

ORIGINAL ARTICLE



Planned and unplanned follow-up visits after mandibular third molar surgery in the Public Dental Service in Örebro

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ABSTRACT

Objective: This study examined the frequency of unplanned follow-up visits to the Public Dental Service in Örebro due to postoperative discomfort/complications after mandibular third molar surgery and associated factors.

Materials and methods: Data were retrieved from the dental records of 465 patients who underwent mandibular third molar surgery in 2017. The collected data covered patient age and gender, health status, diagnosis, surgeon, and planned and unplanned follow-up visits.

Results: Twenty-eight percent of patients had unplanned visits after mandibular third molar surgery, while 68% of patients without a planned follow-up visit had an unscheduled visit. None of the patients with a planned visit had an unplanned visit. Female patients and patients who had bone removed during surgery had significantly more unplanned follow-up visits due to post-extraction discomfort ($p=.047$ and $.01$, respectively). Patients diagnosed with caries made fewer unplanned follow-up visits ($p<.012$).

Conclusions: The frequency of unplanned follow-up visits after third molar surgery was relatively high, though no patient with a planned follow-up visit made an unplanned visit. Scheduling follow-up visits could significantly reduce the number of unplanned follow-up visits.

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Introduction

Third molar surgery is the most common surgical procedure in dentistry in Sweden [1]. Surgical removal of third molars is performed by both specialized surgeons and general dentists in the Public Dental Service. A Norwegian study from 1994 found that about 75,000 third molars were removed every year [2]. Of these, approximately 55,000 were removed by general dentists and the rest by specialized surgeons [2]. There are multiple reasons why a third molar may need to be surgically removed, including caries in the third or second molars, pericoronitis, periodontal defects posterior to the second molars, pathological bone degradation, occurrence of cysts, unopposed/hyper/nonfunctional third molars, neurogenic and myofascial pain, and orthodontic indications [3,4]. When mandibular third molar surgery is performed, it is reportedly associated with less frequent postoperative complications in patients under the age of 25 years [5,6]. Surgical removal of third molars is associated with several common and generally accepted postoperative complications, so adequate preoperative information is important. The most common postoperative complications described in the literature include pain, swelling, trismus and alveolitis [7–10]; more unusual and severe complications include bleeding, loss of sensation, infections, jaw fractures, leftover parts of instruments, and root fragments [11,12]. Patients undergoing third molar surgery may need to stay home from school,

work and other social activities due to complications after surgery [13].

The reported frequency of postoperative complications after third molar surgery ranges from 2.6% to 30.9% [14–17], depending on the author's definition of complication and the experience of the surgeon. Chiapasco et al. reported that 2.6% of patients had postoperative complications, and that all patients were treated with postoperative antibiotics after surgery [16]. Sisk et al. reported that 30.9% of patients had postoperative complications, and that patients treated by oral and maxillofacial surgery residents had more postoperative complications than did those treated by oral surgeons [17]. Two studies reported almost identical frequencies of postoperative complications, 10.6% and 10.8% [14,15], though the complications were different. One study considered alveolar osteitis, infection, dysesthesia and bleeding as postoperative complications, whereas the other study considered disturbed wound healing, alveolitis, abscess, paresthesia, trismus, swelling and bleeding as postoperative complications [14,15]. Reported risk factors for developing postoperative complications are age, gender, medical condition, surgeon experience, tooth anatomy, inclination and degree of retention [3,4,7–9,14]. According to a systematic review, there is no consensus that smoking, gender and stage of menstrual cycle are risk factors [18].

One way to preoperatively assess the severity of third molar removal is to use radiological examinations of the teeth. Winter's as well as Pell and Gregory's systems are two examples of classification systems based on radiographic examination [19,20].

On the other hand, some authors claim that operation severity cannot be determined before the operation and therefore should be assessed during the operation [21,22]. A prospective cohort study published in 2017 concluded that factors affecting the duration of third molar surgery were patient ability to open their mouth, tooth anatomy and ability to withdraw the patient's cheek during surgery for accessibility. Surgery duration, in turn, has been shown to affect the development of postoperative complications [23]. Planned follow-up visits after third molar surgery have been used to assess postoperative discomfort, presenting a mean and median of 34 and 33 for men and of 38 and 37 for women, respectively, on the Full PoSse Scale for patients treated by trained surgeons [13]. Others have reported a mean of 1.03 follow-up visits after third molar surgery [7]. Hence, follow-up visits may be required after mandibular third molar surgery performed by general dentists.

