

Application of 2.0 mm Titanium Plates in Rigid Internal Fixation of Mandibular Angle Fractures

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Abstract

Purpose The present study aimed to evaluate the efficacy and stability of 2.0 mm Titanium plates in treatment of mandibular angle fractures.

Materials and Methods A randomized, prospective study was carried out on 17 patients treated by ORIF with 2.0 mm titanium plates. Operative handling of the plate and clinical stability were qualitatively analyzed.

Results The 2.0 mm plate showed good intra-operative handling and adequate clinical stability with follow up of 6 months showing good soft tissue healing.

Conclusion A single 2.0 mm titanium plate provides easy handling and adequate occlusal stability in the post-operative phase as compared to the traditional 2.5 mm plate without post-operative MMF.

Keywords 2.0 mm plate · Angle fractures · Rigid fixation · Open reduction

Introduction

The modalities for the treatment of fractures of the mandible have been in a constant state of evolution [1]. Fractures of the angle of the mandible are technically challenging and many techniques for treatment of these fractures have been proposed in literature. Despite numerous advances angle fractures remain amongst the most difficult and unpredictable to treat as compared with those of other areas of mandible. Fractures of the mandibular angle are plagued with the highest rate of complications amongst all mandibular fractures [1].

The use of ORIF eliminates the need for maxillomandibular fixation and facilitates stable anatomic reduction while reducing the risk of post-operative displacement of the fractured segments allowing immediate return to function [2, 3]. Champy and Lodde [4] determined the ‘ideal lines of osteosynthesis’ in the mandible or locations where bone plate fixation should provide the most stable means of fixation. For the angle, the most effective location was found to be along the superior border of the mandible. Michelet and Champy [4, 5] advocated the use of small, bendable, noncompression plates in the line of ideal osteosynthesis. Of all the different techniques used for the fixation of fractures of the angle of the mandible, the single miniplate at the upper border has the least morbidity with the lowest number of complications and has become the standard in the management of fractures of the mandibular angle [6–9]. As the plates are small and the screws were inserted monocortically, fixation could be applied in this most mechanically advantageous area without any damage to the teeth [2, 10, 11].

The purpose of the study was to evaluate the efficacy of 2.0 mm titanium miniplates in the fractures of the mandibular angle with a main focus on post-operative stability of occlusion.

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Patients and Methods

A prospective, randomized control study was carried out, the study period being from August 2006 to September 2008. Seventeen patients with clinically (Fig. 1) and radiologically (Fig. 2) confirmed fracture of the angle were involved in the study. The selection criteria for the study included patients with fracture of angle of mandible with or without any other fractures in the facial skeleton which warrant an open reduction and internal fixation. All unfavourable fractures of the angle of the mandible and those favourable fractures with the presence of the impacted wisdom tooth in the fracture line and hence requiring surgery were included in the study. The exclusion criteria was any patient deemed unfit for anaesthesia due to poor physical status. All the patients received routine intravenous antibiotics and mouthrinse with chlorhexidine from the time of admission till discharge. All patients were treated under general anaesthesia after naso-tracheal intubation. Maxillary and mandibular ivy loops were secured. In case the third molar was impacted an extended Wards incision was taken, otherwise a vestibular incision was made over the external oblique ridge. A full thickness mucoperiosteal flap was reflected to expose the fracture. Extraction of the tooth in the line of fracture including impacted molars was performed where required. Fiber optic retractors were used to aid in visualization and the fracture was then reduced after establishment of proper dental occlusion. A titanium non compression miniplate (Orthomax 2.0 mm 4 hole with bar) was adapted along Champy's lines of ideal osteosynthesis and secured with monocortical screws of 6 mm length (Fig. 3). The transbuccal kit was kept ready as a part of the armamentarium but was not required to be used in any of the cases. Care



