

# *Complications Following Removal of Impacted Third Molars: The Role of the Experience of the Surgeon*

ALLEN L. SISK, DDS,\* WADE B. HAMMER, DDS,† DAVID W. SHELTON, DMD,† AND EDWIN D. JOY, JR., DDS‡

The incidence of complications associated with the removal of impacted third molars in a group of 500 patients treated by oral surgery faculty were compared with the incidence of complications in 208 patients treated during the same period by residents in oral and maxillofacial surgery. The results show that complications were more numerous after the removal of third molars classified as partial bony or complete bony impactions, and that less-experienced surgeons had a significantly higher incidence of such complications.

The surgical removal of impacted third molars can result in considerable pain, swelling, and dysfunction.<sup>1</sup> The factors contributing to these sequelae are complex, but many of the contributing factors are related to the inflammatory process initiated by the surgical trauma. Meticulous surgical techniques will minimize this process but will not prevent it.

In addition to pain, swelling, and trismus, the removal of impacted third molars may result in other complications, which may be transitory or permanent. Among the more common potential complications are hemorrhage, alveolar osteitis, and inferior alveolar nerve injury. Other potential complications include infection, injury to adjacent teeth, fracture of the maxillary tuberosity or the mandible, oroantral communication and fistula, and periodontal pocket formation distal to adjacent teeth.<sup>2-5</sup> The reported incidences of the various complications differ widely, as do the reported success rates for methods used to reduce the occurrence or severity of these complications.<sup>6-18</sup>

This investigation determined the incidence of complications in two groups of patients undergoing

the removal of impacted third molars in a dental school outpatient clinic. A group of patients treated by faculty and another group treated by residents in oral and maxillofacial surgery were compared to determine the role of the experience of the surgeon in reducing the incidence of complications.

## **Materials and Methods**

The records of 500 consecutive cases in which removal of impacted third molars in outpatients was performed by four members of the faculty of the Department of Oral and Maxillofacial Surgery, Medical College of Georgia, and the records of 208 cases in which the same procedure was performed during the same period by 10 residents in oral and maxillofacial surgery were analyzed for the incidence of both intraoperative and postoperative complications. All surgical procedures were performed in the same clinic with similar equipment; either dental students or the same dental assistant was used as a surgical assistant. For all procedures, local anesthesia alone or a combination of local anesthesia and intravenous sedation was used. Cases in which general anesthesia was used were excluded from the study. Postoperative antibiotics were used only if indicated by an intraoperative complication or by a finding in the patient's medical history that required prophylactic administration. Patients in whom a topical antibiotic dressing was placed in the extraction site immediately after sur-

---

Received from the Department of Oral and Maxillofacial Surgery, Medical College of Georgia, Augusta.

Address correspondence and reprint requests to Dr. Sisk: Assistant Professor, Department of Oral and Maxillofacial Surgery, Medical College of Georgia, Augusta, GA 30912.

**Table 1. Classification of Maxillary and Mandibular Third Molars**

	Erupted	Tissue Impaction	Partial Bony Impaction	Complete Bony Impaction
<b>Maxillary</b>				
Faculty (n = 832)	22.4% (186)	9.0% (75)	23.2% (193)	45.4% (378)
Resident (n = 329)	45.3% (149)	9.4% (31)	13.1% (43)	32.2% (106)
<b>Mandibular</b>				
Faculty (n = 843)	1.2% (10)	8.2% (69)	31.3% (264)	59.3% (500)
Resident (n = 359)	2.8% (10)	16.2% (58)	44.0% (158)	37.0% (133)

gery were excluded. Patient age and sex, medical history, radiographic classification of the impacted teeth, indications for extraction, medications and dosages, and the types and frequency of surgical complications were recorded. Patients were required to undergo removal of at least one impacted mandibular third molar for inclusion in the study.

The statistical significance of the results was determined by the chi-square test.

### Results

The 500 patients in the faculty-treated group had a mean age of 18.9 years (range, 13–48 years). The 208 patients in the resident-treated group had a mean age of 19.7 years (range, 14–51 years). Men constituted 43.6% of the faculty-treated group and 45.2% of the resident-treated group. Based on age, sex, race, or incidence of positive findings in the medical history, there was no statistical difference between the patients in the two groups.

