

Risk Indicators of Postoperative Complications following Surgical Extraction of Lower Third Molars

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Key Words

Pain · Swelling · Trismus · Dry socket · Third molar extraction · Complications after extraction

Abstract

Objective: The aim of this prospective clinical trial was to evaluate the incidence of postoperative complications following surgical extraction of lower third molars (L8) and the risk factors and clinical variables associated with these complications. **Subjects and Methods:** Three-hundred and twenty-seven consecutive patients (128 men and 199 women, mean age = 23.1 ± 3.9 years, range: 18–40) were recruited to this study. The L8 of all the patients were surgically extracted. Immediate and late complications like pain, swelling, trismus, paresthesia, bleeding, dry socket, infection and fracture were assessed 3 and 7–14 days, respectively, following the surgery. **Results:** The most frequent immediate and late complications were slight pain, swelling, and trismus. Thirty-nine (11.9%) patients reported dry socket and 10 (0.3%) reversible sensory nerve complications. More immediate and late complications were experienced by females ($p = 0.000$ and 0.016 , respectively). Older subjects reported more late complications. Frequent immediate and late complications were associated with preexisting pericoronitis, longer duration of operation, extraction of two molars, flaps with vertical incision, extractions with bone removal, extractions without tooth sectioning and distoangular impactions

($p \leq 0.05$). Linear regression analysis showed that the above factors were able to predict postoperative complications. **Conclusion:** The most frequent immediate and late complications were slight pain, swelling, and trismus. Preoperative complaints, angulation of the impacted molars, duration of surgery, type of surgical flap, the need for bone removal and tooth sectioning could predict and had an impact on the incidence of postoperative complications following L8 removal. Females and older patients were likely to have more postoperative complications following surgical extraction of L8.

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Introduction

The surgical extraction of lower third molars is the most common intervention in oral surgery [1]. It is usually associated with considerable postoperative complications that have biological and social impact [2, 3]. These complications include dysesthesia, severe infection, fracture, dry socket, pain, swelling, trismus, hemorrhage, oroantral communication, damage to adjacent teeth, and displaced teeth [4, 5].

Factors thought to affect the occurrence of complications after third molar removal include age, gender, medical history, smoking, use of oral contraceptives, poor oral hygiene, presence of pericoronitis, relationship of third molar to the inferior alveolar nerve, type of impac-

tion, surgeon's experience, anesthetic technique, surgical time, surgical technique, topical antiseptics, intrasocket medications, and perioperative antibiotics [4, 5].

Postoperative complications after the surgical extraction of a lower third molar still remain a significant factor in patient comfort and recovery. The knowledge of various methods of reducing morbidity following third molar surgery would help both the surgeon and the patients in the management of impacted lower third molars [6].

Consequently, clinicians would profit from knowing the risk factors that are associated with postoperative complications following third molar surgery. This in turn will enable them to avoid subjecting patients to such risks while carrying out lower third molar surgery. Therefore, the aim of this prospective clinical trial was to evaluate the incidence of postoperative complications following third molar surgical extraction and the risk factors such as age, sex, angulation of third molars, duration of surgery, type of surgical flap design, and the need for tooth sectioning and bone removal that are associated with the incidence of these complications.

Subjects and Methods

Three hundred and twenty-seven consecutive patients (128 men and 199 women) were recruited to the study from patients attending the oral and maxillofacial surgery clinic for surgical extraction of lower third molars at Jordan University Hospital, Amman, Jordan. Mean age of the patients was 23.1 ± 3.9 years (range 18–40).

Each patient was thoroughly assessed clinically and radiographically before and after third molar surgical extraction. Before surgery, the assessment included patients' dental and medical histories, complaints, and personal information regarding name, age, gender, level of education, occupation, address and marital status. The angulation of third molars with respect to the longitudinal axis of the second molar (mesial angulation, distal angulation, vertical and horizontal) was evaluated from orthopantomography and recorded based on the classification of Winter [7].

Patients with any medical problem that might affect immunity or contraindicate surgery such as diabetes, cardiovascular disease, bleeding disorders, kidney or liver disease, respiratory disease, AIDS, hepatitis B or C were excluded from the study. None of the recruited patients had any of the above-mentioned medical problems.

