Does the Relationship between Retained Mandibular Third Molar and Mandibular Angle Fracture Exist? An Assessment of Three Possible Causes

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Craniomaxillofac Trauma Reconstruction 2012;5:127–136

Abstract

Keywords

- ▶ third molar
- ▶ impacted mandible third molar
- ▶ mandibular fractures
- ▶ angle fracture
- ▶ fracture healing

The objective of this study is to discuss problems associated with dental retention through three clinical cases of mandible fractures related to the presence of retained lower third molars, emphasizing the possibility of mandible fractures resulting from this or from the extraction procedure. The three evaluated patients had a fracture in the mandible angle. The third molars were present in all the cases, as was the relationship of the fracture with the teeth. After evaluating the three cases and reviewing literature, it is believed that the presence of the retained lower third molars and the surgical procedures for their extraction increase the risk of mandible angle fractures.

A retained tooth is when, after normal eruption, is still covered by bone and/or soft tissue.¹ This can occur due to: early loss of deciduous teeth, dental anomalies, poor positioning of the dental germ or of adjacent teeth, lack of space for eruption, permanence of deciduous teeth, trauma, impacted hard, soft, or both tissues, supernumerary teeth, odontogenic cysts, and/or tumors.^{2,3}

Verri et al⁴ indicated that lower third molars are the teeth that most remain impacted, followed by upper third molars, upper canines, and supernumerary teeth. These data were confirmed by other authors.^{1,2}

Retained third molars can be classified according to the angle of the third molars' long axis compared with the adjacent second molars.⁵ The vertical position is the most common, followed by mesial or mesioangulated,^{6–8} but van der Linden et al⁹ and Farish and Bouloux¹⁰ ensured that the

mesioangulated lower third molars are the most common position, followed by the vertical.

According to Torres et al,⁷ in the Pell and Gregory¹¹ classification, the most common position for retained lower third molars is IIB (the space between the ascending and distal ramus of the second molar is smaller than the mesial-distal diameter of the lower third molar, and the highest position of the retained tooth is below the occlusal plane and above the cervical line of the lower second molar), which were the same data uncovered by Nery et al.¹²

The presence of these teeth is related to complications such as caries, radicular resorption of adjacent teeth, pericoronaritis, local pain, cyst, or tumor alterations,^{10,13,14} and may also increase two^{15,16} to three^{17,18} times the risk of mandible angle fractures in patients submitted to mandibular trauma, as such a situation makes this region more fragile.^{19,20}

received

October 9, 2011

accepted after revision

November 8, 2011

published online

June 5, 2012

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Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0032-1313355>.
ISSN 1943-3875.

Figure 1 Panoramic radiograph showing the fracture in the left mandible angle region, retained tooth 38, and the possible paradental cyst.

Among the facial skeleton bones, the mandible is one of the most commonly fractured,^{21–23} and the mandible angle is the most commonly affected area,^{24,25} as it consists of a transition zone between the dentulous and edentulous part of the mandible, where retained teeth are frequently found.¹⁶

As retained teeth relate to complications, prophylactic exodontia became a common practice with the objective of avoiding or minimizing such complications.^{17,26–29} However, the indication of that sort of procedure is often questioned by some authors in literature,^{16,30,31} as the procedure can also cause complications, such as: alveolitis,³⁰ lesion to the lower

and lingual alveolar nerve,⁵ increase in the chance of condylar fractures,^{30,32,33} or even mandible angle fractures,^{34,35} which can occur either trans-³⁵ or postoperative.^{34,36}

Bresaola²¹ indicated traffic accidents as the most common cause of fractures, followed by domestic accidents, aggressions, sports accidents, and work accidents. Sakr et al²⁴ presented work accidents as the main cause of trauma, followed by falls and assaults.

The most common signs and symptoms of mandible fractures are malocclusion, edema, pain, trismus, bone mobility and crepitation, loss of dental elements, changes in facial contour, ecchymosis or hematoma, paresthesia of the lower lip.^{37,38} Confirmation of the diagnostic hypothesis is made through clinical examinations and imaging, where panoramic radiography, oblique lateral radiographs, and computed tomographic (CT) scans stand out.^{2,38}

Treatment of mandible fractures is based on the principles of reduction and immobilization,^{1,38,39} preferably being treated by surgical reduction with rigid internal fixation^{22,25} using plates and screws.^{25,38}

The objective of this study is to report on three cases of mandible angle fractures related to the presence of retained lower third molars, and in which fractures occurred at three different moments: at the moment of trauma, during extraction, and after extraction.

