Original Article

Single Miniplate versus Two Miniplates in the Management of Mandibular Symphysis Fracture: A Comparative Study

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Abstract

Symphysis fracture of mandibular region is most common fracture due to its prominence. The treatment through miniplates is the modality opted by maxillofacial surgeons, but usage whether single or two miniplates has always been a debatable issue. Thus, we conducted a study on 30 patients, where in 15 patients of Group A – single miniplate was used and in 15 patients of Group B – two miniplates were used in treatment of symphysis fracture of mandible. We found that use of two miniplates was almost the same as compared to conventional single miniplate. The use of two miniplates in mandibular midsymphysis fracture is efficacious enough to bear masticatory loads during the osteosynthesis of fracture. It has greater stability, less precision required in plate adaptation due to the "internal/external fixator," and less alteration in periosteal blood supply and reducing the need and duration of IMF.

Keywords: Mandibular fracture, Single miniplate, Symphysis fracture

Introduction

Fractures of the mandible are more common than that of any other fractures of facial skeleton. This may be attributed to its comparatively prominent anatomical position especially in the symphysis region of the mandibular bone.[1] There are different treatment modalities mentioned in the literature for the fixation of mandibular symphysis fractures in the form of the pin in the groove technique, wires, miniplates, lag screws, three dimensional plates, and the trapezoidal plate. Miniplates are commonly used for the fixation of mandibular symphysis fractures.[2] The large number of studies on the treatment of mandibular fractures reflects the fact that a consensus has not been reached on a single ideal treatment method. The scope of these methods is broad, including wire osteosynthesis, a single superior border miniplate, a single inferior border plate, two plates (one at the superior and one at the inferior border), geometric plates, or a lag screw. Despite developments in the treatment of maxillofacial traumas, there is no agreement regarding the best and standard modality in the management of mandibular fractures. In majority of the centers, open reduction and rigid internal fixation are done using conventional miniplates based on the champy's principle.

Access this article online

Website: www.jrad.co.in

DOI: https://doi.org/10.53064/jrad.2022.13.4.215

Thus, after studying all these facts, we designed a study to evaluate the necessity of plating system in patients of mandibular symphysis fractures strictly according to champy's principle of plating in one group of patients who will be compared with another group of patients who will undergo rigid internal fixation of fractured fragments in symphysis region using single miniplate and arch bar fixation.

Inclusion criteria

The following criteria were included in the study:

1) Patients of mandibular fractures having isolated fracture of symphysis region with or without involvement of the condylar or subcondylar region of the ipsilateral or contralateral side only, without fracture of any other part

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Received: Apr. 03, 2022; **Accepted:** May. 03, 2022; **Published:** Apr. 06, 2022

How to cite this article: Dravid H, Jain N, Pillai AK, Chouhan P, Siddiqui O, Shukla H. Single Miniplate Versus Two Miniplates in the Management of Mandibular Symphysis Fracture: A Comparative Study. J Res Adv Dent 2022;13(4):121-125.

of the mandible (body and angle) will be included in the study.

2) Patients having panfacial trauma, with associated fractures of other bones of the face such as maxilla or with or without injuries of any other part of the body will be included in the study.
3) Only those patients of symphysis fracture of the mandible with or without involvement of the condylar or subcondylar region of the ipsilateral or contralateral side only who underwent treatment with open reduction under appropriate anesthesia in the Department of Oral and Maxillofacial Surgery of Rishiraj College of Dental Sciences and Research Center will be included in the study.

Exclusion criteria

The following criteria were excluded from the study:

1) Patients of mandibular fractures who did not undergo treatment in the department of the institute have not been included in the study.
2) Medically compromised patients will be excluded from the study.

Sample Size 30 patients (15 of Group A and 15 of Group B as categorized above).

Aim

The aim of the study is to compare and evaluate the healing of the fracture site, complications, and clinical results obtained from single miniplate in comparison with two miniplates according to champy's principle in patients of mandibular symphysis fractures.

1) To analyze various clinical parameters such as occlusal stability, post-operative edema, healing of operative site, signs of infection, and stability of reduced fracture segments. Assessment of stability of reduced fracture segments will be done clinically as well as with Orthopantamogram of all 30 patients. The entire operative procedure and evaluation will be done in the Department of Oral and Maxillofacial Surgery at Rishiraj College of Dental Sciences and Research Center.
2) To document the clinical outcomes of single miniplate when compared with two miniplates as per Champy's principle in patients of mandibular symphysis fractures.