Seventy-three of the 500 patients in the faculty group had positive findings in their medical histories, while 38 of the 208 patients in the resident group had positive findings. The majority of the positive findings in each group were allergy-related, usually a reported allergy to penicillin. In the faculty group 9.2% (46 of 500 patients) had histories of allergy, and in the resident group 10% (21 of 208 patients) had such histories.

The distribution of extractions on the basis of tooth position is summarized in Table 1. Statistical analysis of the distribution of impacted teeth on the basis of tooth position between faculty and resident groups showed that the faculty-treated group included a significantly greater proportion of more difficult extractions ( $P < 0.001$ ).

The overall complication rate for all extractions was significantly less for the faculty-treated group

than for the resident-treated group ( $P < 0.001$ , chi-square). The complication rates of the faculty-treated group were 8.5% (72 of 843 teeth) for mandibular extractions and 1.3% (11 of 832 teeth) for maxillary extractions. The complication rates of the resident-treated group were 30.9% (111 of 359 teeth) for mandibular extractions and 6.1% (20 of 329 teeth) for maxillary extractions. When complication rates for mandibular extractions alone were compared between groups, the incidence of complications was again significantly greater in the resident-treated group ( $P < 0.001$ ).

In the faculty group 9.6% (48 of 500) and in the resident group 38.5% (80 of 208) of the patients experienced at least one complication related to the third molar extractions. The most common complication in both groups was alveolar osteitis. The incidences of alveolar osteitis following mandibular third molar extractions were 6.4% (54 of 843 teeth) for the faculty group and 19.5% (70 of 359 teeth) for the resident group. In both groups, the greatest incidence of alveolar osteitis followed the removal of complete bony impactions (Table 2). The overall rates of osteitis for both faculty and resident groups combined were 10.3% (124 of 1202 teeth) following removal of mandibular third molars and 0.43% (5 of 1161 teeth) following maxillary third molar removal. The differences in osteitis rates between faculty and resident groups were statistically significant for mandibular extractions ( $P < 0.01$ ), and for maxillary and mandibular extractions combined ( $P < 0.01$ ). The incidence of osteitis following maxillary third molar extractions was too low to permit meaningful statistical analysis.

Postoperative or secondary infections occurred in 21 patients; eight of these patients were treated by faculty and 13 by residents. The incidences of postoperative infection following maxillary third molar extraction were 0.36% (three of 832 teeth) in the faculty-treated group and 1.2% (four of 329 teeth) in the resident-treated group. The incidences of infection following mandibular third molar extraction were 0.59% (five of 843 teeth) in the faculty

**Table 2. Incidence of Alveolar Osteitis Following Removal of Mandibular Third Molars in Different Tooth Positions**

	Erupted	Tissue Impaction	Partial Bony Impaction	Complete Bony Impaction
Faculty	0% (0/10)	7.25% (5/69)	4.17% (11/264)	7.60% (38/500)
Resident	10.00% (1/10)	17.24% (10/58)	18.35% (29/158)	22.56% (30/133)

group and 2.5% (nine of 359 teeth) in the resident group. The overall postoperative infection rate was 0.89% (21 of 2363 teeth). Eighty-three per cent of the infections were associated with the removal of mandibular bony impactions.

Altered sensation of the lingual or inferior alveolar branches of the mandibular nerve occurred in 19 cases (2.6%) (Table 3). In two of these 19 cases the altered sensation was bilateral, involving the inferior alveolar nerves bilaterally in one and the lingual nerves bilaterally in the other. In eight of the 17 patients with postoperative dysesthesia, nerve trauma was observed during surgery, occurring bilaterally in one case. All nine instances of intraoperative nerve trauma were associated with removal of complete bony impactions. When inferior alveolar nerve trauma was found during surgery, there was a 55.5% (five of nine extractions) incidence of postoperative labial dysesthesia. Three of the five cases of labial dysesthesia were permanent (lasting for one year or longer), while two resolved within six months. The incidences of labial dysesthesia were 0.36% in the faculty group (three of 843 mandibular extractions) and 3.6% in the resident group (13 of 359 mandibular extractions). There were no instances of lingual dysesthesia in the faculty group; the incidence of lingual dysesthesia in the resident group was 0.84% (three of 359 mandibular extractions). In all three cases the lingual dysesthesia had persisted for more than six months when the two patients involved were lost to follow-up study.