Figure 2 (A) Third molar removed during surgery together with the associated lesion; (B) intrabuccal access with submucosa incision after tooth removal; (C) extraoral Risdon approach; (D) fixation of the fracture with plates and titanium screws.

Case Reports

Case 1

A 41-year-old man, victim of a head butt by a large animal (bovine) presented facial asymmetry from edema on the left, spontaneous pain and pain on palpation as well as limited oral opening. Panoramic and posteroanterior radiographs were requested of the mandible, where a fracture was observed in the mandible angle region, as well as the presence of a radiolucid lesion surrounded by a radiopaque halo around the crown of the retained lower third molar, suggestive of a paradental cyst. ►**Fig. 1** reproduces the panoramic radiograph and shows the fracture line in the left mandible angle region, retained tooth 38, and the possible paradental cyst.

The decision was for surgical reduction and rigid internal fixation of the fracture, as well as removal of tooth 38 and the associated lesion, with the latter being performed in a hospital environment, under general anesthesia, and with nasotracheal intubation. The fracture region was approached by intra- and extraoral approaches (Risdon approach), permitting exodontia of tooth 38 and removal of the lesion, as well as fixation of the fracture with one four-hole plate of the 2.4 system and bicortical titanium screws at the base of the mandible and another four-hole plate of the 2.0 system,

with four monocortical screws in the oblique line (►**Fig. 2**). The patient remained under intermaxillary block during reduction and fracture fixation and after the block was released during the transoperative period, final cleaning and hemostasis of the area was performed as was synthesis of the plane.

After around 60 days, postoperatively, the patient evolved an abscess in the left mandible angle region with spontaneous draining of purulent secretion. A panoramic radiograph showed bone resorption related to the fracture line and the screw near the fracture, in the proximal stump, which was loose and had shifted out of the plate (►**Fig. 3**); the diagnosis of this second moment was mandibular osteomyelitis associated with abscess. It was then decided to immediately begin oral antibiotic therapy with 1500 mg/d amoxicillin and drainage of the abscess under local anesthesia and admission into the hospital. Endovenous antibiotic therapy with 1 g of cephalothin every 6 hours and 100 mg of Ketoprofen every 12 hours and a new surgical procedure was indicated to replace the plate on the infected area. After 2 days of drainage, the patient again underwent surgery under general anesthesia to replace the fixation material. After the Risdon approach and removal of existing plates in the region, new plates were inserted: one six-hole reconstruction plate of the 2.4 system and bicortical titanium screws at the base of the mandible and

Figure 3 (A) Clinical aspect of the spontaneous drainage of purulent secretion in the mandible angle region; (B) panoramic radiograph showing bone resorption related to the fracture line and screw near the fracture which was loose and shifted out of the plate; (C) access to the mandible angle region after removal of plates; (D) fixation of the fracture using a 2.4-mm reconstruction plate and 2.0 system plate.

Figure 4 Panoramic radiograph showing fixation of the fracture with a 2.4-mm reconstruction plate at the base of the mandible and the 2.0 system plate with six holes and five screws, in the oblique line region.

another six-hole plate with intermediary of the 2.0 system and six monocortical screws in the oblique line (►Fig. 3).

After this new surgical procedure, the patient evolved properly. We continued the use of 1 g of cephalexin every 6 hours for 10 days, as well as analgesics and nonsteroidal anti-inflammatories; 17 months after the last surgical procedure, the patient has not had any complications and has been released (►Fig. 4).

Case 2

A 27-year-old patient was evaluated with pain, trismus, and discrete edema, reporting he had suffered a mandible fracture during exodontia of tooth 38 (►Fig. 5). He had a panoramic radiograph that had been taken immediately after the fracture during exodontia of tooth 38. The intraoral examination revealed vertical misalignment of proximal and distal stumps, as well as the presence of a suture with stitches interrupted in the region corresponding to the third molar socket. The panoramic radiograph also revealed an image compatible with a mandible fracture in the angle region, as well as the vertical shift of stumps and the postextraction socket of tooth 38 (►Fig. 6A). The patient was taking 1500 mg/d of amoxicillin and 200 mg/d of nimesulide. The proposed treatment was for surgical reduction of the fracture with rigid internal fixation.