Objectives

The objectives of this study were to evaluate SINGLE MINIPLATE Versus TWO MINIPLATES using following parameters:

1. Time taken for plate fixation
2. Primary stability
3. Ease of application
4. Need for MMF
5. Hardware failure
6. Infection
7. Type of Union

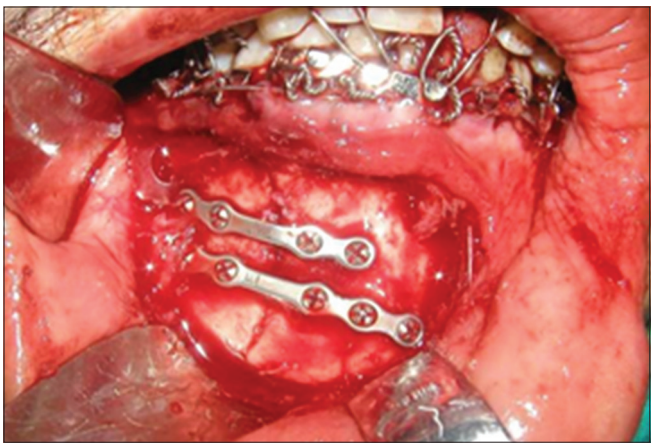
Case photos

Pre-operative orthopantamogram

Operative Photo

Post-operative orthopantamogram

Case 2



Observations and Results

In this study, of 30 patients with mandibular fracture were found to meet the inclusion and exclusion criteria and they were randomly assigned to two groups: Group A consisted of 15 patients and Group B consisted of 15 patients.

Group A patients were treated using a single miniplate (two hole with gap) and 6 mm screws.

Group B patients were treated using two miniplates (two hole with gap 6 mm screws and four hole with gap 8 mm screws). It was found that the results obtained in both Group A single miniplate and Group B two miniplates with IMF were almost similar.

There were 52 (86.7%) males and 8 (13.3%) female patients, with road traffic accident (RTA) 42 (70%) being the most common cause of etiology followed by 11 (18.3%) work related or self-fall and 7 (11.7%) interpersonal violence.

Fracture distribution consisted of Rt. parasymphysis fracture 17 (28.3%) patients followed by symphysis fracture 13 (21.7%) patients, Lt. parasymphysis fracture 9 (15%) patients, Lt. body fracture 7 (11.7%) patients, bilateral parasymphysis fracture 6 (10%) patients, Rt. angle fracture 3 (5.0%) patients, Rt. body fracture 3 (5.0%) patients, B/L body frature 1 (1.7%) patients, and Lt. angle fracture 1 (1.7%) patients.

Discussion

Over the years, the methods to treat mandibular fractures have undergone many refinements. As the saying goes the only permanent thing in this world is change, for the treatment of mandible, new methods have been tried and older ones have had improvements. The strategic position of the mandible on the facial skeleton and its unique role in mastication, deglutition, phonation, and esthetics compels the clinician to give immediate attention whenever it is fractured.

Open reduction and internal fixation (ORIF) of the mandible with bone plates was first described by Schede (1888). General acceptance of open osteosynthesis did not appear in maxillofacial literature until an organized research by AO in 1950. Lur *et al*. derived inspiration from orthopedic biomechanical studies performed by Schenk who suggested accelerated bone healing through compression. Rigid fixation using dynamic compression plate which has its own disadvantages such as requirement of a wide incision, bulky nature of the plates, and the procedure which are technique sensitive according to findings given by Iizuka *et al*. (1991).[1-4] Using a simple cantilever beam model, Gabrielli *et al*.[5] showed that the superior border of mandible was subjected to tension and splaying, and the inferior border was subjected to compression. The transition zone between the areas of tension and compression has been referred to as a "Line of Zero Force" running along the inferior alveolar nerve. Champy's experiment with miniplates, further, delineated the "Ideal Line of Osteosynthesis" with the mandible. Plates placed along these lines were thought to provide optimal fixation and stability.[6-32]

In the present study of fracture patients, the age group most commonly affected was 20–30 years (35%) and it was mainly due to RTAs, that is, 70%. The number of male patients was higher (86.7%) than that of female patients (9%), in accordance with the other studies by Renton.[5,29,31,32] This male dominance was also reported by Hayter *et al*. (1990)[33] who did a 5 years retrospective review of facial fractures and concluded that RTA was the most common reason for the facial fractures. Higher incidence of RTA can be explained by the fact that there are no comprehensive rules for traffic safety in our country as there are

in western countries. This needs to be formulated and strictly enforced. This may be justified by the fact that the males are generally more prone to situations, in which there are higher risk of trauma. RTAs account for majority of cases with 42 (70%) of mandible fractures, work related or self-fall accounts for 11 (18.3%) cases of and 7 (11.7%) interpersonal violence.

Ellis *et al*. found the most common site of fracture to be the body, condyle, and angle depending on the etiology. Our results are inconsistent with any other study.

