



## EFFICACY OF OPEN REDUCTION INTERNAL FIXATION IN MANAGEMENT OF MINIMALLY DISPLACED UNILATERAL MANDIBULAR ANTERIOR FRACTURE BY TWO PLATE AND SINGLE PLATE WITH ARCH BAR: A COMPARATIVE STUDY

### Dental Science

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### ABSTRACT

This comparative study was conducted on dentate minimally displaced mandibular anterior fracture patients, treated by open reduction and internal fixation (ORIF) by mini plates and screws in two Groups. Group-A, patients treated by one plate fixation with tension banding by an arch bar in place of second plate to provide effective stabilization of fracture segments and Group-B patients, treated by two plate fixation.

Aim was to evaluate an arch bar as tension band in comparison with tension band plate to reduce implant material and minimize implant related post-operative complications, with provision of an alternative technique for mandibular osteosynthesis. Further, patients were also evaluated for infection, malocclusion, stability, and radiographic evaluation for anatomical reduction post operatively at different intervals (1<sup>st</sup> week, 1<sup>st</sup> month, 3<sup>rd</sup> month).

Malocclusion was a more common finding in Group-A patients when compared with Group B patients. Group-A patients were further managed by intermaxillary fixation for 2 weeks for mobility of segments whereas no such complications were found in patients of Group-B.

### KEYWORDS

Mandibular fracture, erich arch bar , tension band

### INTRODUCTION

Open reduction of fractures of mandible has evolved significantly from wire osteosynthesis with intermaxillary fixation to rigid internal fixation. Now a days, different methods of open reduction and internal fixation (ORIF) are present which include:-miniplates, Dynamic compression plates (DCP), Eccentric dynamic compression plates (EDCP), Bio-resorbable miniplates & 3-D miniplates.

Champy's popularized that the treatment of mandible fracture is done by the fixation of miniplate. All study mode present till date have suggested fixation at two point's i.e two plates and suggested that it provide better stability than a single plate. Champy suggested that when the plates are placed along the ideal line of osteosynthesis they give maximum stability and proper osteosynthesis. ORIF with miniplates and screws has proven to be the most effective method, associated with minimal morbidity, early mobilization and return to work.

Champy and colleagues advocated the use of 2 mini plates anterior to the mental foraminae. in the symphysis and parasymphysis regions. In this study the minimally displaced anterior mandible fracture is treated by various methods ie by single plate with arch bar which acts as a tension band and the another method by two plate and in the both methods has advantages and disadvantage as the patient is treated with single plate has an advantage of reduced hardware, roots can be preserved but disadvantage is the duration of IMF was done for 1-4 weeks depends on severity of displacement of fracture which causes great patient discomfort, speech difficulties, weight loss, local effects such as gingivitis, and the rate of recovery to normal masticatory function is generally slower and the patient was treated with two plate has a disadvantage of use of foreign bodies which is common cause for infection during plating roots can be hinged and the advantage are duration of IMF is decreased and got good stability .

Our study aims to evaluate post-operative Infection, Malocclusion, Stability, and Radiographic evaluation for anatomic reduction.

### MATERIAL AND METHODOLOGY

#### INCLUSION CRITERIA

- Age more than 18 years.
- Unilateral minimally displaced fracture in anterior mandible ( mental foramen – mental foramen ) was selected for this study

- Patients with complete dentition
- Patients who were willing to participate in this study

#### Exclusion criteria

- Patients with comminuted mandibular anterior fracture
- Patients with panfacial injury or polytrauma cases
- Medically compromised patients
- Patients with condylar fracture
- Edentulous patients

Study plan/ Sample size- With the clearance of the ethical committee this randomized prospective study was conducted in the Department of Oral & Maxillofacial Surgery on 20 patients of unilateral minimally displaced mandibular anterior fracture who had undergone open reduction internal fixation under local/general anaesthesia.

This randomized prospective study was conducted on 20 trauma patients having unilateral minimally displaced mandibular anterior fracture without any systemic disease Proper case history was taken and all clinical and radiological examination was done to achieve the diagnosis of minimally displaced mandibular anterior fracture. Patient was advised for all haematological investigation, all patients were explained in detail about the surgical procedure and informed consent was taken before surgical procedure. Patients were randomly divided into two group of 10 patients each i.e. Group A and Group B. Preoperatively all patients underwent Inter maxillary fixation under local anaesthesia.