The lower third molars of all recruited patients were surgically extracted by the same surgeon, who is an experienced consultant in oral and maxillofacial surgery. All patients received antibiotic treatment (either intravenous *Velocel* 1 g or intraoral *cephalexin* 500 mg) before or during and after the surgery. All unilateral surgeries were conducted under local anesthesia while bilateral surgeries were conducted under general anesthesia.

After surgery, assessment included the number of extracted teeth, duration of surgery, type of flap (envelope flap versus flap

with vertical incision), the need for bone removal and tooth sectioning, and immediate and late complications of the surgery.

The assessed complications included pain, swelling, trismus, paresthesia, bleeding, dry socket, infection and fracture. Immediate complications were assessed during the first 3 days following the surgery and late complications were assessed 7–14 days later in the clinic in postoperative visits. Patients rated the severity of postoperative pain by choosing a number from 0 to 10 on a visual analogue scale. The severity of swelling was evaluated by the investigator (Z.M.) and was subjectively categorized into slight, moderate, and severe depending on the size of the swelling in relation to the face: slight swelling – if less than one third of the cheek on the side of the surgery was involved; moderate swelling – if one to two thirds of the cheek was involved; severe swelling – when more than two thirds of the cheek was affected. Trismus was assessed by measuring the mouth opening before surgery and postoperatively. If the mouth opening was reduced by one third this was considered as slight trismus; up to two thirds trismus was considered to be moderate and if the reduction was more than two thirds of the preoperative mouth opening, trismus was considered to be severe.

Statistical Analysis

The data were analyzed using SPSS computer software (Statistical Package for the Social Sciences, version 11.0, SPSS Inc., Chicago, Ill., USA). The association between the variables was analyzed using the χ^2 test and Pearson's correlation test, while the linear regression analysis was used to predict complications. For all statistical analyses, the significance level was set at $p \leq 0.05$.

Results

One hundred and four patients (104, 31.9%) had only one lower third molar removed (60 patients left and 44 right third molars), while 223 (68.2%) patients had both right and left third molars extracted.

Patients' preoperative complaints were pericoronitis ($n = 255$), caries ($n = 62$) and orthodontic problems ($n = 10$). Duration of the surgery ranged from 15 min for the extraction of one molar to 90 min for the extraction of two molars. Mean surgical time was 32.2 ± 13.5 min for each molar. Also, envelope flaps were used in 110 patients while flaps with vertical incision were used in 217 patients. Bone removal was required in 272 patients while tooth sectioning was required in 123 patients.

Patients' immediate postoperative complications are summarized in table 1. The most frequent complications were slight pain, swelling, and trismus. The late complications are summarized in table 2; the most frequent complications were also slight pain, swelling, and trismus. However, no late complications were recorded in 187 patients.

The inclination of impacted third molars among the patients is given in table 3. In total, 267 lower right third molars and 283 lower left third molars were extracted.

Correlations

Immediate complications were significantly related to gender ($p = 0.000$), pre-operative complaints ($p = 0.026$), number of extracted teeth ($p = 0.011$), duration of the procedure ($p = 0.009$), type of flap ($p = 0.000$), the need for bone removal ($p = 0.000$), the need for tooth sectioning ($p = 0.000$), and the inclination of the impacted lower third molar ($p = 0.000$; table 4).

Female patients reported significantly more frequent immediate complications. Also, more frequent immediate complications were associated with preexisting pericoronitis, extraction of two molars in the same patient, longer duration of the operation, flaps with vertical incision, extractions needing bone removal, extractions without tooth sectioning, and mesioangular third molars.

Older patients and females reported significantly more frequent late complications ($p = 0.000$ and 0.016 , respectively). Also, more frequent late complications were associated with preexisting pericoronitis ($p = 0.000$), extraction of two molars in the same patient ($p = 0.000$), longer duration of the operation ($p = 0.000$), flaps with vertical incision ($p = 0.000$), extractions needing bone removal ($p = 0.001$), extractions without tooth sectioning ($p = 0.000$), and mesioangular impacted third molars ($p = 0.000$; table 4).

When each immediate complication was considered individually the following significant relations were identified: extraction of two molars was associated with more trismus ($r = 0.161$, $p = 0.003$); bone removal with more swelling ($r = -0.4$, $p = 0.000$) and more trismus ($r = -0.5$, $p = 0.000$), and vertically inclined molars with less trismus ($r = 0.171$, $p = 0.004$).

