

Routine removal of the plate after surgical treatment for mandibular angle fracture with a third molar in relation to the fracture line

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ABSTRACT

Purpose: The purpose was to analyze the clinical course of surgically treated mandibular angle fractures from the viewpoint of routine removal of the plate because these fractures are associated with high rates of complications and plate removal. **Subjects and Methods:** The subjects were 40 patients with unilateral mandibular angle fracture, which was intraorally reduced and principally fixed with a single miniplate on the external oblique ridge. The third molar in relation to the fracture line was extracted in seven patients during the surgery. Clinical course was evaluated in terms of removal of the plate, preservation of the third molar and complications. **Results:** One patient showed a wound infection postoperatively, and two patients developed pericoronitis during the follow-up. These were managed with medication and local irrigation. One patient with a preserved third molar did not make a required visit and was lost from the follow-up. Removal of the plates was performed in 39 patients after confirmation of good fracture healing, mostly within a year. Twenty-four of 32 preserved third molars were simultaneously extracted. These procedures were generally performed under local anesthesia on an outpatient basis, and they did not cause any complications. **Conclusions:** Routine removal of the plate after surgical treatment for mandibular angle fractures, simultaneously with extraction of the third molar if indicated, may be beneficial to avoid complications related to the plate and the third molar later in life.

Keywords: Fixation, fracture, mandibular angle, miniplate, third molar

INTRODUCTION

Mandibular angle fractures are commonly encountered in the practice of oral and maxillofacial surgery. Open reduction and internal fixation (ORIF) is one of the treatments of choice. Simple (linear) mandibular angle fractures are primarily treated via an intraoral approach. Fixation by miniplate is generally made on the external oblique ridge along the ideal osteosynthesis line proposed by Champy *et al.*^[1] This technique provides stable fixation with minimum intervention and results in good postoperative healing. The plate used for fixation is usually left after surgery because it has been previously thought that these plates seldom cause complications requiring surgical intervention.^[2,3] However, a plate

left in this area could be exposed or could be a focus of infection because the external oblique ridge is covered with mobile mucosa close to the molar teeth, which lack an adequate width of attached gingiva. In addition, a third molar present in this area is known to develop pathologic conditions like pericoronitis.^[4,5] If pericoronitis occurs after surgery, the plate is definitely involved and can be an obstacle in managing the condition. Therefore, we routinely remove the plates after healing of the fracture. This procedure is principally performed under local anesthesia. A third molar preserved at the surgery can be removed simultaneously with the plate.

In this report, we presented our experiences with the routine removal of the plate after surgical treatment for mandibular angle

fractures with a third molar in relation with the fracture line, and we discussed the benefits of this procedure.

SUBJECTS AND METHODS

Forty patients treated with ORIF for mandibular angle fractures at the Department of Oral and Maxillofacial Surgery were the subjects of the study. Data from these patients were obtained from their clinical records and radiographs, and records were retrospectively analyzed. The criteria for inclusion of the subjects were patients who had simple mandibular angle fractures with a third molar in relation to the fracture line. Patients with associated fractures at the symphyseal or body region of the mandible, which were also treated with ORIF, were included. However, patients with condylar or ramal fractures and bilateral or comminuted angle fractures, as well as those without stable occlusion or using a removable denture, were excluded. This study protocol was approved by the university's institutional review board, in accordance with the principles of the Declaration of Helsinki.

Fractures were treated under general anesthesia via nasal intubation. A preadapted arch bar was secured first in the maxillary arch. In cases with a single mandibular angle fracture, a preadapted arch bar was then secured in the mandibular arch. If there were any fractures in the symphyseal or body region, these were reduced and fixed with miniplates, as previously described.^[6] Then, the fracture of the mandibular angle was exposed and reduced properly. A single titanium miniplate was placed on the external oblique ridge of the mandible and fixed with miniscrews under maxillomandibular fixation (MMF) after confirmation of appropriate occlusion. If fixation with single miniplate was not stable enough, another plate was placed on the lateral aspect of the superior border. Third molars were typically preserved unless they were an obstacle to reduction or in a pathologic state. After the release of MMF, occlusion and mandibular movements were checked. The wounds were then closed by suture.

After surgery, MMF was not performed principally, and only elastics were used for occlusal guidance if necessary. Oral hygiene was checked twice a day until the discharge of the patients. Rehabilitation for active mandibular movements was started 2 weeks after the surgery. The patients were clinically and radiologically checked with regular follow-ups. Unfavorable events, such as infection of the surgical wound, plate exposure and pathology related to the plates and/or the third molar were monitored. Removal of the plates was scheduled after confirmation of bone healing and was principally performed between 6 months and a year, under local anesthesia, on an outpatient basis. Third molars preserved at the surgery sites were removed simultaneously with the plates if they were likely to be involved in pathologic conditions, like pericoronitis, later in life.

RESULTS

The patient pool included 31 males and nine females. Their ages ranged from 15 to 44 years, with an average age of 22.5 years. Causes of the fractures included traffic accidents in 16 patients, assault in 13 patients, sports in eight patients, and falls in three.

