

Mandibular Fractures Related to the Surgical Extraction of Impacted Lower Third Molars: A Report of 11 Cases

Vicent Grau-Manclús, DDS,* Jordi Gargallo-Albiol, DDS, PhD,†

Nieves Almendros-Marqués, DDS,‡ and

Cosme Gay-Escoda, MD, DDS, PhD§

Lower third molar extraction is one of the most frequent procedures in oral surgery. Although the prevalence of complications in relation to this surgical procedure is low, the surgeon must previously inform the patient of the possible intra- and postoperative risks and complications. The main intra- and postoperative accidents or complications related to impacted lower third molar extraction are bleeding, pain, dental or bone fracture, the displacement of teeth or fragments, soft tissue damage, subcutaneous emphysema, nerve damage, trismus, swelling, and infection.¹ Of all these complications, those that are most common and that must be particularly explained to the patient are pain, swelling, bleeding, and infection—although the risk of damaging the inferior alveolar nerve and/or lingual nerve must also be explained, in view of its clinical relevance.

The incidence of intra- or postoperative mandibular fractures is very low and ranges from 0.0033% to 0.0036% and 0.0013% to 0.0046%, depending on the literature source.²⁻⁴ Such fracture requires prompt treatment to avoid serious complications. Accordingly, surgeons who often extract impacted lower third molars must understand the nature of mandibu-

lar fracture in such situations to identify those cases that are more likely to develop fracture, with a view to providing adequate patient forewarning and obtaining written informed consent.

The present study describes the clinical and radiologic characteristics of 11 mandibular fractures secondary to impacted lower third molar extraction (6 have been published elsewhere⁵), explores the possible underlying risk factors, and provides a review of the literature on the subject.

Report of Cases

A retrospective analysis was made of 11 mandibular fractures secondary to the surgical removal of impacted lower third molars corresponding to the period from 1996 to 2007. The extractions were carried out in different centers by different surgeons: 4 in the Service of Oral Surgery, University of Barcelona Dental Clinic (Barcelona, Spain) by second- and third-year residents; 6 in different private clinics by dental surgeons; and 1 in a hospital setting performed by a first-year resident in maxillofacial surgery.

The following data were collected: patient age and gender, the presence of systemic disease or medication capable of favoring mandibular fracture, the extracted molar, previous infection in relation to the extracted molar, the time from surgery to the fracture, patient perception of the complication and the underlying causal factor, the treatment provided after the complication, the location of the lower third molar according to the classification of Pell and Gregory,⁶ the presence of associated bone damage, angulation of the molar and its relation to the inferior dental canal and alveolar nerve, the surgeon's experience, and the presence or absence of displaced bone fragments.

Results

The results obtained in the present patient series are presented in **Tables 1** and **2**. The mean patient age was 42.7 years (range, 28 to 63 years). There were no differences in patient gender (6 female and 5 male). Only 1 patient had systemic disease (osteoporosis) and received chronic treatment with bone density-altering drugs (glucocorticoids). In the present series there were 4 postoperative and 7 intraoperative fractures. A history of pericoronitis associated to the mo-

*Resident, Master of Oral Surgery and Implantology, Barcelona University Dental School, Barcelona, Spain.

†Professor, Master of Oral Surgery and Implantology, Barcelona University Dental School; Investigator, UB-IDIBELL Institute, Barcelona, Spain.

‡Associate Professor, Oral Surgery, and Professor, Master of Oral Surgery and Implantology, Barcelona University Dental School; Investigator, UB-IDIBELL Institute, Barcelona, Spain.

§Full Professor, Oral and Maxillofacial Surgery, and Director, Master of Oral Surgery and Implantology, Barcelona University Dental School; Coordinating Investigator, UB-IDIBELL Institute; Head, Service of Maxillofacial Surgery, Teknon Medical Center, Barcelona, Spain.

Address correspondence and reprint requests to Dr Gay-Escoda: Centro Médico, Teknon Instituto de Investigación UB-IDIBELL C/Vilana 12, 08022 Barcelona, Spain; e-mail: vicentegraumanclus@hotmail.com

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Table 1. CLINICAL CHARACTERISTICS OF PATIENTS, FRACTURES, AND TREATMENTS PROVIDED

Case Number	Age (yr)	Gender	History of Infection	Interval from Removal to Fracture (d)	Causal Factor	Patient Fracture Perception	Treatment
1	30	F	No	0	Winter elevator	No	OR-IF
2	29	M	Pericoronitis	0	Winter elevator	No	OR-IF
3	42	F	Pericoronitis	0	Winter elevator	No	OR-IF
4	28	F	Pericoronitis	0	Winter elevator	No	IF
5	52	M	Pericoronitis	0	Winter elevator	No	OR-IF + FIM
6	54	M	Pericoronitis	0	Winter elevator	No	OR-IF + FIM
7	37	M	No	0	Winter elevator	No	OR-IF + FIM
8*	31	F	No	15	Chewing	Crackling + pain	SD
9*	45	M	No	30	Chewing	Crackling	SD
10*	63	F	Pericoronitis	28	Chewing	Crackling + pain	SD
11*	59	F	Pericoronitis	14	Chewing	Crackling + pain	IF
Mean 42.7		F/M 6/5	Yes/no 7/4	Mean* 21.8			

Abbreviations: F, female; FIM, intermaxillary fixation; M, male; OR-IF, open reduction and internal fixation; SD, soft diet.

