

Extraction of Impacted Mandibular Third Molars: Postoperative Complications and Their Risk Factors

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ABSTRACT

Objective: The purpose of this prospective study was to evaluate the incidence of various complications, including alveolitis, infection and paresthesia of the inferior alveolar nerve, in association with removal of impacted mandibular third molars. The relation between these 3 complications and several clinical variables (age, sex, degree of impaction, surgical difficulty and use of oral contraceptives) was also examined.

Materials and Methods: Data were collected prospectively for all patients who underwent extraction of an impacted third molar in a single private dental practice over a 12-month period. A variety of data were collected for each patient, including age, sex, medical status at the time of the procedure and type of procedure performed. Patients were contacted at 2 days and 4 weeks after surgery to establish the occurrence of complications, and those with complications were treated; those with paresthesia were followed for at least 24 months.

Results: A total of 550 impacted mandibular third molars were extracted from 327 patients (136 males and 191 females). The complication rate was 6.9%, consisting of 20 cases of alveolitis, 12 cases of infection and 6 cases of paresthesia of the inferior alveolar nerve. Of the 6 neurosensory deficits, 3 resolved and 3 were permanent. The risk factors associated with permanent neurosensory deficit were female sex, Pell and Gregory IC or IIC classification of impaction, and age greater than 24 years. The risk of postoperative alveolitis and infection was also greater among women. There was no significant relation between the use of oral contraceptives and alveolitis.

Conclusions: Surgical removal of impacted mandibular third molars should be carried out well before the age of 24 years, especially for female patients. Older patients are at greater risk of postoperative complications and permanent sequelae. A surgeon's lack of experience could also be a major factor in the development of postoperative complications.

For citation purposes, the electronic version is the definitive version of this article: www.cda-adc.ca/jcda/vol-73/issue-4/325.html

The extraction of impacted mandibular third molars is a common procedure in oral and maxillofacial surgery. The reasons for extracting these teeth include acute or chronic pericoronitis, presence of cysts or a tumour, periodontal problems and pres-

ence of a carious lesion on the second or third mandibular molar.¹ In some cases, extraction is performed in preparation for orthodontic treatment or orthognathic surgery. In North America, extraction of impacted mandibular third molars is often intended to prevent

future complications. Before any such procedure, the patient must be informed of the reason for the surgery and the associated risks.

Several complications are associated with extraction of impacted mandibular third molars, the most common being alveolitis, infection and paresthesia of the inferior alveolar nerve.²⁻⁴ Hemorrhage during or after surgery and paresthesia of the lingual nerve are relatively rare^{2,5,6}; surgical technique seems to play a major role in the occurrence of the latter problem.⁷

Most of these problems are temporary, but in some cases, paresthesia may become permanent and lead to functional problems.^{6,8}

Several factors have been associated with these complications, including age and health of the patient, degree of impaction, the surgeon's experience, the surgical technique used, smoking and the use of oral contraceptives (OC).^{4,6} From previous studies, the first 3 of these factors appear to be associated with higher complication rates.^{2,4,5}

The purpose of this prospective study was to evaluate the incidence of complications associated with the extraction of impacted mandibular third molars. All cases of alveolitis, postoperative infection and paresthesia were noted. No other complications were identified. An attempt was also made to determine the risk factors associated with each of these complications.

Materials and Methods

This study took place between January 1 and December 31, 2003. All patients referred to a private dental practice for extraction of impacted mandibular third molars were included; no patients were excluded for any reason. All patients were treated by the first author (F.B.), who has 20 years of experience as a specialist in oral and maxillofacial surgery. A variety of data were collected for each patient, including age, sex, medical status at the time of the procedure and type of procedure performed.

Most of the patients had been referred by a general dentist, but some were referred by a specialist, in particular a single orthodontist. All procedures were carried out under local anesthesia with or without sedation (given orally, intravenously or by inhalation of nitrous oxide). The surgical technique was that recommended in North America, namely an oral approach using ostectomy and/or odontectomy. The British technique of "lingual splits"⁷ was not used. After extraction of the tooth and cleaning of the surgical site, a small piece of Gelfoam surgical sponge (Pharmacia and Upjohn, Kalamazoo, Mich.) soaked in tetracycline was placed in the alveoli before suturing with dissolvable thread (usually general chromic gut 4-0). Overall, no preoperative or postoperative prophylactic or antibiotic treatment was given, except to patients with a previously existing medical condi-

tion or acute infection of the impacted mandibular third molar(s).

