



# A Clinical Study of Mandibular Angle Fracture

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## Abstract

**Purpose:** To establish management protocol for mandibular angle fracture, we describe pertinent factors including cause, impacted third molar and recent treatment tendency.

**Methods:** We examined the records of 62 patients who had unilateral mandibular angle fracture. Sixty patients who had open reduction surgery were examined at postoperative weeks 1, 4, 8, 12, and 28.

**Results:** Left mandibular angle fracture is frequent in younger males. Presence of the mandibular third molar can increase fracture risk. Because of attached muscle, favorable fractures occurred primarily in the mandibular angle area.

**Conclusion:** Extracting the mandibular third molar can prevent angle fractures, and open reduction with only one plate adaptation is generally the proper treatment method for mandibular angle fracture.

**Key words:** Mandibular injuries, Jaw fracture

## Introduction

Mandibular fractures occur frequently because of high risk of trauma, and an anatomic structure of arched form without a bone suture line cannot disperse the external force[1]. The frequency of mandibular fractures is increasing with the increase in trauma such as traffic accident, industrial accident, falling, sports, and interpersonal violence following rapid societal changes[2].

In the mandible, unlike other hard tissues, fracture pattern and directions of the fracture line are affected by the cause, direction of external force, position of attached muscles on the parts of fractured bone and existence of pathologic elements[1].

The mandibular angle is a region particularly prone to fracture from falls or attack, comprising 25% to 33% of all mandibular fractures. Masseter muscle and medial pterygoid muscle are attached to the angle and these can cause displacement of bone fragments after fracture. Reduction as a treatment for fracture should be considered especially for patients with a mandibular third molar. Other pertinent factors are the biomechanical characteristics of the mandible, bone density, and the pathologic state of the bone[3]. Because it is difficult to fix with intermaxillary fixation, open reduction is universal[4].

There is a recent emphasis on increasing cosmetic factor and correcting occlusal recovery when treating mandibular angle fracture. But other studies treating mandibular frac-

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ture emphasize the general mandibular aspect rather than the particular location of mandible. This clinical study is to analyze and assess patterns in patients whose unilateral mandibular angle was fractured, and propose the proper treatment protocol.

## Materials and Methods

We studied 62 patients who visited the Department of Oral and Maxillofacial Surgery of Chosun University Dental Hospital from January 2009 to July 2012 with fracture in the mandibular angle, who were possible to examine up to a year after surgery, without fractures on other parts or bilateral fracture in mandibular angle. The case analysis study was conducted under Institutional Review Board (IRB) approval granted by the Chosun University Dental Hospital (CDMDIRB-1429-170).

We researched patient information retrospectively, referring to clinical examination, dental panorama, radiographs of skull PA and computed tomography, and chart records. All patients were classified by age and sex, and we classified the fractures by cause, location, and pattern of fracture.

We estimate surgical technique through the number and type of plates used, whether a mandibular third molar relating mandibular angle is extracted, and complications after operation such as neurologic damage, malocclusion, and infection.

Among 62 patients, 60 patients received open reduction under general anesthesia, and two patients received intermaxillary fixation because of systemic disease. The fractures were rigidly fixed with 4-hole metal miniplates and

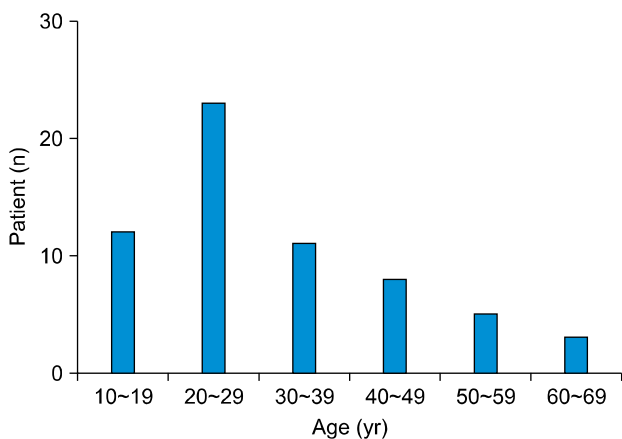


Fig. 1. Age distribution.

screws (Leforte; Jeil Medical Corporation, Seoul, Korea). The patients were re-examined at postoperative weeks 1, 4, 8, 12, and 28. The arch bar used for intermaxillary fixation was removed three weeks after surgery.

## Results

### 1. Patients

The average patient age is 32, distributed from 15 to 66 years, with clustering in the third decade (Fig. 1). Gender distribution is 56 men (90.3%) and six women (9.7%). The fracture causes are fist blow (23 cases, 37.1%), slip down (14 cases, 22.6%), traffic accident (seven cases, 11.3%), fall down (six cases, 9.7%), hit by objects (10 cases, 16.1%), others (two cases, 3.2%). Fractures are located on the left side in 47 cases (75.8%) and on the right side in 15 cases (24.2%). We note that fracture of left mandibular angle occurs three times more frequently than the right (Table 1). We hypothesize that mandibular fractures often result from fist blows from right-handed young people.