Postoperative hemorrhage requiring treatment occurred in 1.4% (seven of 500 patients) of the faculty group and 2.4% (five of 208 patients) of the resident group. Maxillary third molar extractions resulted in an incidence of excessive postoperative bleeding of 0.36% (three of 832 teeth) in the faculty group, and 0.61% (two of 329 teeth) in the resident group. The overall incidence of excessive postoperative bleeding following maxillary third molar removal was 0.43% (5 of 1161 teeth). Mandibular third molar extractions resulted in postoperative bleeding in 0.47% (four of 843 teeth) of the faculty group and 0.84% (three of 359 teeth) of the resident group. The overall incidence of excessive postoperative bleeding following mandibular third molar removal was 0.58% (seven of 1202 teeth) (Table 3).

Excessive intraoperative bleeding occurred in eight cases, all of which involved mandibular third molar extractions. Complete bony impactions had been present in six of the eight cases and partial bony impactions in two. The incidences of excessive intraoperative bleeding were 0.47% (four of 843 mandibular teeth) in the faculty group and 1.11% (four of 359 mandibular teeth) in the resident

**Table 3. Intraoperative and Postoperative Complications**

	Faculty Group		Resident Group	
	Maxillary (832)	Mandibular (843)	Maxillary (329)	Mandibular (359)
Alveolar osteitis	0.2% (2)	6.4% (54)	0.9% (3)	19.5% (70)
Secondary infection	0.4% (3)	0.6% (5)	1.2% (4)	2.5% (9)
Dysesthesia	0	0.4% (3)	0	4.5% (16)
Postoperative bleeding	0.4% (3)	0.5% (4)	0.6% (2)	0.8% (3)
Intraoperative bleeding	0	0.5% (4)	0	1.1% (4)
Adjacent tooth injury	0	0.2% (2)	0.6% (2)	0.8% (3)
Oroantral communication	0.4% (3)	0	1.2% (4)	0

group. Two of the four faculty cases of excessive intraoperative bleeding were associated with postoperative alveolar osteitis. Two of the four resident cases of excessive intraoperative bleeding were associated with alveolar osteitis, and a third case was associated with postoperative infection, osteomyelitis, and permanent labial dysesthesia.

The overall incidence of injury to adjacent teeth was 0.30% (seven of 2363 teeth). Two injuries to adjacent teeth, both fractures of amalgam restorations in mandibular second molars adjacent to mandibular third molar extraction sites, occurred in the faculty group. Four of the five injuries to adjacent teeth found in the resident group were either fractures of amalgam restorations or dislodging of full crown restorations. The other tooth injury in the resident group was the inadvertent sectioning of the distal root of a mandibular second molar, which required endodontic treatment.

Oroantral communication was a complication in 0.36% (three of 832 maxillary extractions) of the faculty-treated group and 1.2% (four of 329 maxillary extractions) of the resident-treated group. The overall incidence was 0.60% (seven of 1161 maxillary teeth). All oroantral communications were observed during surgery. Postoperative antibiotics and nasal decongestants were administered, and all communications resolved without further complication.

## Discussion

Complications invariably occur following the surgical removal of impacted third molars. Although attention to the basic principles of surgery, including proper preparation of the patient, asepsis, hemostasis, use of controlled force, thorough de-

bridement, and meticulous management of both bone and soft tissues, will reduce the number and severity of complications, certain unavoidable complications will still occur.<sup>19</sup> The surgeon must inform the patient before surgery of the statistical likelihood of complications so that the patient can make an informed decision as to whether to undergo surgery. Because of the lack of statistical data concerning the risks associated with the surgical removal of impacted third molars, the incidence of complications is estimated on the basis of clinical impressions alone. This frequently leads to significant underestimation of the incidence of surgical morbidity.