Surgery was performed in a hospital environment under general anesthesia 3 days after the fracture. The patient was medicated in preimmediate and postoperative periods with

Figure 5 Panoramic radiograph where we can observe tooth 38 in the vertical C3 position.

50 mg of ranitidine, 100 mg of Ketoprofen, 1 g of cephalothin, and 10 mg of dexamethasone. The fracture region was approached using the Risdon approach and maxillomandibular blocks and manipulation of bone stumps, and it was reduced. Fixation was performed using six-hole, 2.4 system titanium plate and six bicortical screws placed in the mandible base region and one five-hole plate of the 2.0 system and four monocortical screws placed in the oblique line. After that, the maxillomandibular block was removed, final cleaning and hemostasis were performed, and suturing was done by planes (►Fig. 6). The mucosa that covers the portion that corresponds to tooth 38's socket was resutured.

Skin and intraoral sutures were removed on the 7th day postoperative and the patient evolved without any complications. The patient was kept on a soft diet for ~60 days, and is still under postoperative control (►Fig. 7).

Case 3

A 33-year-old man sought care with an edema located in the left mandible angle region. He complained of pain and said he had undergone exodontia of the retained lower third molar about 4 weeks ago and that the edema and pain had begun immediately after hearing a snap while eating a sandwich. Trismus and discrete mobility and crepitation were also observed. A panoramic radiograph revealed the postexodontia socket of tooth 48 as well as extensive osteotomy or bone resorption and a fracture line in the right mandible angle region. The patient was medicated with 1500 mg/d of amoxicillin, 200 mg/d of nimesulide, was given a liquid diet, and was asked to get a digital volume CT scan, which permitted confirmation of the mandible fracture diagnosis, with the presence of an intermediary bone fragment (►Fig. 8).

In a hospital environment and before the procedure, 500 mg/mL of sodium dipyrone, 50 mg of ranitidine, and 1 g of cephalothin were used every 6 hours. Treatment involved the surgical reduction of the fracture under general anesthesia in a hospital environment using an intraoral approach and extraoral incisions only to permit passage of a trocar (►Fig. 9). The fracture was reduced by surgical manipulation and transoperative maxillomandibular block and immobilized using a reconstruction plate with an intermediary of the 2.4 system and six bicortical screws near the mandible base region (►Fig. 10).

After surgery 500 mg/mL of sodium dipyrone every 6 hours, 100 mg of Ketoprofen every 12 hours, 10 mg of dexamethasone (single dose), and 1 g cephalothin every 12 hours were prescribed. The patient returned 5 days later for removal of external stitches. Intraoral stitches were removed 20 days after the surgical procedure (►Fig. 11). Panoramic and posteroanterior radiographs of mandible revealed the reduction and consolidation of the fracture, as well as the lack of complications, 180 days after the surgical procedure.

Discussion

Lower third molars are the most common teeth to be retained² and they are frequently related to problems of infection, caries, dental resorption, cysts, tumors, and

Figure 6 (A) Panoramic radiograph showing the fracture in the left mandible angle region; (B) extraoral approach to the fracture; (C) functional reduction of the fracture; (D) fixation of the fracture with plates and titanium screws.

predisposition to mandible fractures. Therefore, the extraction of asymptomatic retained lower third molars, known as prophylactic extraction, is one of the most common procedures performed in dental clinics.^{7,10,30,34–36,40} The decision to conduct this procedure or not represents a surgical challenge and is subject to discussion.⁴¹ It seems clear to us that

keeping asymptomatic nonerupted lower third molars may be tied to complications, with an increase in the chance for mandible angle fractures after trauma.^{16,18,23,32} Likewise, the procedures for extracting asymptomatic retained third molars are not exempt from morbidity and, mandible fractures may occur during the trans-^{30,35} or postoperative periods.^{30,34,36,42,43}

In the reported cases, a relation was observed between the third molars and their respective mandible fractures. In the first case, the presence of the retained tooth and the association with a paradental cyst weakened the mandible angle region, favoring the fracture that resulted from the impact with the animal. In Cases 2 and 3, mandible fractures occurred in the trans- and postoperative periods, both related to the weakening of the mandible by the presence of the teeth and complicated by probable errors in surgical technique for extraction (Case 2) and the weakening of the mandible resulting from ample osteotomy performed to remove the tooth (Case 3).