### 2. Existence of mandibular third molar

The rate of patients with mandibular third molar at the fracture line is 77.4% and of those who underwent surgery,

Table 1. Patient characteristics

Variable	Value
Total	62 (100.0)
Sex	
Male	56 (90.3)
Female	6 (9.7)
Mechanism of fracture	
Fist blow	23 (37.1)
Slip down	14 (22.6)
Stuck by object	10 (16.1)
Traffic accident	7 (11.3)
Fall down	6 (9.7)
Others	2 (3.2)
Site of fracture	
Left angle	47 (75.8)
Right angle	15 (24.2)

Values are presented as number (%).

Table 2. Presence and extraction of mandibular third molars in fracture line

	Present (n)	Absent (n)	Total (n)
Extraction	27	0	27
Non-extraction	21	14	35
Total	48	14	62

56.3% (27 cases) had the mandibular third molar extracted (Table 2). This shows that mandibular third molar can affect the risk of mandibular angle fracture (Fig. 2).

### 3. Fracture pattern and number of used plates

The direction of fracture is unfavorable for all patients. Fifty-three patients received one metal plate, seven patients received two, and no patients received absorbable plate. If there was comminuted fracture or masseter muscle hypertrophy, two plates were used to increase rigidity.

### 4. Complications

Post-surgical complications include 17 cases (28.3%) of hypoesthesia caused by neurologic damage, but this symptom was present before surgery. There were four cases (6.7%) of mandible pain during opening and closing, three cases (5.1%) of screw loosening (Fig. 3, 4), two cases (3.3%) of malocclusion, one case (1.7%) of infection at the surgical site, and one case (1.7%) of plate exposure. The rate of the post-surgical complications after operation

is 9.8%. There was no osteomyelitis, non-union of bone fragment, or displacement of metal plate (Table 3).

## Discussion

### 1. Relation of mandibular third molar and risk of angle fracture

An impacted third molar can weaken the mandibular angle area by replacing osseous space, depending on its position and angulation[5]. In cross-section, the angle area is thinner than the tooth-bearing region, and the angle can function as a lever biomechanically[6]. Thus the angle region is prone to fracture, comprising 25% to 33% of all

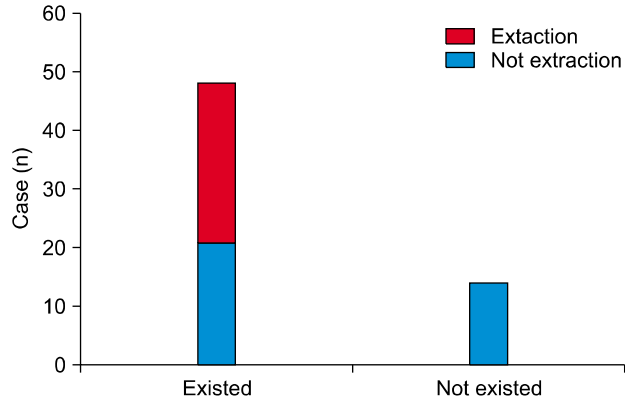


Fig. 2. Presence and extraction of mandibular third molar in fracture line.



Fig. 3. Loosening screw on fixed plate.

Table 3. Complication after operation

Variable	Value
Nerve injury	17 (28.3)
Pain	4 (6.7)
Loosening of screw	3 (5.1)
Malocclusion	2 (3.3)
Infection	1 (1.7)
Plate exposure	1 (1.7)

Values are presented as number (%).