Fig. 1 Displacement at the angle region



Fig. 2 Preoperative PA mandible radiograph



Fig. 3 Fixation with 2-mm titanium plate

was taken to place these screws lateral to the roots of teeth and superior to the neurovascular bundle. MMF was released, occlusion checked and the wound was closed after placement suction drain with a 4-0 Vicryl suture (NW 2443). The patients were advised to take liquid diet for 2 days and thereafter a soft diet for a period of 2 weeks. The mouthrinses with Chlorhexidine were continued for a period of 3 weeks after surgery. Post-operative radiographs (Fig. 4) were completed on the first or second day after surgery. Occlusal evaluation and records were done on the third, fifth and seventh day with a provision to apply rescue elastics if any discrepancy was noticed. The patients were followed up weekly for a period of 4 weeks after which the ivy loops were removed under local anaesthesia. The follow up was then continued at 1, 3 and 6 months (Fig. 5). Post-operatively, after a period of 1 month at every

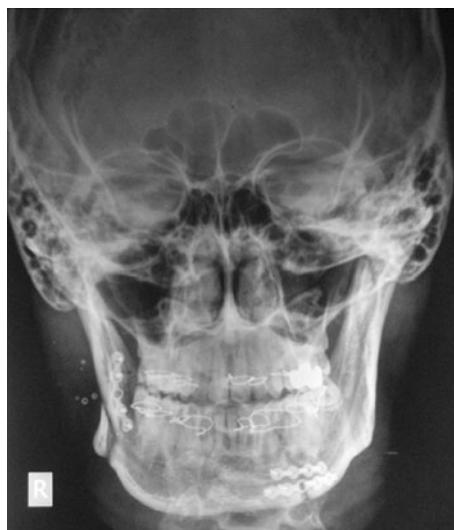


Fig. 4 Postoperative PA mandible radiograph



Fig. 6 Postoperative healing of incision



Fig. 5 Six months postoperative occlusion

follow-up appointment the patient was examined for healing of the wound (Fig. 6) and surgical complications including infections, wound dehiscence, malunion, non-union, malocclusion, dental injuries, plate palpability and post-operative sensory abnormalities.

Results

In 17 patients, 15(88%) were males and 2(12%) were females with a mean age of 30.41 years. Road traffic accident was the etiological factor in 11(64.71%) patients followed by falls in 5(29.41%) patients whereas assault caused fracture in 1(5.88%) patient (Table 1; Supplementary Graph 1). Overall there were 7 patients with fractures of the left angle and 10 patients with a fracture on the right side (Table 2; Supplementary Graph 2). 14(82%) cases had a displaced fracture and 3(18%) cases were undisplaced with the presence of the impacted wisdom tooth in the

Table 1 Etiology of injury

Etiology	No. of patients	Percentage
Road traffic accident (RTA)	11	5.88
Fall	5	29.41
Assault	1	64.71

Table 2 Diagnosis of mandibular fracture

Diagnosis	No. of patients	Percentage
Isolated right angle of mandible	4	23.53
Isolated left angle of mandible	3	17.65
Right angle with left parasymphysis	6	35.29
Right angle with left parasymphysis	4	23.53

fracture line hence requiring surgery (Table 3; Supplementary Graph 3). Un-displaced fractures of the angle with no occlusal derangement were treated by simple closed reduction and hence not included in the study. After fixation of the miniplate all fractures appeared to be well reduced and stable. Post-operative occlusion was normal in all but one patient who showed minor occlusal discrepancies corrected by the use of elastics for 1 week (Table 4). The PA mandible view was used to assess the patient pre

Table 3 Showing severity of fracture

Severity of fracture	No. of patients	Percentage
Displaced	14	82
Undisplaced	3	18

Table 4 Showing status of occlusal disturbances

Status of occlusal disturbance	No. of patients	Percentage
No occlusal disturbance	16	94.12
Occlusal disturbances with symptoms	1	5.88

Table 5 Showing palpability status of plates

Palpability status of plates	No. of patients	Percentage
Not palpable	0	0
Palpable on pressure	16	94.12
Pain on palpation	1	5.88
Plate exposure	0	0

operatively as it best showed the displacement of the fracture. The same view was done post operatively to assess the reduction and fixation of the fracture. When we analyzed the palpability of the plate after 6 months, it was observed that in 16 (94.12%) cases the plate was palpable only on exerting pressure and 1 (5.88%) case was found to have pain on palpation, with no infection present (Table 5; Supplementary Graph 4). There was no case of plate exposure but we encountered 3 patients with local inflammation due to improper oral hygiene. This was resolved with antibiotics and local oral hygiene methods without any further surgical intervention. There was no case with post-operative paraesthesia.