Specific surgical procedures and protocols as well as surgeon experience can all affect the frequency of reported postoperative complications. There is reason to suspect that the frequency of complications after third molar surgery reported in the literature does not reflect the postoperative complications encountered in a Public Dental Service clinic. Hence, it is of interest to understand how common postoperative complications are and to be aware of what risk factors should be considered preoperatively.

Study objective

The primary aim of this study was to study the frequency of unplanned follow-up visits due to postoperative complications after mandibular third molar removal by general

dentists in the Public Dental Service in Örebro. The secondary aim of the study was to identify factors associated with unplanned follow-up visits after third molar surgery.

Materials and methods

Design

The study was designed as a retrospective study. All patients who had third molar surgery performed in the mandible in public dental clinics in Örebro County during 2017 were included in the study. Patients who had their third mandibular molar tooth removed at the Public Dental Service emergency clinic were excluded.

Subjects and procedures

Data were retrieved from patient records from 23 dental clinics in the Public Dental Service. In cases in which patients had both their mandibular third molars surgically removed, only the first extracted tooth was included in the study to prevent the patient factor from affecting the results.

Unidentified data were collected from patient charts. Each chart was opened only once; to prevent data from the same chart being recorded twice, a note was made in the chart that data had been extracted from it. The following data were retrieved from the dental charts: surgeon, diagnosis, patient gender and age, whether the patient was on medication, smoking habits, anatomical classification of tooth according to Winter's as well as Pell and Gregory's classification systems (Figure 1), planned follow-up visits, unplanned follow-up visits, whether the patient used analgesics, and whether antibiotics were prescribed. The surgeon's diagnosis of postoperative complications was recorded during the data collection. Factors taken into account when registering the surgeon were the surgeon's gender and experience. A surgeon with five or fewer years in the profession was defined

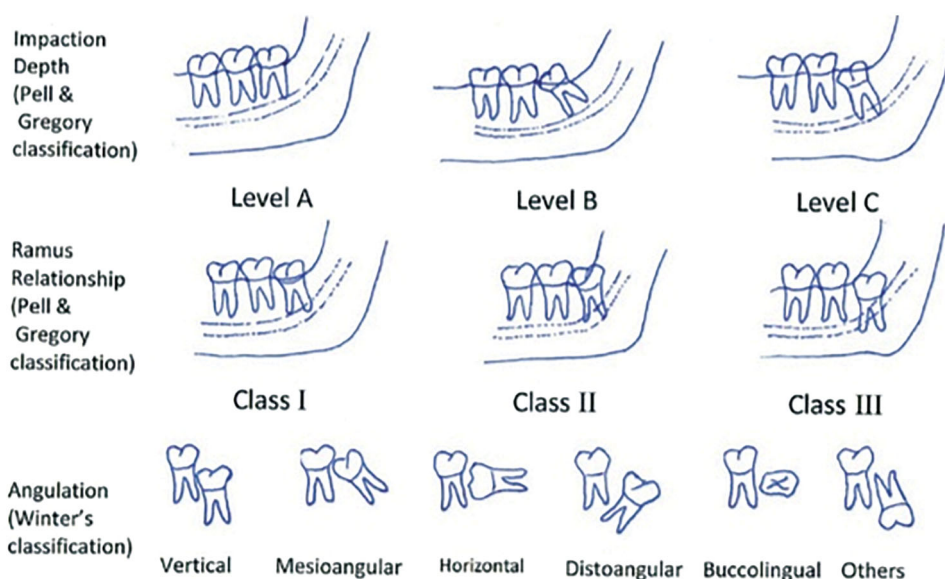


Figure 1. Classification according to Pell and Gregory [20] as well as Winter [19].

as inexperienced and one with more than 5 years in the profession was defined as experienced. All dentists in the experienced group had at least 7 years in the profession.

Furthermore, data were collected regarding whether a gingival flap was raised, bone removed and/or tooth separated at the time of surgery. In addition, complications during the surgery such as root fracture and whether fractured roots were left in the alveolus were noted in the protocol.

The degree of difficulty of tooth removal was assessed based on existing radiological examination regarding tooth inclination. A tooth in a vertical position was defined as easily removed; all teeth not in a vertical position were classified as difficult to remove surgically.

Both authors examined the first 15 dental records for calibration; thereafter, one author continued extracting data from the remaining dental records.