Case 1 corroborates the opinion of authors who see prophylactic extraction as a mechanism to prevent possible cystic and/or tumor alterations,^{27,43} to reduce risks of mandible angle fractures in patients who undergo constant, low-intensity trauma,^{17,23,27} or even to reduce surgical morbidity in patients with advanced age.⁴¹

Figure 7 Postoperative panoramic radiograph showing fixation of the fracture using a four-hole, 2.4 system titanium plate and four bicortical screws in the mandible base region and one five-hole, 2.0 system plate with four monocortical screws placed in the oblique line.

Figure 8 (A) Panoramic radiograph showing the postexodontia socket of tooth 48, as well as extensive osteotomy or bone resorption and a fracture line in the right mandible angle region; (B) posteroanterior radiograph of the mandible showing the postexodontia socket with extensive osteotomy and the fracture line; (C and D) digital volume CT scan showing the mandible fracture and the presence of an intermediary fragment.

The presence of lower third molars has been cited as responsible for the increase in chances for fractures in the mandible angle region.^{15–20} This can be attributed to the fact that the mandible angle is characterized as a transition zone between the mandible's dentulous and edentulous parts and the area where impacted teeth are most commonly found.¹⁶ This results in a reduction in bone mass in that area, making it crumbly.^{15–20} Besides the presence of impacted teeth, it is possible to have the presence of pathological alterations that may further debilitate this region.^{35,36,39} In the first case, the mandible angle fracture occurred in a 41-year-old individual with a retained lower third molar associated with a paradental cyst which seems to have further weakened the mandible, making the trauma-related fracture possible. It must be underscored that if the patient had not suffered the trauma, the mandible fracture would not have occurred. But a question remains: Would the fracture have occurred, even with the trauma, if there had been no retained tooth and lesion?

In relation to the prophylactic extraction of retained lower third molars, it is considered that a proper examination of the patient, surgical planning, surgical technique, postoperative instructions, training, and experience of the professional involved, will reduce possible accidents/complications. Through anamnesis it is possible to identify factors such as age, systemic conditions, smoking, oral hygiene, and a light

diet during the postoperative period may favor complications in the trans and postoperative periods.³⁴ During surgical planning, we can resort to some diagnosis methods using imaging, such as: panoramic radiographs and CT scans,⁵ for better surgical planning, as the surgeon as well as the patient must be aware of the possible risks involved in the procedure,⁴⁰ such as the risk of lesions to the lower alveolar nerve and the incidence of mandible fractures.³⁴

The patient's age represents a factor that must be considered before surgery, because as the patient gets older, there is a reduction in bone elasticity, and probable dental ankylosis,^{34,35} with greater difficulty expected in patients over 25 years of age,^{37,41,44} when it becomes necessary to perform odontosection for removing teeth. The three patients cited in this study were over 25 years of age, generating an additional difficulty in removal (Cases 2 and 3), which may have favored the mandible angle fracture.

According to Wagner et al.,³⁴ teeth located on the left side of the mandible may need a bigger osteotomy as a result of the difficulty in visualization found in most right-handed operators. Therefore, in cases where extensive osteotomy was needed, it is prudent to give the patient a liquid and mild diet, especially during the first 4 weeks,^{35,42} because this is the most critical period, when there are greater chances for postoperative mandible fractures.^{35,42} In Case 3, although it

Figure 9 (A) Intraoral view of plate placement in position; (B) intraoral suture; (C) extraoral incisions for passage of the trocar; (D) extraoral suture.

Figure 10 Panoramic radiograph showing fixation of the fracture with a 2.4-mm reconstruction plate.

Figure 11 Panoramic radiograph 180 after the bloody reduction procedure for the mandible fracture with rigid internal fixation.

deals with the right side, ample osteotomy was performed to remove the tooth, which led to greater weakening of the mandible and, even in the fourth postoperative week, while eating nonpasty food (a sandwich), the patient fractured his mandible. This type of fracture can be related to masticatory force,^{34,35} revealing an increased risk in men, because they have greater masticatory force when compared with women.