### ARMAMENTARIUM

**SURGICAL APPROACH**

Standard instruments were used for the management of fracture. Under proper aseptic condition patient was painted with 2% providine iodine intraorally and extraorally and draping was performed followed by infiltration with 2% lignocaine (1: 80,000) at surgical site. An intraoral mandibular vestibular degloving incision was used and curvilinear (vestibular) incision

**ARMAMENTARIUM**

5 mm apical to the mucogingival junction was given. The mentalis muscle was exposed and incised perpendicular and deep to the bone, leaving a flap of muscle attached to bone for closure. A full thickness mucoperiosteal flap was raised carefully keeping the mental neurovascular bundle intact. If the existing cut lacerated wound was present extraorally then that was used to expose the fracture site.

After obtaining adequate exposure of the fractured segments, the segments were manipulated and satisfactorily reduced. After reduction of the fractured segments, temporary intermaxillary fixation was done to achieve the satisfactory occlusion and fixation of the fractured segment was achieved by using single 2.0 mm (4 hole with gap) conventional miniplate with 2.0 mm x 8.0 mm screws in group A patients and group B patients are treated by 2.0 mm, 4 holes with gap miniplate was adapted and fixed with using 4 screws (2.0 mm x 8.0 mm) 5 mm above the lower border of mandible and a second 2.0 mm, 4 hole with gap miniplate was adapted and fixed using 4 screws (2.0 mm x 6.0mm) above at the distance of 5mm from the first miniplate below the root apices of teeth. Adequacy of stability and occlusion were rechecked after miniplate fixation.

The area was irrigated with Betadine & saline and adequate hemostasis was achieved. The deeper layers of the wound was closed using 3-0 Vicryl and mucosal layer was closed with 3-0 silk. Intermaxillary fixation was released and an adhesive pressure bandage was given extraorally Radiograph was taken postoperatively to check the adequacy of reduction and fixation. After discharge the patient were recalled on the 1<sup>st</sup> week, 1<sup>st</sup> month, 3<sup>rd</sup> month and respectively. However patient were also instructed to report for any complaint post operatively any time. On each appointment apart from the routine examination and wound care, occurrence of complications (like soft tissue infection, malocclusion, stability, radiographic evaluation) were checked.

**Outcomes-**

In the present study patients were evaluated clinically as well as radiographically to determine the success or failure by assessing certain parameters such as, presence of infection, malocclusion, stability, and radiographic evaluation of anatomic reduction.

Infection was determined by the extent of pus discharge, exposure of plate and dehiscence of wound. For Malocclusion Maximum interdigitation, Midline relationship, Molar relationship, Canine relationship, Attrition wear facet relationship, Patient complain of difficulty in mastication were observed. Postoperative segmental stability was evaluated by **bimanual method**. The presence or absence of movement in fracture segment was marked.

Post-operative OPG was taken at first postoperative day, 1 month and 3 month post operatively for evaluation of anatomic reduction.

**Statistics**

Data was subjected to statistical analysis using SPSS version 16. Comparison of study groups based on post-operative evaluation of infection, malocclusion, stability, and radiographs was done using Independent t test; p<0.05 was considered to be statistically significant.



**Patient with Single Miniplate**



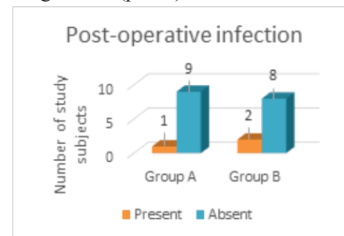
**Patient with Double Miniplate**

**RESULTS**

The patients were divided into two groups (Group A and Group B) of 10 patients each.

**Postoperative Evaluation of different Parameters Infection:**

On comparing the study groups based in occurrence of post-operative infection it was found that only 1 subject in group A and 2 subjects in group B presented with post-operative infection. This difference was statistically not significant (p>0.0)

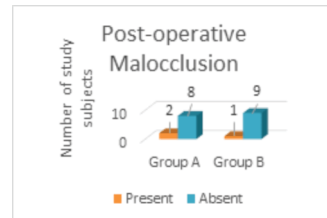


**Graph 1: Showing the Post-Operative Infection**

In group A infection was seen in one patient on postoperative week that was successfully managed by antibiotics and irrigation. In group B infection was seen in two patients as suppuration and exposure of plate on 16<sup>th</sup> and 24<sup>th</sup> post op day respectively which was managed successfully by local wound debridment and antibiotic therapy.