Fifteen patients had isolated mandibular angle fractures, and 25 had accompanying fractures at the symphysis or body of the mandible. The third molar was impacted or covered with mucosa in 34 patients and erupted in six patients. ORIF was performed under general anesthesia, as described above. The duration between the injury and the surgery ranged from four to 18 days, with the average of 10.1 days. Single miniplate was used for fixation in 34 patients (85.0%), and two miniplates were used in six patients (15.0%). The third molar in relation to the fracture line was preserved in 33 patients (82.5%) and extracted in seven patients (17.5%). Postoperative courses were uneventful without dehiscence or infection of the surgical wound in most patients. One patient had a minor postoperative infection and was managed by medication and local irrigation. At the regular follow-up, no complications requiring surgical intervention had developed in any patients. One patient with a preserved third molar did not make a required visit 2 months after surgery and was lost from regular follow-up. Pericoronitis developed in the third molar in relation to the fracture line in two patients. Both cases were not severe and controlled by medication and local irrigation. Osteosynthesis of the fracture was confirmed by panoramic X-ray examination. Removal of the plates was performed in 39 patients from 5 months to 16 months after surgery, with the average removal time of 8.9 months. The plates fixed for fractures at the body and the symphysis were also removed together with those at the angle fracture. Twenty-eight patients were treated under local anesthesia with sedation. Eleven patients were treated under general anesthesia at their request or for other reasons. All plates were removed without difficulty. The third molar in relation to the fracture line was present in 32 patients at the time of plate removal. Twenty-four of these molars (75.0%) were extracted simultaneously with the plate. The preserved third molars in eight patients were functionally or asymptotically impacted. Clinical course after removal of the plate and simultaneous extraction of the third molar was uneventful, with no complications.

DISCUSSION

Several factors should be considered in the surgical treatment for mandibular angle fractures, such as the route of approach, the choice of osteosynthesis materials and the number and site of their placement. In addition, a determination must be made whether the third molar is to be extracted or preserved, according to the condition, if it is present in relation to the fracture line.^[7-9] However, removal of the plate after bone healing has not been a primary focus of debate. In the present study, we evaluated the clinical course of routine removal of the plate after surgical treatment for mandibular angle fracture with a third molar in relation to the fracture line, and we discussed the benefits of this procedure, considering the anatomical and physiological characteristics of the mandibular angle region.

There have been many studies concerned with the fixation method used for mandibular angle fractures.^[8-19] Some researchers have advocated the use of two miniplates, one on the external oblique ridge and the other on the lower border of the mandible, to obtain stable fixation based on biomechanical studies.^[20-22] However, Ellis and Walker reported high complication rates in cases intraorally fixed with two miniplates.^[23] Since then, several studies have been conducted.^[8,10,11,24] Recent studies

have shown that fixation by single miniplate is superior to that by two miniplates, with a lower rate of complications.^[8,25-28] We used a single miniplate fixation on the external oblique ridge in accordance with this principle. This fixation is stable enough with minimum intervention.

Removal of the third molar in relation to the fracture line is sometimes necessary at the time of surgery.^[29] Criteria for removal are indicated by Ellis^[7] as the following: Fractured teeth, pericoronar/periodontal infection, gross caries, tooth mobility, exposure of the apical half or more of the root (including the apex), and inability to reduce the fracture without tooth removal. Our criteria are principally the same. However, in the present study, only seven out of 40 third molars were extracted at the time of surgery, a rate much smaller than in previous studies.^[7,9] This result, in part, is attributed to the relatively good conditions of the third molars in our patients. Although most of the third molars, in relation to the fracture line, were nonfunctional and indicative for removal at surgery, preservation of the third molar may have contributed to the stability of the bone fragment and reduced the dead space susceptible to infection.^[30] Therefore, preservation may have been favorable for fracture healing. On the other hand, preserved third molars may develop pathologic conditions, like pericoronitis, later in life, even though the conditions of these same molar were outside the criteria for removal at the time of surgery. Therefore, some authors recommend a vigilant follow-up to monitor such potentially unfavorable events.^[2,31]

There have been several studies as to the removal of the plates after healing of the mandibular fractures.^[2,3,32-39] Most of these studies have concluded that routine removal of the plates is

not necessary because complication rates are relatively low. These studies have suggested the removal of symptomatic plates only.^[3,33,35,39] However, postoperative complications are higher in mandibular angle fracture compared with those in a fracture at other sites of the mandible.^[2,11,29,30,40-42] Therefore, removal of the plates is performed at higher rates in the mandibular angle region^[2,32-35] because most of these plates are involved and/or related to the complications.^[2,8,10,43] Relatively higher rates of complications in this area are ascribed, in part, to the anatomical and physiological characteristics of the mandibular angle region. In mandibular fractures of the symphyseal or body region, plates are fixed below the mucogingival fold, with a broad width of attached gingiva. In such cases, rates of complications, including exposure and infection, related to the plates are considered low, unless there are unmanaged periapical and/or marginal periodontal lesions adjacent to the plates. However, the retromolar region is covered with mobile mucosa and is close to molar teeth lacking an adequate width of attached gingiva.^[17,28] Because of these characteristics, there may be a greater chance of complications such as plate exposure or infection. Therefore, it is reasonable to remove the plate, which becomes a foreign body after healing of the fracture and a possible cause of further trouble.