Fractures in the mandible angle region can occur transoperative,³⁰ where the type of impact³² seems to be important in this context. According to Iizuka et al,³⁶ fractures may be related to factors such as: deeply impacted teeth, use of exaggerated force during exodontia, presence of bone pathologies, or cystic lesions or tumors. In the second case described, the fracture in the angle region occurred transoperative and it is possible that the class IIIC position (Pell and Gregory classification) favored the mandible fracture, because in these situations there is little bone tissue between the tooth and the base of mandible, weakening the latter. This situation, associated with a thin mandible (—Fig. 6) and excess force applied to remove the tooth, may favor the fracture. It is worth underscoring that in these cases it is ideal to use conservative osteotomies, odontosection, and care in applying force with extractors.

Despite the different surgical interventions, all cases related in this article were treated according to the basic principles of fracture reduction and immobilization,^{1,22,38} regardless of

cause, where surgical reduction³⁷ and immobilization using rigid internal fixation^{22,25} achieved with plates and screws,^{25,38} is the most accepted method today. The main objective of this treatment is to restore the integrity of fractured bone tissue and to promote fracture repair without complications and the need for maxillomandibular blocks during postoperative.³⁸ However, literature shows reports where postoperative infection is the most common complication as a result of mandible angle fracture treatment.^{38,45}

According to a study by Barry and Kearns,⁴⁵ these complications may be related to deficient nutrition and hygiene, as well as the abusive use of drugs and alcohol. Paza et al³⁸ also adds that improper fixation of the fracture may delay the fracture repair process, contributing toward infections. This instability results from the patient's noncooperation as well as fracture severity. In Case 1, despite the use of one 2.0 plate and another 2.4 plate at the base, it seemed thin and fragile, possibly without proper resistance for rigid fixation of the fracture. The mobility of fractured stumps favored the resorption of their edges, which may have contributed to screw shifting and postoperative infection. Another fault that can be pointed out is the positioning of the plate which ended up placing the screws too close to the fracture line, or an inadequate plate size and screw numbers at the first surgical time, only four (two by each side of the fracture) on 2.4 mm plate, incapable to support the load starting infection process. The second surgical approach seemed to be more stable by the use of a six-hole 2.4-mm plate and three screws by each side of the fracture positioned further away from the fracture line, the case was solved. Another factor to consider in this case is the patient's diet. He probably did not have a light diet as he was a cowboy, and in our country, this involves a tougher diet with great need for calories. Scolozzi and Richter⁴⁶ reported that the use of the 2.4-mm reconstruction plate presented lower postoperative complication rates (3%). As seen in this study, the second and third clinical cases were treated with these plates, and no complications were observed in the postoperative period.

One point that has been discussed in literature is in relation to the conduct of those teeth located along the fracture line. In the first clinical case, the patient had a mandible angle fracture related to the presence of a third molar, which was related to radiopaque lesion surrounded by a radiolucid halo. According to Ellis,⁴⁷ the presence of teeth related to fractures did not have a statistically significant difference, although a higher rate of complications was observed in those cases where the teeth were left in situ. According to Ellis,²⁵ in cases where treatment will be conducted by open reduction, removal of these teeth may be tied to lower rates of infection, whereas with closed reduction, this difference does not exist. According to Shetty, Freymiller, the indications for removal of teeth located along the fracture line are: partially erupted third molars with pericoronaritis or cysts, teeth that impede fracture reduction, teeth with fractured roots, teeth with exposed roots, and delays in treating the fracture.

This article shows three cases of the relationship of unerupted molars and mandible fractures in different situations,

two clinical fractures caused by surgical procedures treated in different time stages and one by facial trauma and a lesion associated to the tooth. Different cases were shown to emphasize how it can improve mandibular fractures justifying the need for unerupted third molars removal.

Conclusions

The most commonly retained teeth are the lower third molars and their presence is related to a greater possibility for mandible angle fractures, whether caused by trauma or as a result of procedures for the prophylactic removal of the referred to teeth.

Although maintenance of asymptomatic retained lower third molars is controversial and the risks of problems related to these teeth do exist, it is necessary to point out that the prophylactic exodontia of retained teeth is not a risk-free procedure.

When the dental surgeon and the patient have opted for exodontia of asymptomatic teeth, they should be aware of such risks and all care needed for a technically perfect procedure must be taken.

In face of trans- and/or postoperative complications, all care needed for solving the problem must be taken. When there is a fracture of the mandible, the patient must be treated by a skilled professional (oral and maxillofacial surgeon) and the treatment will follow the principles for treating mandible fractures, regardless of the cause.

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