**Malocclusion:**

When the occurrence of post-operative malocclusion was compared, 2 subjects in group A and 1 in group B were found to have malocclusion. This difference was statistically not significant (p>0.05)

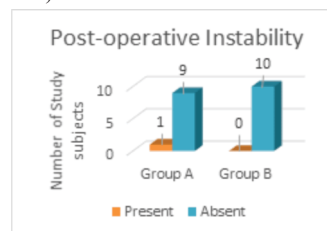


**Graph 2- Post operative malocclusion**

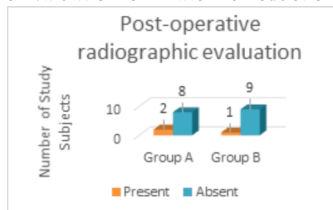
One patient from group A and one patient from group B presented with malocclusion which were successfully managed by guiding elastics for one week and one patient from group A required selective grinding of molar on one side.

**Stability:**

Table shows the comparison of study groups based on post-operative instability. It was found that there was no instability among the study subjects in group B whereas only 1 subject showed instability in group A that was successfully managed by intermaxillary fixation for 2 weeks. The difference in post-operative instability was statistically not significant (p>0.05).



**Graph 3- Post-operative instability**

**Radiographic Evaluation for Anatomic Reduction:****Graph 5- Post-operative Radiographic Evaluation for Anatomical Reduction**

Post-operative radiographic evaluation showed mild discrepancy at inferior border in 2 patients of group A and in one patient of group B. This difference was statistically not significant ( $p > 0.05$ ).

**DISCUSSION**

Champy *et al*<sup>2</sup> describe the ideal line of osteosynthesis in which the system of semirigid fixation with screws and miniplates were introduced by champy's and his associates. According to his technique if the miniplate are placed along the ideal osteosynthesis they tend to provide good stability and osteosynthesis. It consisted of monocortical, juxta alveolar, and subapical osteosynthesis without compression and intermaxillary fixation using miniaturized malleable plates.<sup>1,3</sup> If the fracture site is distal to mental foramen the technique suggested is the use of a single miniplate in the sub apical region or against the external oblique ridge. However if the fracture are proximal to foramina two miniplate should be used to counter the torsional forces. This inter maxillary fixation will acts as second line of resistance to counter load anterior to the fracture line.

Sami SM *et al*<sup>4</sup> did a study using champy's principle on nine comminuted symphyseal/ parasymphiseal fracture they suggested that good surgical outcome can be achieved with the application of two miniplate with monocortical screws. In order to eliminate the use of other plate at superior border<sup>4</sup>, arch bar that is used for intermaxillary fixation can be used as a tension band. With this concept in mind we planned our study to compare and analyze the results between two groups using either single plate with lower arch bar and two plates according to Champy's principle in 20 patients with unilateral mandibular anterior fracture. These patients were randomly divided into 2 groups of 10 patients each.

Thus in group B we used two miniplates and compared the effects with the group A in which lower arch bar acted as a tension band. In our study postoperatively in group A 1 (10%) patients and in group B (20%) patients had occlusal discrepancy which was corrected by giving guiding elastic for 5-7 days. In second (1st month) & third (3rd month) visit, there were no occlusal discrepancy in both groups. Our study similar to other study as Alpert B *et al*<sup>5</sup> miniplate osteosynthesis should be perfectly adapted to the underlying bone to prevent alteration in the alignment of the segments and changes in the occlusal relationship. Malocclusion recorded was 6% in a study by Sauerbier S *et al*<sup>6</sup> in which 2mm locking plating system was used, 4.4% in a study by Moreno *et al*<sup>4</sup>, which was based on Champy's principle. Occlusal discrepancy comparison of both the groups in our study was not significant ( $P = 0.1$ ). In our study there was 15% infection in total, one patient (10%) belonging to group A, and two patients (20%) in group B. Infection in both groups were resolved with the help of normal saline irrigations & antibiotics prescribed for 7 days which lead to satisfactory healing. Hussain S.<sup>8</sup> favours the assumption that reduction of implanted material has minimized procedural errors and has facilitated easy adaptation of one plate at selected mandibular fracture. The incidence of infection after comparison of both the groups in our study was not significant. Infection rate of 3% to 27% has been reported in previous studies with the use of metal plates and screws for the treatment of mandibular fractures. Hussain S<sup>5</sup> stated the mobility of fractured segments have been the most common technical cause of infection. Technical errors, like inadvertent placement of screws in the line of fracture, poor plate adaptation or contouring, in adequate cooling during preparation of holes for insertion of screws, increase the risk of postoperative infection. Champy M *et al*<sup>7</sup> and Orringer JS *et al* stated the technique failure was proved to be a frequent event in the application of rigid internal fixation devices to mandible fractures. Lack of antibiotics used is considered as a predisposing factor for infection, so the use of antibiotics, as prophylaxis as well as after surgery has been advocated in routine.<sup>7</sup> In our study, we routinely