Statistics

Descriptive statistics were used in presenting the data. Chi-squared tests were used to investigate possible explanatory factors for planned and unplanned patient follow-up visits after surgery depending on: patient gender, patient age, surgeon experience, surgeon gender, bone removal, smoking habits and tooth inclination. A logistic regression (enter method) was used to investigate which possible explanatory factors significantly influenced the patients making unplanned follow-up visits. Data analysis was performed using IBM SPSS version 25 (IBM SPSS Statistics, Armonk, NY); $p < .05$ was considered statistically significant.

Ethics

The study was approved by the regional ethics committee in Uppsala (Dnr 2018/061).

Results

Sample characteristics

In 2017, 541 patients had third molar surgery in the mandible performed in the Public Dental Service in Örebro. A total of 76 teeth were excluded: 40 patients had both mandibular third molars surgically removed and 36 patients had their third molar tooth surgically removed at the Public Dental Service emergency clinic. All 465 patients, 228 women and 237 men, who had a mandibular third molar surgically removed were included in the study. The average patient age was 30 years; the youngest was 16 and the oldest 82 years old.

Pericoronitis was the most common diagnosis for the surgically removed teeth (37.4%) and caries was the second most common diagnosis (31.8%); for the third largest diagnostic group, no diagnosis was recorded for the surgically removed third molar (12.5%). The most common complication during operation was fractured roots, which were left in the jaw for various reasons in 21 cases; of these, 16 patients were scheduled for a planned check-up after surgery, while

the remaining five patients returned for an unplanned follow-up visit.

A total of 23 clinics and 69 general dentists were included in the study; 31 male dentists removed 224 teeth and 38 female dentists removed 241 teeth. Most dentists, i.e. 63% of the female and 68% of the male dentists, had five or fewer years of experience as a dentist. Table 1 shows the number of planned and unplanned follow-up visits in relation to background factors such as surgeon gender and experience, patient gender and age, tooth inclination, diagnosis for surgery, bone removal, complications during surgery, smoking and whether antibiotics were prescribed.

Of the patients included in the study, 22% stated that they were taking at least one prescribed medicine and 14% that they smoked. The use of analgesics was recorded in 46% of cases and only two of the patients were prescribed antibiotics, hence they were excluded from further analysis (Table 1).

Of the 465 surgical extractions, 464 (99.8%) were performed with a gingival flap, 407 (88%) required removal of bone and 320 (69%) were performed with crown and/or root separation. Complications during the operation were reported in 26 cases.

Of the 465 patients, 402 (86%) returned for post-extraction follow-up visits, of which 58% were planned and 28% unplanned. All unplanned follow-up visits were recorded for patients who had not scheduled a return visit after their third molar surgery. The reason for the unplanned follow-up visits was rarely documented in the dental charts. Of patients operated on by a dentist with more than 5 years of experience, 80% returned for a planned or unplanned return visit versus 89% of the patients operated on by a dentist with five or fewer years of experience; the difference was statistically significant ($p = .027$). The bivariate tests indicated that significantly more women than men made unplanned follow-up visits, 33% versus 23%, respectively ($p = .047$; Table 1). Also, bone removal during surgery was statistically significantly associated with more unplanned follow-up visits ($p = .001$), whereas a diagnosis of caries was associated with significantly fewer unplanned follow-up visits ($p = .037$).

Of the 194 patients not scheduled for a planned check-up visit, 131 (68%) contacted the clinic and were seen at an appointment due to postoperative discomfort. Eighty-six of the patients who made an unplanned follow-up visit were >25 years old and 45 patients were ≤ 25 years old (Table 1). The few patients younger than 20 years old were less likely to make an unplanned visit than were patients 20–25 years old, though the difference was not statistically significant. The logistic regression indicated that patients >25 years old were more likely (odds ratio (OR) 1.96, 95% confidence interval (CI) 1.25–3.69) to have an unplanned visit than were those under the age of 25 years and patients who had bone removed (OR 2.79, 95% CI 1.28–6.05). Male patients and patients who had teeth extracted due to caries were less likely to have an unplanned visit ($p = .045$ and $.0012$, respectively) (Table 2). The ORs were 1.51 and 1.36 for an unplanned return visit by patients operated on by female dentists and less-experienced dentists, respectively, though

Table 1. Sample characteristics and background factors of potential explanatory value for planned and unplanned follow-up visits after surgery.