The surgeon met each patient before surgery to discuss participation in the study. Medical status, age and sex were noted. To respect ethical standards for voluntary participation, the patients were given a written description of the study and were asked to sign a consent form. The risks associated with the surgery were discussed with each patient before approval was requested.

The Pell and Gregory⁹ and Winter¹⁰ classifications were used to document the position of the impacted mandibular third molars. These classifications were used to predict the surgical difficulty and to evaluate the risk of postoperative complications, in particular neurosensory problems, but also the other complications of interest (alveolitis and infection). All of the surgical procedures were documented, and each case was classified according to the type of intervention, e.g., mucoperiosteal flap only, flap with ostectomy, flap with odontectomy, or flap with ostectomy and odontectomy.

After the surgery, each patient received instructions for care. Patients were told to contact the clinic for any postoperative problem or if certain symptoms occurred, such as pain that could not be relieved by the prescribed analgesics, neurosensory problems, bleeding or recurrent edema.

Most patients received ibuprofen and/or codeine as an analgesic, with the dosage adjusted according to usual guidelines.

Patients were contacted by telephone 48 hours after the surgery and were asked about their initial postoperative condition. They were called again 4 weeks later to check whether other problems had arisen. All patients who had doubts about their postoperative condition or who experienced complications (i.e., alveolitis, infection or paresthesia) were seen, and appropriate treatment was initiated. Alveolitis was defined as the presence of pain requiring treatment at 2 to 5 days after surgery. The presence of infection was defined by purulent discharge at the extraction site and/or painful induration. Paresthesia was defined as any postoperative change in sensitivity of the tissues innervated by the trigeminal nerve (evaluated both subjectively and objectively, using light touch and a needle).

Cases of alveolitis were treated by irrigating the site with sterile saline and applying Alvogyl paste (Septodont, Cambridge, Ont.). Cases of infection were examined, and antibiotic therapy was prescribed. In some cases, depending on the clinical judgement of the surgeon and the severity of the problem, surgical drainage was carried out and the patient was followed. Patients with paresthesia were followed regularly for at least 24 months; paresthesia that persisted for more than 12 months was considered permanent. No case of paresthesia showed recovery beyond this 12-month period.

Table 1 Complications according to patients' sex

Complication	Males n = 225 teeth (%)	Females n = 325 teeth (%)	Total n = 550 teeth (%)
Alveolitis	4 (1.8)	16 (4.9)	20 (3.6)
Infection	1 (0.4)	11 (3.4)	12 (2.2)
Paresthesia of the IAN	0	6 (1.8)	6 (1.1)
Lingual paresthesia	0	0	0
None	220 (97.8)	292 (89.8)	512 (93.1)
Total	5 (2.2)	33 (10.2)	38 (6.9)

IAN = inferior alveolar nerve

Table 2 Incidence of paresthesia according to patients' age

Type of paresthesia	Age (years)				Total
	< 20	20–23	24–29	≥ 30	
Temporary	0	1	1	1	3
Permanent	0	0	2	1	3
Total	0	1	3	2	6

Results

A total of 550 impacted mandibular third molars were extracted. The 327 patients (191 [58.4%] females and 136 [41.6%] males) were between the ages of 12 and 55 years (average 24.4 years). The complication rate was 6.9% (**Table 1**). The overall complication rate differed significantly between men and women (2.2% and 10.2%, respectively; $\chi^2 = 13.00$, $p = 0.0003$). This difference was also evident for the individual complications reported: 1.8% and 4.9%, respectively, for alveolitis; 0.4% and 3.4%, respectively, for postoperative infection; and 0% and 1.8%, respectively, for paresthesia of the inferior alveolar nerve.

All of the patients with neurosensory problems were female (**Table 2**). The total incidence of paresthesia of the inferior alveolar nerve was 1.1% (6 cases). The patients with paresthesia were between the ages of 21 and 36 years, and 5 of these patients were older than 24 years. Of the 6 cases encountered, 3 (0.5% of the whole cohort) involved temporary paresthesia that disappeared within 12 months after the surgery. The 3 patients with permanent paresthesia (0.5% of the whole cohort) were at least 24 years of age (24, 27 and 36 years, respectively). There were no cases of bilateral paresthesia.

χ^2 testing indicated that age over 24 years was not a statistically significant factor in the development of paresthesia ($\chi^2 = 3.5762$, $p = 0.06$), but it seems noteworthy that all cases of permanent paresthesia were observed in women over 24 years of age.

