

A multi-centre retrospective study of mandibular fractures: do occlusal support and the mandibular third molar affect mandibular angle and condylar fractures?

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Abstract. This retrospective study was performed to investigate the influence of occlusal support and the presence, state, and position of mandibular third molars on the incidence of mandibular angle and condylar fractures. The following variables were investigated: age, sex, cause of fracture, presence and state (impaction, angulation, and the number of roots) of the mandibular third molars, site of the mandibular fracture, presence of occlusal support, duration of intermaxillary fixation, and postoperative complications. Various risk factors for mandibular angle and condylar fractures were investigated by univariate analysis. The risk of mandibular angle fracture was significantly higher in patients with occlusal support and mandibular third molars. The risk of condylar fracture was significantly higher in patients without occlusal support or mandibular third molars. The position and angulation of the mandibular third molars were not significant risk factors in mandibular angle and condylar fractures. This study demonstrated the influence of occlusal support and the presence of mandibular third molars on the incidence of mandibular angle and condylar fractures. The presence of occlusal support may be a more important factor affecting mandibular angle or condylar fractures than the position of the mandibular third molars.

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With an incidence rate of 36% to 70%, mandibular fracture is the most common fracture of the maxillofacial complex.¹ Among mandibular fractures, mandibular condylar fractures are the most frequent, representing 29% to 52% of all mandibular fractures.² Ellis reported that the high rate of mandibular fracture could be explained by unique characteristics such as the mobility and limited bone support when compared to other facial bones.³ Mandibular fractures are influenced by various factors including the direction and impact of force, occlusal loading pattern, and biomechanical factors such as bone density and anatomical structures creating weak areas.⁴⁻⁶ Currently, the standard treatment for mandibular fractures involves open reduction and stable intermaxillary fixation (IMF). However, there is still some controversy regarding the fixation system and technique that should be used.^{4,7,8}

Recently, many investigators have reported an increased risk of mandibular angle fractures in the presence of the mandibular third molars.^{5,9-11} There are also reports indicating that the presence of the mandibular third molars decreases the incidence of condylar fractures.^{9,10,12} Based on a recent biomechanical model, it has been suggested that the mandibular third molar decreases the bone mass and cortical continuity in the region of the mandibular angle.⁵ However, there have been no formal assessments of this subject, and the relationship between fracture risk and the mandibular third molar remains unclear. Furthermore, no study has investigated the relationship between occlusal support and the risk of fracture. It is hypothesized that the presence of occlusal support is an important factor associated with mandibular angle and condylar fractures because of its buffering abilities. The purpose of this study was to investigate the influence of occlusal support and the presence, state, and position of mandibular third molars on the incidence of mandibular angle and condylar fractures.

Patients and methods

This was a non-randomized, multi-centre, retrospective cohort study. Between April 2010 and March 2014, 298 cases of mandibular fracture were treated in the oral and maxillofacial surgery departments of 11 different medical facilities in Japan. A total of 216 male patients and 82 female patients were included in this study. The mean age of the patients was 42.9 ± 44.6 years (range 4–95 years). The major cause of mandibular fracture was a fall ($n = 147$,

49.3%). Other causes of the mandibular fracture were traffic accident ($n = 58$, 19.5%), assault ($n = 56$, 18.8%), sports ($n = 24$, 8.1%), and others ($n = 13$, 4.4%). This study was approved by the necessary institutional review board. Before surgery, each patient was informed of all possible complications; all patients provided full informed consent. Cases of symphysis, body, or coronoid process fracture were excluded from this study. Finally, a total of 286 mandibular sides (condylar or angle fractures) in 239 patients were included in this study.

Mandibular angle fractures were identified according to the methods of Kelly and Harrigan.¹³ A mandibular angle fracture was defined as a fracture located posterior to the second molar, extending from any point on the curve formed by the junction of the body and ramus in the retromolar area to any point on the curve formed by the inferior border of the body and posterior border of the ramus of the mandible.¹³ A condylar fracture was defined as a fracture with a fracture line superior to the sigmoid notch.

The following variables were investigated: age, sex, cause of the fracture, presence and state of the mandibular third molars, site of the mandibular fracture, presence of occlusal support, duration of IMF, and postoperative complications. Patients for whom conventional panoramic radiographs were available were included in the study, and the films were analyzed. The impaction (according to Pell and Gregory)¹⁴ and angulation (Winter's classification)¹⁵ were assessed radiographically. The number of roots was also determined on the panoramic radiographs. All factors investigated are listed in the tables. Occlusal support was determined based on the presence or absence of an occlusal contact in the molar region. Occlusal support was classified into five groups: none (edentulous), bilateral at the mandibular fracture site, ipsilateral to the mandibular fracture site, contralateral occlusion, and other (occlusion of only the incisor region, or non-vertical stop occlusion).

Statistical analysis

The data collection and statistical analyses were performed using IBM SPSS Statistics for Windows version 22.0 (IBM Corp., Armonk, NY, USA) and StatView J4.5 (Abacus Concepts, Berkeley, CA, USA) software. Variables were tested by non-parametric Mann-Whitney *U*-test (ordinal variables), or Fisher's exact test or the χ^2 test (categorical variables).

A *P*-value of <0.05 was considered statistically significant.

Results

Of the patients enrolled in this study, 129 (54.0%) underwent surgical treatment and 110 (46.0%) underwent non-surgical treatment (Table 1). The duration of IMF was significantly longer for the patients who underwent non-surgical treatment than for the patients who underwent surgical treatment ($P = 0.004$) (Table 1). The major postoperative complication was paresthesia of the lower lip. There were significantly more postoperative complications in the patients who underwent surgical treatment than in the patients who underwent non-surgical treatment ($P = 0.008$) (Table 1).

The proportion of male patients with angle fractures was greater than the proportion of male patients with condylar fractures (Table 2). The patients with condylar fractures had a mean age of 50.6 ± 24.8 years. The patients with angle fractures had a mean age of 26.0 ± 13.0 years. Patients with condylar fractures were significantly older than those with angle fractures ($P < 0.001$) (Table 2).

The risk of condylar fracture was significantly higher in patients without occlusal support (occlusion in bilateral molar region) or mandibular third molars ($P < 0.001$) (Table 2). In contrast, the risk of mandibular angle fracture was significantly higher in the patients with occlusal support (occlusion in bilateral molar region) and mandibular third molars ($P < 0.001$) (Table 2).

In patients with partially impacted mandibular third molars, the risk of angle fracture was higher than in the other groups ($P = 0.019$) (Table 2). In the patients with condylar fractures, the most common position, angulation, and number of roots were class I (21 teeth, 30.0%), class A (19 teeth, 27.1%), mesioangular (33 teeth, 47.1%), and multiple roots (34 teeth, 48.6%), respectively. In the patients with mandibular angle fractures, the most common position, angulation, and number of roots were class II (21 teeth, 32.3%), class B (27 teeth, 41.5%), mesioangular (36 teeth, 55.4%), and multiple roots (39 teeth, 60.0%), respectively. However, there were no significant differences in the position, angulation, and number of roots between patients with condylar fractures and those with mandibular angle fractures (Table 2).

Discussion

Mandibular fractures are influenced by various factors including the direction

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