*Postoperative fracture.

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lar was recorded in 63.6% of cases. For the postoperative fractures the mean time from extraction to fracture was 21.8 days (range, 14 to 30 days). These fractures occurred secondary to the chewing of relatively hard foods. In contrast, a winter root elevator was seen to have been used in all intraoperative fractures. In the group of 4 postoperative fractures, 3 patients reported having noted a crackling sound associated with intense pain, and only 1 patient experienced such crackling without pain. In 3 cases intraoperative fracture was subjected to surgical reduction, miniplate osteosynthesis, and intermaxillary fixation. In 3 cases intermaxillary fixation did not prove necessary; surgical reduction was carried out, along with

osteosynthesis using miniplates fixed with bicortical screws. In contrast, in the postoperative fracture group, 3 patients were exclusively treated with a soft diet during 3 months, whereas intermaxillary fixation was decided in 1 patient (Fig 1). In 9 of the overall 11 cases there were prior bone lesions associated with the molar: 2 cysts and 7 dental follicle widenings measuring 2 to 4 mm on panoramic radiograph (Fig 2). In all patients there was a close relation between the molar or its roots and the inferior dental canal (7 in juxtaposition and 4 adjacent to the canal). In 6 mandibular fractures (4 of which were postoperative) there were no bone fragment displacements. In the remaining 5 patients the fracture line was not favor-

Table 2. RADIOLOGIC CHARACTERISTICS OF LOWER THIRD MOLARS AND MANDIBLE

Case Number	Tooth	Associated Pathologic Bone Lesion	Position According to Pell and Gregory ⁶		Angulation	Bone Fragment Displacement	Relation to IAN
			A/P	Vertical			
1	3.8	Follicle	II	C	M	Yes	Juxtaposition
2	4.8	Follicle	II	B	M	Yes	Juxtaposition
3	4.8	Cyst	III	C	H	Yes	Adjacent
4	4.8	Follicle	II	C	M	No	Juxtaposition
5	4.8	Follicle	II	C	M	No	Juxtaposition
6	3.8	Follicle	III	C	M	Yes	Adjacent
7	4.8	Cyst	II	C	H	Yes	Adjacent
8*	4.8	No	III	C	H	No	Juxtaposition
9*	3.8	No	II	C	H	No	Juxtaposition
10*	3.8	Follicle	II	B	V	No	Juxtaposition
11*	4.8	Follicle	II	C	H	No	Adjacent
3.8/4.8 4/7		Yes/no 9/2	II/III 8/3	B/C 2/9	M 5, H 5, V 1	Yes/no 5/6	Yes/no 11/0

Abbreviations: A, angular; H, horizontal; IAN, inferior alveolar nerve; M, mesioangular; P, preangular; V, vertical.

*Postoperative fracture.

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FIGURE 1. Case number 11. Panoramic radiography view showing a post-extraction fracture of the mandibular body. Intermaxillary fixation was carried out with 4 screws affixing metal wires.

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able, and muscle traction caused displacement of the bone fragments. In 8 cases the surgeon's mean experience was 22.9 months (range, 3 to 48 months).

Discussion

In recent years there has been a considerable increase in the number of publications on mandibular fracture risk factors associated with the surgical removal of lower third molars.^{3,4,7-9} Factors such as patient age and gender, systemic disease and medication, the existence of preoperative infection and cystic lesions, third molar position, and the relation of the third molar to the inferior alveolar nerve have been cited.^{4,7-9}

The present results coincide with those of the literature with respect to mean patient age at the time of mandibular fractures associated with the surgical removal of impacted third molars.^{7,10,11} Although the surgical removal of third molars is more common in young patients, the incidence in the present series proved similar between young and middle-aged to elderly patients (>35 years). This may be explained by the fact that in older age bone elasticity begins to decline, the periodontal ligament narrows, and there is a greater presence of concomitant diseases and the use of drugs that may alter bone density.^{12,13} One patient presented with osteoporosis and was receiving treatment for systemic lupus erythematosus with low-dose corticoids (prednisone 5 mg/d orally; Dacortin; Merk Farma y Química, Barcelona, Spain).

Gender appears to play an important role in mandibular fractures associated with the surgical removal of third molars. Postoperative fractures are slightly more prevalent in male patients.^{8,9} This may be because men are more involved in risky sports and are in more traffic accidents than women, for example. In addition, men appear to apply greater masticatory



FIGURE 2. Case number 10. Radiography view of 3.8 in position IIB according to the classification of Pell and Gregory. Note the juxtapositioned roots and inferior dental canal, and the distal follicular widening.