Discussion

The intra oral miniplate fixation at the superior border has been a popular modality of management of angle fractures with many advantages like no extra oral scar and prevention of injury to the facial nerve with an easy surgical technique. The purpose of this study was done

1. To analyze the efficacy of 2.0 mm titanium non compression miniplate for fixation of angle fractures.
2. To assess the ease of manipulation and adaptability of the 2.0 mm titanium miniplate in the fixation of mandibular angle fractures.
3. To assess the stability provided by these plates in the phase of fracture healing by maintaining dental occlusion without MMF.

The main etiological factor causing the fracture was road traffic accidents, which is in agreement with many studies. In the 17 patients in our study, the 2.0 mm miniplate was very easy to handle and adapt to the mandible aiding in a stable fixation of the fracture site. The trans-buccal kit was kept ready as a part of the armamentarium

but was not required to be used in any of the cases suggesting that the 2.0 mm plate provides for easy manipulation in the confines of the angle and hence screw tightening proved non problematic.

10 (58.82%) of our cases had a parasymphysis fracture in combination with the angle fracture. The parasymphysis was fixed rigidly with two plates in accordance to Champy's principle and did not cause any problems for the healing of the fracture as compared to the isolated angle. Accurate reduction, proper intra-operative MMF and adequate fixation are the key factors for the uneventful healing of these fractures.

For a post surgical infection to occur many factors are involved. These include the patient's general condition, type of fracture, treatment rendered and the timing of surgery it was carried out. The most important factors are the patient's dental status and oral hygiene which affects the degree of pre and post surgical contamination of the fracture site. The presence of a tooth in the line of fracture site is another important factor as it can cause problems in reduction or fixation as well as can be associated with dental fracture, pulpitis, periodontal or periapical infection. In these cases extraction of the tooth was carried out before the fracture is fixed as advocated by Izuka and Lindquist [12]. The reason for local inflammation in all three cases was due to improper oral hygiene which is very critical in preventing implant exposure or infection later. The presence of postsurgical malocclusion depends on the patient's dental condition, the number of fractures and their displacement, the reduction that can be achieved, the kind of immobilization, and the duration of immobilization [13]. There was only one patient who presented with minor occlusal discrepancy. This could be due to the fact that he was treated 1 month after the fracture. When ORIF is chosen as a treatment option whether an intra-oral or extra-oral approach is used determines the appearance of a number of complications that are different from those caused by MMF [14, 15]. The incidence of sensory deficit in the inferior alveolar or mental nerves, not always caused by the fracture is similar in most studies when an extra-oral approach is used [12, 16, 17]. We did not encounter any patients with post-operative paraesthesia.

When an implant is placed in the bone the one question which arises is whether to retain the plate or remove it. There are various reasons which favours removal of plate after the period of healing, but most studies have concluded to retain the plate *in situ*. This adheres strictly to a non compression miniplate osteosynthesis, as these miniplates are less problematic and adapts to allow flexion and tension as they respond to loading making stress less significant. Removal of plate is indicated in case of loose screws and plate exposure [18]. The important feature of the study was that the 2.0 mm plate was able to provide adequate

occlusal stability without the need for MMF. Glineburg et al. [19] showed that MMF is not a benign procedure, immobilization of the temporomandibular joint for 8 weeks in a primate model caused marked thinning and disruption of the normal organization of the articular cartilage. There was no case of implant exposure which may be due to the fact that the 2.0 mm plate is thinner than the conventional 2.5 mm plate used routinely for mandibular fractures. None of the patients in the study underwent plate removal.

All the parameters considered in our study suggest that fixation of mandibular angle fractures with a single 2.0 mm miniplate at the superior border provides adequate occlusal stability in the phase of fracture healing. The incidence of complications was very low with this plate which is in accordance with Ellis and Walker [1].

Conclusion

A single 2.0 mm plate at the superior border provides adequate occlusal stability in the post-operative phase with no need for MMF when unilateral fractures of the mandibular angle are fixed as per the Champy's principle of osteosynthesis. It is associated with greater ease of manipulation and lesser rate of complications in comparison to the traditionally used 2.5 mm plate.

Conflict of interest None.

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