In this study, time taken for plate fixation is less in Group B followed by Group A and Group C. However, this finding alone cannot prove the higher stability of locking plate system. The severity of displacement of fracture segments and precise anatomical reduction achieved should be taken into consideration for successful treatment.

Bolourian *et al* [4] found that the mean operating time for traditional ORIF with IMF of angle fractures of the mandible was 98.5 min and the mean operating time for ORIF of angle fracture of the mandible without the use of IMF was 40.2 min.

Out of 60, in (68.3%) patients, application was difficult, in (20%) patients, it is very difficult and in 7 (11.7%), it is moderate.

In Group B, application of locking plates is difficult in (90%) patient and very difficult in (10%) patients. In Group C, application of 3D plates is difficult in (70%) patient and very difficult in (30%) patients. In Group C, application of miniplates is moderate in (35%) patients, difficult in (45%) patients and very difficult in (20%). However, ease of application is also based on other findings such as site of fracture and associated fractures.

In a prospective study by Collins *et al*.,[28] the efficacy of the treatment of mandibular fractures using a 2.0 mm non-locking miniplate and 2 weeks of IMF was with a complication rate of 4.52%, whereas infection rate in our study in non-locking group was 15% with post-operative IMF period of 7 days. The higher complication rate in our study cannot be directly attributed to the lesser period of IMF. Other factors related to patient, operator, and surgical technique may also influence the complication rate.

In another study by Gabrielli *et al*[5] on 2.0 mm locking miniplate screw system in the treatment of mandibular fractures with 1 week period of IMF, it was found that a single 2.0-mm locking miniplate placed along Champy's line of ideal osteosynthesis plus 1 week of IMF is a reliable and effective treatment modality for mandibular fractures. Several researchers advocated that post-operative IMF should be done for a period of 2–4 weeks.[28,29]

In our study, it was observed that (43.3%) patients required post-operative IMF. In Group A (35%) and in Group B, (40%) required post-operative IMF. Displacement of fracture and associated condyle fracture was also responsible for post-operative IMF. We recommend post-operative IMF if required for 5 days, which is supported by many other studies Bolourian *et al*[4] and Kirkpatrick *et al*.[6]

As observed in our study, the infection rate was higher in non-locking group 9 (15%) patients; three in Group A and six in Group C, but no such infection/post-operative complication was found in Group B. In patients with persistent infection, it was found that loosening of screws was present on surgical exploration in non-locking group. Hardware failure was noted in 3 (15%) patients in Group A and 3 (15%) patients, no hardware failure was found in Group B.

Total infection rate observed in our study was 15% and similar kind of observations were being recorded in other studies[4,6,30] with the almost similar rate of infection, but in our study, no infection and hardware failure observed in Group B.

Dimitroulis *et al*,[3] a total of 80 fractures in 59 patients were treated with the 2.0 mm locking plate/screw system. About 9% patients developed post-surgical infections.

Kuriakose *et al*. observed in their study that the reasons for plate removal were mainly infection (37.8%), elective (29.7%), and exposed plates (16.3%).

Kirkpatrick *et al*.[6] reported 0.5% incidence of delayed union and non-union in patients treated with small plate osteosynthesis[9] In contrast, we did not experience any problem related to non-union and malunion.

In our study, temporary paresthesia was noted to be present in two patients postoperatively in Group A. The main reason of post-operative paresthesia in Group A was due to need for more tissue retraction to accommodate the drill guide and subsequent placement of perpendicular screws.

Conclusion

The patient presenting with mandibular fracture requiring ORIF was selected for the study. The procedures were done under both general anesthesia and local anesthesia. The approaches were both intraoral and extraoral as required. Intermaxillary fixation was done intraoperative and released immediately postoperatively except in those patients with associated fractures, in which it was released after 3 weeks. The patient was kept under follow-up for 3 months and 6 months, respectively, and evaluated for the treatment results and complications. Malunion, non-union, and plate fracture were not noticed in any of the cases. When comparing the two modalities, the following aspects were highlighted:

1. Time taken for plate fixation is less in Group A (single miniplate) versus Group B (two miniplates).
2. There was no significant differences in ease of application for the placement of both the modalities.
3. The infection rate was higher in two miniplates as compared to single miniplate.
4. The incidence of plate removal was higher with two miniplates as compared to single miniplate.
5. Maxillomandibular fixation was required in all the two plating systems, but it depends on site of fracture and associated fractures.

6. No malunion and non-union were noticed in any group of patients.

From this study, we concluded that the use of two miniplates was almost the same as compared to conventional single miniplate taking into account its various advantages. The use of two miniplates in mandibular midsymphysis fracture is efficacious enough to bear masticatory loads during the osteosynthesis of fracture. It has greater stability, less precision required in plate adaptation due to the "internal/external fixator," and less alteration in periosteal blood supply and reducing the need and duration of IMF.

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