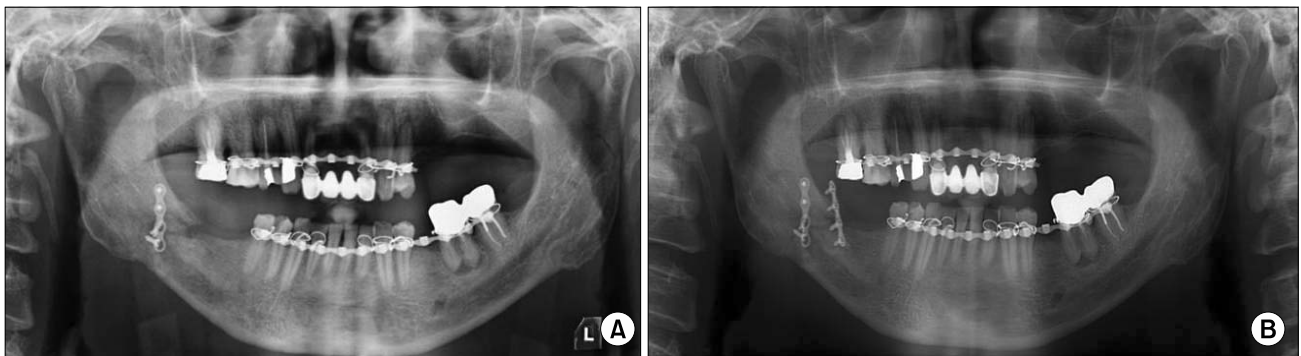


Fig. 4. (A) Loosening screw on fixed plate and exposure to oral cavity. (B) After removal of exposed plate.

mandibular fractures[3].

Schwimmer *et al.*[7] found early removal of impacted teeth to be an effective way of preventing mandibular fracture in athletes who are exposed to trauma. Reitzik *et al.*[8] reported that mandibles with impacted third molars can be fractured at 60% of the force needed when there is no tooth. In this study, mandible fractures with impacted third molars occurred four times more than that fractures with no tooth.

When performing open reduction, extraction of the mandibular third molar is still controversial[9]. Some scholars reported that extraction of the tooth may make the fracture site unstable, leading to additional damage (Fig. 5)[9]. On the other hand, retaining a tooth within the fracture line may lead to certain complications because of decreased bone contact and blood supply (Fig. 6)[9].

Our patients were divided evenly between extraction and retention of the mandibular third molar during the operation (Table 2). If completely impacted or malpositioned, disturbing reduction in the fractured segment, extraction is recommended. If there is no difficulty in reduction or the third molar is erupted, retention of third molar would be a better choice, considering the risk of infection

to the extraction socket and possibility of delayed bone union[10].

## 2. Factors affecting risk and treatment of mandibular angle fracture

In the mandible, unlike fractures of other hard tissues, the form of fracture, direction and degree of segment transition are affected by the anatomic structure, muscle insertion and bite force[11]. The angle is a common site for mandible fracture and has many active muscles that can displace segments. There is a high complication rate and the fracture only can rarely be adequately reduced by simple intermaxillary fixation. Therefore, the primary technique is open reduction[4]. In this study, except with those unsuitable for surgery, all patients were treated by open reduction. There are literature perspectives stating that the pterygomasseteric muscle sling provides protection against external forces to the angle region of the mandible[5].

## 3. Treatment criteria for mandibular angle fracture

Champy *et al.*[12] found that in a centered inferior alveolar canal, the tensile forces are generated on the upper border of mandibular angle and compressive forces are

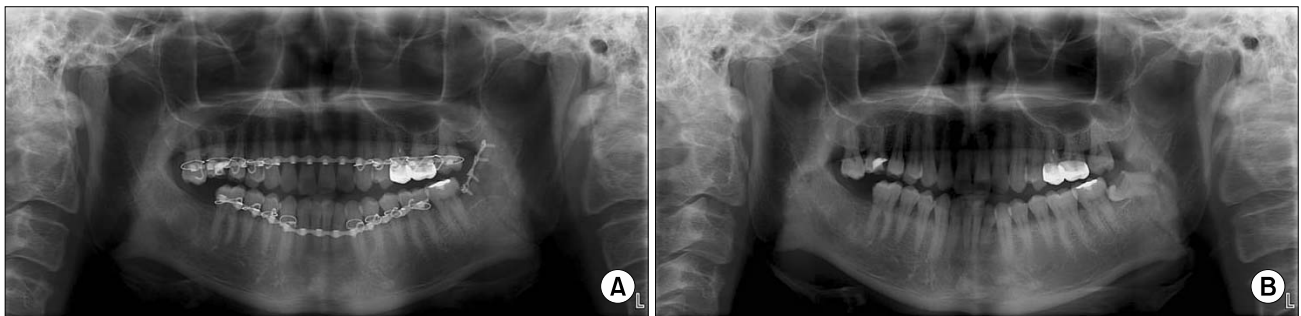


Fig. 5. (A) Preoperation. (B) After open reduction internal fixation with miniplate extracting impacted third molar.