The reported incidence of postoperative alveolar osteitis following removal of third molars ranges from 0.5% to 68.4%<sup>19</sup> although most authors report an incidence of 5 to 10%.<sup>7,21-23</sup> The great variability in the reported incidence of alveolar osteitis may be due to differences in diagnostic criteria; in intraoperative and postoperative treatment of the extraction sites; in patient populations with respect to age, medical status, or tooth positions; or in surgical techniques or surgical skill. The reported incidences of alveolar osteitis tend to be lower in single-surgeon and private practice studies than in multiple-surgeon and institutional studies.

The diagnostic criteria for alveolar osteitis in this study were the postoperative return of the patient with pain and placement of an anodyne dressing in the extraction site. Systemic antibiotics were used in 3.4% (24 of 708 patients), primarily for prophylaxis to minimize the risk of endocarditis in susceptible patients, or in patients in whom oroantral communications were detected at surgery. Topical antibiotics were not used in the patients included in this study. There were no significant differences in the two groups with respect to age or preoperative medical status, but the patient population treated by faculty included a significantly larger number of patients with bony and partial bony impactions than did the resident group. This difference in distribution among groups was corrected statistically during analysis of data.

The incidence of alveolar osteitis following mandibular third molar extractions was three times greater in the resident-treated group than in the faculty-treated group, despite the significantly greater percentage of surgically difficult tooth positions among the third molars in the faculty-treated group. Increased surgical trauma by less-experienced residents probably contributed significantly to the increased incidence of alveolar osteitis in their group.

Secondary infection following maxillary third molar removal was three times more frequent in the

resident group than in the faculty group, and four times more frequent in the resident group following removal of impacted mandibular third molars. For the entire patient population, based on the total number of teeth removed, the infection rate was 0.89%. This rate was significantly greater following the removal of bony impactions than for all other types of extractions combined. This is consistent with reports in the literature.<sup>4</sup> Due to the extremely low incidence of postoperative infections associated with the removal of erupted teeth, tissue impactions, and partial bony impactions, the routine use of antibiotics is not advised. However, antibiotics may be advantageous following removal of complete bony impactions or following particularly difficult extractions.<sup>8,9</sup> Systemic antibiotics have also been advocated for patients with associated gingivitis, pericoronitis, or general debilitating diseases,<sup>23</sup> but their use for minimizing the inflammatory sequelae of the removal of the majority of third molars is controversial.<sup>13,24</sup>

Based on the total number of mandibular teeth removed, the overall incidence of postoperative labial dysesthesia was 1.3%; the incidence in the resident group (3.6%) was nine times greater than that in the faculty group (0.4%). Fourteen of the 16 cases of labial dysesthesia were associated with complete bony impactions, and the remaining two followed the removal of partially bony impacted teeth. In three cases the labial dysesthesia persisted for longer than one year. All cases of persistent labial dysesthesia were associated with trauma to the inferior alveolar nerve that was observed during surgery. In one resident case in which the nerve was transected at surgery, dysesthesia persisted for more than three years without resolving. The incidence of persistent labial dysesthesia in this study was 0.25%. Previous studies reported incidences of labial dysesthesia ranging from 0.57 to 5.3%, with the incidence of permanent dysesthesia generally less than 1%.<sup>4,5,16,25,26</sup> The incidence of lingual dysesthesia in this study was 0.25%; all of these patients were in the resident group, and the dysesthesia persisted for more than six months without resolution in all. Dysesthesia is one of the most distressing complications associated with the removal of impacted third molars. The incidence of dysesthesia is relatively low; it is associated primarily with the removal of complete bony or partial bony impacted mandibular third molars, and the level of experience of the surgeon appears to be of significance in minimizing the risk of occurrence.

The remaining complications encountered in this study—excessive intraoperative or postoperative bleeding, injury to adjacent teeth, and oroantral

communication—had overall rates of occurrence of less than 1%. The incidence of each of these complications was greater in the resident group.

### Summary

The overall incidence of complications associated with the removal of third molars was four times greater in the resident-treated group than in the faculty-treated group. The most frequent complication in both groups was alveolar osteitis. Most complications were associated with the removal of either partial bony or complete bony impacted mandibular third molars. The results of this study show that increased numbers of complications occur in the removal of third molars positioned with their crowns either completely or partially covered by bone, and that less-experienced surgeons as a group have a significantly higher incidence of complications.