When each late complication was considered individually the following significant relations were identified using Pearson's correlation: older patients had more trismus ($r = 0.11$, $p = 0.046$) and dry socket ($r = 0.242$, $p = 0.000$), females less trismus ($r = -0.195$, $p = 0.000$) and dry socket ($r = -0.169$, $p = 0.002$). Pericoronitis was significantly associated with more swelling ($r = -0.135$, $p = 0.015$), but less trismus ($r = 0.118$, $p = 0.033$) and dry socket ($r = 0.212$, $p = 0.000$). Extraction of two molars was associated with more swelling ($r = -0.133$, $p = 0.016$) and dry socket ($r = -0.238$, $p = 0.000$). Longer duration of the surgical extraction was associated with more swelling ($r = 0.120$, $p = 0.03$). Envelope flap was associated with less pain ($r = 0.363$, $p = 0.000$), less swelling ($r = 0.351$, $p = 0.000$), less trismus ($r = 0.52$, $p = 0.000$), and less dry socket ($r = 0.477$, $p = 0.000$). Bone removal was associated with more trismus ($r = -0.152$, $p = 0.006$). Tooth sectioning was associated with less pain ($r = -0.204$, $p = 0.000$) and

Table 1. Immediate complications associated with surgical removal of lower third molars (n = 327)

Complication	Frequency	Percent
Slight pain	24	7.3
Slight pain and swelling	22	6.7
Slight pain, swelling and trismus	165	50.5
Slight pain and trismus	11	3.4
Moderate pain, swelling and trismus	87	26.6
Severe pain, swelling and trismus	18	5.5
Total	327	100.0

Table 2. Late complications associated with surgical removal of lower third molars (n = 327)

Complication	Frequency	Percent
Slight pain	7	2.1
Slight pain and swelling	3	0.9
Slight pain, swelling and trismus	11	3.4
Slight pain and trismus	46	14.1
Slight swelling	2	0.6
Slight swelling and trismus	5	1.5
Slight swelling, trismus and numbness	1	0.3
Slight trismus	24	7.3
Slight trismus and dry socket	32	9.8
Dry socket	7	2.1
Infected socket	2	0.6
No complications	187	57.2
Total	327	100.0

Table 3. Inclination of impacted third molars among the study population

Inclination of the third molar	Lower right third molar		Lower left third molar	
	frequency	percent	frequency	percent
Vertical	61	18.7	62	19.0
Mesioangular	119	36.4	133	40.7
Distoangular	72	22.0	74	22.6
Horizontal	15	4.6	14	4.3
Total	267	81.7	283	86.5

Table 4. Relationship between complications and associated factors using χ^2 test (n = 327)

Factor	Degree of freedom using Pearson's χ^2 test		Significance (p value) ¹	
	immediate	late	immediate	late
Age	85	221	0.211	0.006
Gender	5	13	0.000	0.016
Preoperative complaint	10	26	0.026	0.000
Number of extracted teeth	5	13	0.011	0.000
Duration of surgical procedure	40	104	0.009	0.000
Type of flap	5	13	0.000	0.000
Need for bone removal	5	13	0.000	0.001
Need for tooth sectioning	5	13	0.000	0.000
Inclination of impacted third molar	15	39	0.000	0.000

¹ Significant relation if $p \leq 0.05$.

trismus ($r = -0.27$, $p = 0.000$). Vertical inclination of the extracted third molar was associated with less pain ($r = 0.286$, $p = 0.000$), swelling ($r = 0.187$, $p = 0.002$), trismus ($r = 0.511$, $p = 0.000$), and dry socket ($r = 0.30$, $p = 0.000$).

Linear regression analysis showed that the need for bone removal, the need for tooth sectioning and the inclination of the impacted lower third molar were the best predictors of the occurrence of immediate complications following the surgical removal of lower third molars ($r = 0.699$, $p = 0.000$ for all factors).

On the other hand, the best predictors of late complications following third molar surgical extraction were flap type ($r = 0.599$, $p = 0.000$), the need for tooth sectioning ($r = 0.599$, $p = 0.000$), and inclination of the impacted third molar ($r = 0.599$, $p = 0.006$).