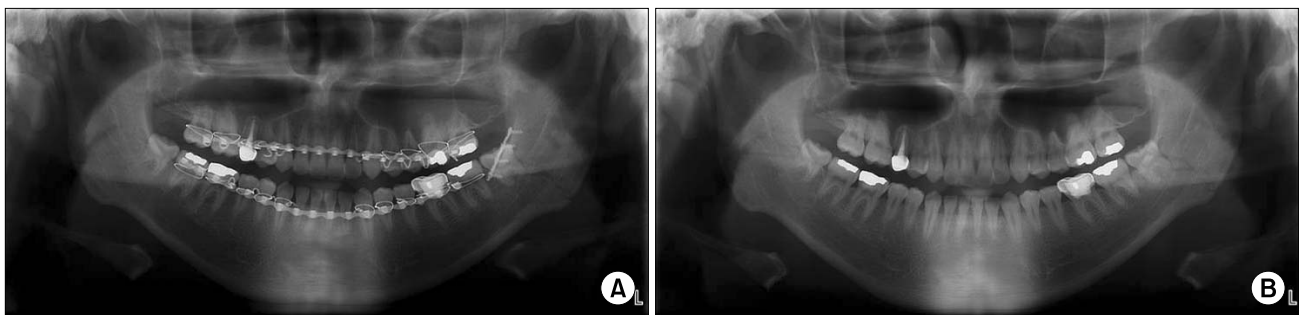


Fig. 6. (A) Preoperation. (B) After open reduction internal fixation with miniplate not extracting third molar.

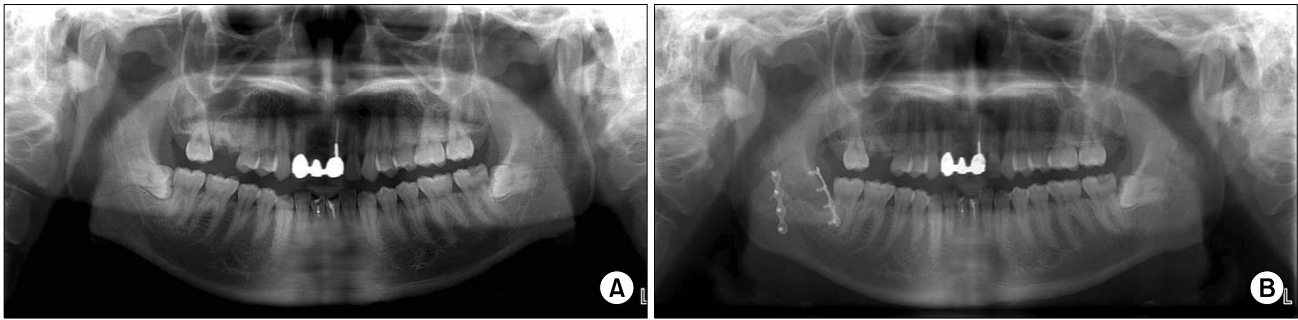


Fig. 7. (A) Preoperation. (B) After open reduction internal fixation with 2 miniplates.

generated on the lower border, so ideal single plate fixation is possible on the external oblique line. But in cases of comminuted fracture and when reduction of interdental fixation is impossible after surgery, more than two plates are placed to improve bone healing and stabilize fixation under the functional load (Fig. 7). Postoperative complications such as the infection caused by reduced bone fixation and malunion can be decreased using lag screws and reconstruction plates[9,13]. Functionally, fixation with two metal plates increases stability of the mandibular angle fracture but the possibilities of infection due to increased surgical time or flap elevation, facial nerve injury, high price of the plates and difficulty of plate removal should be considered[6,14,15]. To overcome these drawbacks, lag screws can be used. Lag screw fixation offers firm fracture stabilization, reduction of tissue exposure compared to using metal plates, and short operation time[16]. The fact that an absorbable plate has lesser resistibility and stability at an average occlusal load than a metal plate after surgery has been demonstrated in several studies[17], so this is not a general method for the angle fracture. In this study, no cases were fixed by absorbable plate.

#### 4. Complications

Many postoperative complications have been reported, but hypoesthesia by inferior alveolar nerve injury was more frequently found than other complications in this study. This is not only because of surgical procedure but also nerve injury from trauma or movement of bone segments. Pain on mandibular movement is another possible complication. It can lead to trismus with the risk of damaging elevated muscles that are attached to the angle region. Other risks include posterior open bite at the fracture site

right after surgery, infections through failure of primary suture and loosening of metal plates or screws[13].

#### 5. Duration of intermaxillary fixation

Although the ideal period of maxillomandibular fixation for the angle fracture is unclear, two weeks of fixation after surgery is regarded as the proper period in various studies as well as our study[15].

### Conclusion

We can draw some conclusions from this study of 62 patients with unilateral fracture in the mandibular angle area.

1. Mandibular angle fracture often occurs in younger males by violence at the left side.
2. Existence of a mandibular third molar can increase risk of fracture, and preventive extraction might be indicated, especially for those involved in sports.
3. Because of attached muscle, favorable fractures occurred predominantly in the mandibular angle area so open reduction is universal.
4. By biomechanical aspects, fixation can be possible by an ideal single plate on the external oblique line, but an absorbable plate is not suitable for in this area.
5. Inferior alveolar nerve damage is the most common complication.

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