There appeared to be a direct relation between the degree of impaction of the extracted tooth and the in-

cidence of postoperative complications (**Table 3**). Most of the complications were associated with a greater degree of impaction. Teeth classified as having IC, IIC and IIIC impaction had more complications than teeth classified as having B or A impaction ($\chi^2 = 7.1649$, $p = 0.0278$). The position of impacted mandibular third molars seemed to influence the incidence of postoperative complications (**Table 4**). The rate of complications was far higher with mesioangular impaction (24/258 or 9%) and distoangular impaction (2/25 or 8%) than with other positions. Together, these 2 positions were associated with a total of 26 complications (out of 283 extractions), whereas the other tooth positions (including vertical and horizontal) were associated with a total of 12 complications (out of 267 extractions) ($\chi^2 = 4.70$, $p = 0.030$). Furthermore, among the 6 cases of paresthesia, 5 of the teeth were in a mesioangular position. The horizontal position had the lowest complication rate (1/58 or 2%).

In 411 (75%) of the cases, the surgical technique involved removing a flap using ostectomy and odontectomy. For the other cases, the technique varied as follows: single flap with elevation of the tooth (96 cases [17%]), ostectomy alone (26 cases [5%]) or odontectomy only (17 [3%]). It is interesting that 35 (92%) of the 38 postoperative complications occurred in cases where ostectomy and odontectomy was used to extract the tooth ($\chi^2 = 5.50$, $p = 0.019$).

Of the 191 females in the study, 111 (58%) were taking OC, but there was no apparent relation between the incidence of alveolitis and use of oral contraceptives (OC).

Table 3 Complications according to degree of impaction

Complication	Pell and Gregory classification of impaction ^a								
	IA (11)	IB (19)	IC (38)	IIA (104)	IIB (163)	IIC (130)	IIIA (2)	IIIB (21)	IIIC (62)
Alveolitis	0	2	2	3	4	5	0	2	2
Infection	0	0	0	0	2	5	0	2	3
Paresthesia	0	0	1	0	0	5	0	0	0
No. of complications (% for category)	0	2 (11)	3 (8)	3 (3)	6 (4)	15 (12)	0	4 (19)	5 (8)

^aNumber of teeth in parentheses

Table 4 Complications according to position of impacted mandibular third molar

Complication	Position of molar (Winter classification)				
	MA (258 teeth)	DA (25 teeth)	Vertical (191 teeth)	Horizontal (58 teeth)	Other (18 teeth)
Alveolitis	12	2	6	0	0
Infection	7	0	4	0	1
Paresthesia	5	0	0	1	0
No. of complications (% for category)	24 (9)	2 (8)	10 (5)	1 (2)	1 (6)

MA = mesioangular, DA = distoangular

Ten (9%) of the 111 females taking OC experienced alveolitis, and 6 (8%) of the 80 not taking OC had this complication ($\chi^2 = 0.14, p = 0.71$).

Eleven women but only 1 man had a postoperative infection ($\chi^2 = 5.38, p = 0.020$). All of these infections were treated with appropriate oral antibiotics; 4 of the patients also underwent intraoral surgical drainage under local anesthesia with insertion of a Penrose tube drain (C.R. Bard, Inc., Covington, Ga.). One patient had 2 drains inserted at different times at each of the 2 surgical sites (teeth 38 and 48). There were no further sequelae, and recovery proceeded as expected.

One patient, a 36-year-old woman, experienced 3 complications associated with extraction of 2 impacted mandibular third molars: paresthesia (which proved to be permanent) and an infection on each side.

Discussion

In this prospective study of extraction of impacted mandibular third molars, the total complication rate (6.9%) compared favourably with previously reported rates, which have ranged from 2.6% to 30.9%.^{5,11}

Most of the complications occurred in women, which conforms with the results of other studies, especially for alveolitis.^{12,13} Muhonen⁵ reported a slightly higher rate of complications among men than among women.

To investigate further the substantial variability in reported complication rates,^{14,15} several factors were tar-

geted for assessment in this study, including population type, surgical technique, degree of impaction and surgeon's experience.