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force. No gender differences were found in the present series.

Seven patients had a history of pericoronitis associated with an impacted third molar (63.6%). In agreement with our findings, Perry and Goldberg⁴ reported a 64% incidence of preoperative infections related to the extracted molars. Although the severity and duration of infection were not registered, it is reasonable to assume that any chronic or repetitive infectious process in the zone may alter the adjacent bone, favoring the possibility of mandibular fracture.

The presence of pathologic bone modifications such as cysts or tumors associated with the molar has been related to mandibular fracture after surgical removal of the tooth. This is attributable to the bone weakening produced by such lesions, particularly in the region of the mandibular angle. It has even been suggested that minor changes such as follicular widening can weaken the mandible.^{7,8} In the present series, 81.8% of mandibular fractures were associated with radiotransparent lesions: 2 follicular cysts and 7 dental follicle widenings (2 to 4 mm on panoramic radiograph).

Lower molar location and angulation also appear to influence these kinds of complication. Complete bone coverage is generally associated with increased osteotomy during surgery. All patients in the present study corresponded to the combination of classes B/C and II/III of the classification of Pell and Gregory⁶; as a result, the osteotomy performed was quite extensive. With regard to inclination, distoangular lower third molars, followed by vertical, horizontal, and mesioangular molars are more difficult to remove and require greater osteotomy. Five molars in the present series showed a horizontal inclination, whereas 5 were mesioangular and 1 was vertical.

Iizuka et al⁷ identified the relation between the molar roots and inferior dental canal as a possible risk factor. The association between mandibular fracture after surgical removal of the lower molar and the relation between the latter and the inferior dental canal could be because the canal constitutes an identifiable anatomic reference of the scant remnant bone thickness beneath the inferior alveolar nerve. When the inferior alveolar nerve is very close to the impacted molar, the odontic section may be at great risk and a more extensive osteotomy may be required. All patients in this study showed a close relation between the molar roots and the inferior dental canal.

In such cases of deep tooth impaction, it is preferable to perform moderate osteotomy with posterior tooth sectioning, to lessen the force required to luxate and extract the molar.¹ When fracture takes place after extraction, one main causal factor is patient failure to adhere to the recommended soft diet. Indeed, all 4 of the postoperative mandibular

fractures in this study occurred during chewing. Although all patients were instructed to consume a soft diet, probably an insufficient emphasis was placed on the type of food indicated and on the duration of the diet.

In the present study, the surgeons had been practicing fewer than 5 years. The present results are not in accord with those of Perry and Goldberg⁴ who found that only 4 of the 28 fractures were reported by surgeons who had been in practice 5 years or less.

Although some studies⁹ have reported mandibular fractures as long as 6 weeks after surgical removal of a lower molar, the mean time from surgery to fracture in the present series was 2 to 4 weeks. In this period, the granulation tissue is replaced by connective tissue in the extraction zone; therefore, an increased risk of fracture is to be expected. The fact that all fractures in the present series occurred within this interval supports this hypothesis. Another possibility is that the postoperative fractures may have been incomplete intraoperative fractures in the form of fissures, which over the weeks after extraction, could have exceeded the corresponding tolerance or stress limits.

Adequate clinical and radiologic evaluations are required to establish a correct diagnosis of postoperative mandibular fracture. In these situations, the patient usually visits the dentist after having noted a crackle while eating. This phenomenon is characteristic of this kind of complication and largely facilitates the diagnosis. All patients in the present study noted crackling, although it also must be stressed that 3 of them reported intense associated pain for a few hours. Fragment displacement may also be palpable. None of the patients with postoperative fracture in the present study showed fragment displacement. In some cases the radiologic findings are more difficult to interpret, and the fracture lines are not identifiable.^{7,10} In the present series all fracture lines were clearly visible on panoramic radiographs. The radiographic projections of choice are the oblique lateral, posteroanterior, and Townes (occipitofrontal) projections. Three-dimensional tomographic reconstruction facilitates the diagnosis of craniofacial fractures.¹⁴ Panoramic, occlusal, and periapical radiographies are complementary techniques that can be of great help in establishing the diagnosis.¹⁵

The objectives of mandibular fracture treatment are to restore the mandibular contour, dental occlusion, and temporomandibular joint function. As with any other type of fracture, anatomic reduction of the fractured bone segments is a first requirement, followed by fixation and immobilization to allow correct bone consolidation. In patients with unfavorable mandibular fractures, it is currently preferable to perform

surgical reduction (often under general anesthesia) and fixation based on osteosynthesis with miniplates and monocortical screws.¹⁶

To conclude, in those cases in which third molar extraction requires extensive osteotomy, the molar shows a close relation to the inferior alveolar nerve, and a patient has a history of pathologic bone disorders and local infection, the patient must receive notification of the risk of fracture. In contrast, in those cases in which the mandible is greatly weakened after removal and/or a patient has some serious systemic disorder or requires medication that decreases bone density, emphasis must be placed on the need to adhere to a soft diet for 4 to 12 weeks.

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