When each individual complication was predicted separately, the best predictors for immediate swelling were the need for bone removal ($r = 0.451$, $p = 0.000$). The best predictors for immediate trismus were the number of extracted teeth ($r = 0.537$, $p = 0.005$), the need for bone removal ($r = 0.537$, $p = 0.000$), and the inclination of the impacted molar ($r = 0.537$, $p = 0.032$).

On the other hand, the best predictors for late pain are the type of the flap ($r = 0.410$, $p = 0.000$) and the need for tooth sectioning ($r = 0.410$, $p = 0.008$). Also, the best predictors for late swelling were preoperative complaints ($r = 0.449$, $p = 0.000$), the number of extracted teeth in the same patient ($r = 0.449$, $p = 0.001$), duration of the surgery ($r = 0.449$, $p = 0.000$), and type of the utilized flap ($r = 0.449$, $p = 0.000$).

In addition, the best predictors for late trismus were duration of the surgery ($r = 0.634$, $p = 0.042$), flap type ($r =$

0.634 , $p = 0.000$), the need for bone removal ($r = 0.634$, $p = 0.008$), the need for tooth sectioning ($r = 0.634$, $p = 0.015$), and the inclination of the impacted molar ($r = 0.634$, $p = 0.000$). Finally, the best predictors for dry socket were gender ($r = 0.575$, $p = 0.009$), preoperative complaint ($r = 0.575$, $p = 0.013$), and flap type ($r = 0.575$, $p = 0.000$).

Discussion

This study has shown that some factors have a definitive role in the incidence of postoperative complications following third molar surgery. Female patients experienced more immediate and late complications, similar to the results of Monaco et al. [8] and Blondeau and Daniel [4]. This could be due to the small size of their jaws, limited surgical field, hormonal status and more dense bone that makes the surgeries more difficult and traumatic.

Older subjects experienced more late complications as in previous studies [8–12], but in contrast to the findings of Fisher et al. [13]. This could be due to the delayed healing capacities associated with aging as well as the increased bone density that might make the surgery more difficult.

More frequent immediate and late complications associated with longer duration of surgery, flaps with vertical incision, extractions needing bone removal, and extractions without tooth sectioning might be responsible for making the surgery more traumatic and more difficult, and thus could increase the risk for postoperative complications. However, these findings contradicted those of Monaco et al. [8] and Fisher et al. [13], who found

no association between duration and difficulty of the extraction and postoperative complications. This contradiction could be due to the small number of samples or the different study settings and factors that were studied.

Considering the angulation of third molars, extraction of vertical third molars was associated with the least complications whereas distoangular molars were associated with most complications. This could be due to the increased difficulty of extraction and the need for more bone removal and time for surgery similar to previous studies [12, 14], but in contrast to Fisher et al. [13].

Preexisting pericoronitis was associated with more complications, which confirms the results of previous studies [14, 15]. However, our finding contradicted other studies that found no relation between preexisting pericoronitis and postoperative complications [12, 13]. The incidence of 11.9% of patients who reported dry socket in our study is within the incidence range of 0–35% reported previously [2, 9, 10, 16]. However, the reversible sensory nerve complications of 0.3% in our study are less than the reported incidence of 0.5–20% in previous studies [2, 12, 17–19]. These differences could be due to the criteria used to define complications.

The strength of our study is that it is the only published report with a large number of patients that evaluated all patients postoperatively and that analyzed post-

operative complications by angulation of impacted molars, the need for bone removal, the type of the utilized flap, and by the need for tooth sectioning. However, other studies involved either extremely small numbers of patients in prospective studies or larger numbers in retrospective studies, none of which stated whether the patients were all seen postoperatively [20, 21].

Conclusions

The most frequently reported immediate and late complications of this study were slight pain, swelling, and trismus. Certain factors including preoperative complaints, angulation of impacted molars, the duration of surgery, the need for bone removal, the type of the utilized flap, and the need for tooth sectioning predicted and had an impact on the incidence of postoperative complications following third molar surgery. Females and older patients are likely to have more postoperative complications following surgical extraction of lower third molars. We recommend that clinicians should be mindful of the above risk indicators during planning for surgical extraction of lower third molars in order to reduce postoperative complications and thus improve the outcome of the provided treatment.

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