The reported incidence of alveolitis varies widely, from as low as 0.5% to as high as 68.4%,^{16,17} but most studies indicate a rate between 5% and 10%.^{2,4} In their review article, Precious and others³ suggested that, despite surgical ability and strict operative protocol, the hypothetical rate of alveolitis was between 1% and 5%. Diagnostic criteria, which vary from author to author, might partly explain this variation. The incidence in the current study (3.6%) was lower than the typical range of 5% to 10%,^{2,4} perhaps because of the surgeon's experience, but perhaps also because of the application of topical tetracycline at the surgical site. Indeed, several studies have reported a lower rate of alveolitis with this technique.¹⁶⁻²⁰ It is difficult therefore to draw any definitive conclusions, since determining the reasons for rates of particular complications was not the focus of this study.

The incidence of postoperative alveolitis in association with OC use has been investigated by many authors, with conflicting results. Some studies have demonstrated an increased rate of alveolitis among women taking OC,^{5,12,13,16,21,22} but Larsen²³ did not. In the current study, there was no significant difference in the rate of alveolitis among women taking and not taking OC. This observation can be explained by the lower estrogen concentration in the new generations of OC, as suggested by Catellani

and others.¹² Nonetheless, there was a major difference in the rate of this complication between the sexes: the incidence of alveolitis was 2.7 times greater among females than among males ($\chi^2 = 3.75, p = 0.052$).

The postoperative infection rate reported in the literature varies between 1.5% and 5.8%,^{1,24} or between 0.9% and 4.3%^{4,25} depending on the articles consulted. In the current study, the infection rate was 2.2%. Chiapasco and others²⁴ reported an incidence of 1.5% in a study of ablation of 1,500 teeth in which all patients received antibiotics after surgery. Bui and others⁴ reported an infection rate of 0.8%; most of the patients (94%) had received postoperative antibiotics.

Given that antibiotics were not used systematically in this study, and the infection rate was relatively low, it appears that the prophylactic use of postoperative antibiotics is unnecessary, as suggested by Poeschl and others.²⁸ Moreover, the irrational use of antibiotics carries its own risks.

In this study, the incidence of paresthesia of the inferior alveolar nerve was 1.1%, whereas the rate reported in the literature varies between 0.4% and 8.4%.^{1,6} In some previous reports, there has been no distinction between permanent and temporary paresthesia. In this study, the rate of permanent paresthesia was 0.5%, and no lingual paresthesia was observed. These results are similar to those previously published by one of the authors (F.B.).²⁷

The relation between the degree of impaction and the appearance of paresthesia was constant. In 5 of the patients with paresthesia, the affected tooth was classified as having IIC impaction, and in the sixth patient, the impaction was classified as IC; together these findings indicate that initial impaction depth is a factor in the risk of paresthesia. For patients who experienced permanent paresthesia, the teeth were classified as having IIC (2 patients) or IC (1 patient) impaction. At the time of the intervention, the first 2 of these extractions were considered surgically difficult and the third was considered easy.

There was also a relation between tooth position based on the Winter classification¹⁰ and the appearance of postoperative complications. Mesioangular and distoangular impaction were associated with nearly twice as many complications as the other tooth positions (26/283 [9.2%] for mesioangular and distoangular, 12/267 [4.5%] for other tooth positions; $\chi^2 = 4.70, p = 0.030$).

In the cases of paresthesia, the important factors were the patient's sex and age. In this study, all cases of permanent neurosensory disturbances occurred in women over 24 years of age, although this result was not statistically significant.

The age-related trend has been noted by most other authors. The factors that have been suggested to explain this situation are increased bone density, surgical difficulty, complete formation of the root and reduced cap-

acity for subsequent healing.^{3,4,28} Brann and others⁷ did not support age as a risk factor, but rather believed that the experience of the surgeon is a determining factor. More recently, Bataineh¹⁴ attributed a higher incidence of paresthesia to lack of experience and the complication rates reported here tend to support this observation.

Conclusions

This study allowed an evaluation of the incidence of postoperative complications associated with extraction of impacted mandibular third molars. Women had significantly more problems with all 3 of the complications examined (alveolitis, infections and paresthesia). No specific factor was identified to explain this difference between the sexes.

For paresthesia, age at the time of extraction appeared to be a major factor.

The rate of postoperative complications and the risks of permanent sequelae increase with age. Therefore, it is recommended that, once a decision has been made to extract an impacted mandibular third molar, the surgery should be carried out as soon as possible and well before the age of 24 years, especially for women. A surgeon's experience or inexperience could also be a major factor in the development of postoperative complications. ♦

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The authors have no declared financial interests in any company manufacturing the types of products mentioned in this article.

This article has been peer reviewed.

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