The third molar is known to be involved in pathologic conditions like pericoronitis at higher rates than other teeth; therefore, most of these are removed later in life, especially in the twenties and thirties, although there are no definite criteria for the removal.^[4,5] A third molar exposed in the surgical field of the fracture is considered more vulnerable to pathologic conditions because of damage to the periodontal tissue. If a third molar present at

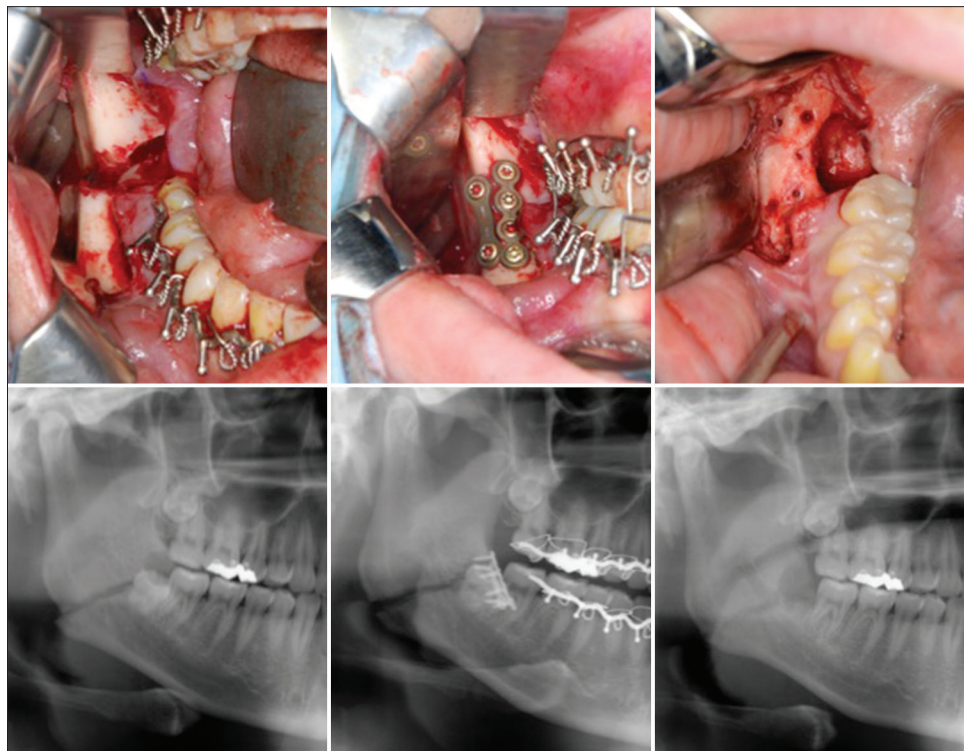


Figure 1: Clinical and radiological findings of the representative case. Left: Before reduction. Middle: After reduction and fixation with two miniplates. Right: After removal of the plates and extraction of the third molar. Mandibular angle fracture was reduced and fixed with two miniplates preserving the third molar. The plates were removed simultaneously with extraction of the third molar 10 months later under local anesthesia

the time of plate removal is likely to be involved in pathologic conditions later in life, it is beneficial to remove it simultaneously with the plates, unless the procedure causes undue risk to the patient.^[33]

In the present cases, all patients except one were followed-up with good compliance and underwent removal of their plate. Twenty-four of 32 third molars were simultaneously extracted at the time of plate removal because of the episode or possible involvement in pathologic conditions later in life. These procedures were minimally invasive and mostly performed under local anesthesia on an outpatient basis without high costs in time and morbidity [Figure 1]. Therefore, we consider that routine removal of the plate, simultaneously with extraction of the third molar if indicated, should be justified as a reasonable procedure and may be beneficial, taking into consideration the relatively high rate of plate-related complications in mandibular angle fractures, as well as the high extraction rates for the third molar due to pathologic conditions. However, it is difficult to determine how much these procedures contribute to the prevention of complications related to the plate and the third molar; therefore, further study is required to clarify the usefulness of these procedures.

In summary, routine removal of the plate after surgical treatment for mandibular angle fractures was accomplished in 39 of 40 patients with good compliance. Twenty-four of 32 third molars present at the plate removal were simultaneously extracted. These procedures were minimally invasive and had low costs in time and morbidity. Therefore, routine removal of the plate after surgical treatment for mandibular angle fractures, simultaneously with extraction of the third molar if indicated, may be beneficial to avoid complications related to the plate and the third molar later in life.

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