bone density between both groups after 1 week and 3 months postoperatively. This is consistent with the study performed by Omezli et al [31] comparing between the screw angulation and reference lines during plate fixation through transoral and transbuccal approaches which resulted in no statistically significant difference between the two approaches in terms of fixation stability.

CONCLUSION

The use of 3d-strut plates in angle fractures through transoral or transbuccal approaches resulted in excellent outcomes with no significant difference clinically or radiographically between both approaches. However, the transbuccal approach was our preferred technique due to ease of use, negligible necessity for plate bending and easy placement of the plate in the neutral mid-point region.

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