prescribed Intravenous followed by oral antibiotics to all our patients. Manor Y *et al*<sup>5</sup> and Orringer JS *et al* have accepted tooth in the line of fracture as a major risk factor for infection.

Preoperatively all patients of group A and group B had mobility of the fracture segment. In our study, Postoperative (10%) segmental mobility was evident in group A compared with group B (0%). Segmental mobility was also reported in 10% cases in a study series of 20 patients by Jain *et al*.<sup>6</sup> In a biomechanical comparison study by Alkan *et al*, it was concluded that stability is better with single miniplate with Erich arch bar system. All biomechanical tests in which a second miniplate had been fixed to the mandibular margin revealed less mobility according to Ellis and Walker<sup>7</sup>. By the end of 1st & 3rd month postoperatively none of the patients in both groups showed any mobility in the fracture segment. In the present study groups, radiographic follow-up was maintained until 3 months to evaluate anatomic reduction. The radiographic evaluation of fracture at different times showed that 2 (20%) of the patients belonging to group A and 1(10%) patients in group B showed distraction of the lower border of the mandible. Our study was similar to Saluja H *et al*<sup>24</sup> studied, which demonstrated radiographically that almost equal number of patients in both the groups had inferior border discrepancy/distraction. The results of our study are in accordance with this study. In a study by Renton TF *et al*, comparing the technique of mandibular osteosynthesis following and ignoring Champy's principle, it was concluded that the use of single stainless steel miniplates was an effective method of treatment for mandibular fracture especially following Champy's principle. In the present study, the results were comparable for both groups following and ignoring Champy's principle. However, adaptation and placement of one miniplate on a limited bone surface was easier, safe, least palpable and less likely to be removed even after healing of bone. There was no complication like infection related to plate, plate exposure or plate palpability as no plate was removed during this study. Postoperative removal of arch bar after four weeks had increased the stresses going to the bone hence had reduced the stress shielding to minimum when compared with double plate fixation system. Utilization of an Arch bar as a tension band has reduced chances of complications related to technical errors during fixation of second plate and screws. It has decreased possibilities of potential complications like stress shielding, Palpability, thermal sensitivity, and others. This technique not only used half of the recommended implanted material but also made it more reliable, cost effective and produced fewer complications. Thus, the outcome of the present study suggested that though the single and double plate fixation provided comparable results in isolated symphysis/parasymphysis fractures, use of single miniplate along with an Erich arch bar for 1-4 weeks depends on the severity of displacement of fracture which acts as a tension band provides several advantages in terms of low morbidity, low infection & low cost. This also reduces the intra-operative time. It is economical for the patient as one miniplate is used instead of two. The use of single miniplate causes minimum injury to the mental nerve in the case of a fracture line running close to the mental foramen.

**CONCLUSION**

Fixation in isolated mandibular symphysis / parasymphysis fracture can be managed either by a single miniplate at the inferior border and utilizing the arch bar as a tension band for 1-4 weeks depending on the severity of fracture or by placing 2 miniplates following Champy's principle. Complication rates were comparable but the distinct advantage of less hardware has made the use of a single miniplate quite popular in the recent times. Rigid fixation by this technique proved to be faster, cost effective, requires less amount of implanted material, fewer problems when compared to double plate fixation. Arch bar fixation provided better control on occlusal stability and made minor occlusal corrections possible post operatively without attempting second surgery. The small sample size and limited follow-up could be considered as the limitations of this study. Further study with larger sample size and long term follow up period is required for establishment of this result.

**Conflicts of interest**

As before this study ethical committee clearance was taken and there was no potential of conflicts regarding this study.

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