### References

1. Sisk AL, Bonnington GJ: Evaluation of methylprednisolone and flurbiprofen for inhibition of the postoperative inflammatory response. *Oral Surg* 60:137, 1985
2. Kohn MW, Chase D, Marciana RD: Surgical misadventures. *Dent Clin North Am* 17:533, 1973
3. Kugelberg CF, Ahlstrom U, Ericson S, et al: Periodontal healing after impacted lower third molar surgery. *Int J Oral Surg* 14:29, 1985
4. Osborn TP, Frederickson G, Small IA, et al: A prospective study of complications related to mandibular third molar surgery. *J Oral Maxillofac Surg* 43:767, 1985
5. Goldberg MH, Nemarick AN, Marco WP: Complications after mandibular third molar surgery: a statistical analysis of 500 consecutive procedures in private practice. *J Am Dent Assoc* 111:277, 1985
6. Belinfante LS, Marlow CD, Myers W, et al: Incidence of dry socket complication in third molar removal. *J Oral Surg* 31:106, 1973
7. Birn H: Etiology and pathogenesis of fibrinolytic alveolitis ("dry socket"). *Int J Oral Surg* 2:211, 1973
8. Bystedt H, Nord CE, Nordenram A: Effect of azidocillin, erythromycin, clindamycin and doxycycline on postoperative complications after surgical removal of impacted mandibular third molars. *Int J Oral Surg* 9:157, 1980
9. Hellem S, Nordenram A: Prevention of postoperative symptoms by general antibiotic treatment and local bandage in removal of mandibular third molars. *Int J Oral Surg* 2:273, 1973
10. Julius LL, Hungerford RW, Nelson WJ, et al: Prevention of dry socket with local application of Terra-Cortril in Gelfoam. *J Oral Maxillofac Surg* 40:285, 1982
11. Hall HD, Bildman BS, Hand CD: Prevention of dry socket with local application of tetracycline. *J Oral Surg* 29:35, 1971
12. Krekmanov L: Alveolitis after operative removal of third molars in the mandible. *Int J Oral Surg* 10:173, 1981
13. MacGregor AJ, Addy A: Value of penicillin in the prevention of pain, swelling, and trismus following the removal of ectopic mandibular third molars. *Int J Oral Surg* 9:166, 1980
14. Olson RA, Roberts DL, Osbon DB: A comparative study of polylactic acid, Gelfoam, and Surgicel in healing extraction sites. *Oral Surg* 53:441, 1982
15. Sweet JB, Macynski AA: Effect of antimicrobial mouth rinses on the incidence of localized alveolitis and infection following mandibular third molar surgery. *Oral Surg* 59:24, 1985
16. Van Gool AV, Ten Bosch JJ, Boering G: Clinical consequences of complaints and complications after removal of the mandibular third molar. *Int J Oral Surg* 6:29, 1977
17. Pedersen A: Decadronphosphate in the relief of complaints after third molar surgery. *Int J Oral Surg* 14:235, 1985
18. Forsgren H, Heimdahl A, Johansson B, et al: Effect of application of cold dressings on the postoperative course in oral surgery. *Int J Oral Surg* 14:223, 1985
19. Osbon DB: Postoperative complications following dentoalveolar surgery. *Dent Clin North Am* 17:483, 1973
20. Erikson RT, Waite DE, Wilkinson RH: A study of dry sockets. *Oral Surg* 13:1046, 1960
21. MacGregor AJ: Aetiology of dry sockets: a clinical investigation. *Br J Oral Surg* 6:49, 1968
22. Lehner T: Analysis of one hundred cases of dry socket. *Dent Pract Dent Rec* 8:275, 1958
23. Krekmanov L, Hallander HO: Relationship between bacterial contamination and alveolitis after third molar surgery. *Int J Oral Surg* 9:274, 1980
24. Seymour RA, Walton JG: Pain control after third molar surgery. *Int J Oral Surg* 13:457, 1984
25. Merrill RG: Prevention, treatment, and prognosis for nerve injury related to the difficult impaction. *Dent Clin North Am* 23:471, 1979
26. Kipp DP, Goldstein BH, Weiss WW: Dysesthesia after mandibular third molar surgery: a retrospective study and analysis of 1,377 surgical procedures. *J Am Dent Assoc* 100:185, 1980