Patients	Total	Planned follow-up visits		Unplanned follow-up visits		No. follow-up visit		χ^2	p Value
		n	%	n	%	n	%		
Total	465	271	58.3	131	28.2	63	13.5	6.108	.047
Female	228	125	54.8	76	33.3	27	11.8		
Male	237	146	61.6	55	23.2	36	15.2		
Patient age at surgery, years								5.313	.070
≤25	199	125	62.8	45	22.6	29	14.6		
>25	266	146	54.9	86	32.3	34	12.8		
Smoking at surgery								2.100	.350
No	380	227	59.7	105	27.6	48	12.6		
Yes	66	35	53.0	24	36.2	7	10.6		
Missing data	19								
Tooth inclination								1.270	.530
Vertical	279	160	57.3	83	29.7	36	12.9		
Not vertical	178	106	59.6	45	25.3	27	15.2		
Missing data	8								
Operator gender								4.742	.093
Female	241	137	56.8	77	32.0	27	11.2		
Male	224	134	59.8	54	24.1	36	16.1		
Operator experience, years								7.195	.027
≤5	331	197	59.5	98	29.6	36	10.9		
>5	134	74	55.2	33	24.6	27	20.1		
Diagnosis for the tooth								10.195	.037
Caries	148	93	62.8	29	19.6	26	17.6		
Pericoronitis	174	93	53.4	59	33.9	22	12.6		
Other/unkn.	143	85	59.4	43	30.1	15	10.1		
Bone removal								13.427	.001
No	58	33	56.9	9	15.5	16	27.6		
Yes	407	238	58.5	122	30.0	47	11.5		
Complication at surgery								5.627	.060
No	439	251	57.2	125	28.5	63	14.4		
Yes	26	20	76.9	6	23.1	0	0.0		

Table 2. Logistic regression (enter method), using unplanned visit as the dependent variable and potential explanatory factors as independent variables.

	OR	95% CI	p Value
Patient gender (ref. male) female	1.56	1.01–2.41	.045
Patient age (ref. ≤25 years) >25 years	1.96	1.25–3.69	.003
Operator experience (ref. ≥5 years) <5 years	1.36	0.84–2.20	.213
Operator gender (ref. male) female	1.51	0.99–2.32	.057
Diagnosis (ref. other/unkn.) caries	0.48	0.28–0.85	.012
Pericoronitis	1.23	0.74–2.05	.435
Bone removal	2.79	1.28–6.05	.010

Nagelkerke R^2 , 0.104.

these were not significant ($p > .05$). There was a tendency for a statistically significant difference regarding operator gender ($p = .057$). The differences between patient gender, diagnosis and bone removal detected in bivariate analyses were also statistically significant according to the logistic regression (Table 2). However, the statistically significant difference between operators with different degrees of experience detected in the bivariate analysis was not detected in the logistic regression.

Discussion

Of the 465 patients who had a third molar surgically removed by a dentist in the Public Dental Service in Örebro, 86.5% returned for a postoperative check-up (58% planned and 28% unplanned). Information about the type and degree of postoperative complication was scarce in the dental charts. Of those who did not have a planned follow-up visit, 68% made an unplanned follow-up visit. The dental records provide no information on how many of the patients with a

scheduled follow-up visit had post-extraction complications. The literature states that the frequency of postoperative complications varies between 2.6% and 30% [14–17]; in comparison, the frequency of postoperative complications in Örebro seems relatively high.

An interesting finding is that none of the patients who had scheduled a post-extraction check-up contacted the clinic for an additional check-up due to postoperative discomfort. It is possible that the patients who had scheduled a check-up after their surgery automatically felt calmer and delayed calling their dentist, as they knew that they would see their operator again. If the planned follow-up visit is about 7–14 days after the operation, the most frequent postoperative complications, such as pain and swelling, will be reduced by then [13]. For those patients who did not schedule a follow-up, it could be more alarming to experience pain and swelling, making them more likely to call their dentist. Adequate preoperative information is probably crucial to prevent patients from unnecessarily returning for unplanned follow-up visits. Routinely seeing patients for a post-extraction check-up probably makes the patients feel well taken care of and gives the operators feedback on their surgical performance. For those patients who have a complication during their third molar surgery, a postoperative check-up should be scheduled because, in the present study, 100% of these patients returned for a postoperative visit.

The number of unplanned return follow-up visits differed depending on the operator's gender, with 32% of patients operated on by a female dentist returning for an unplanned visit due to postoperative complications compared with 24% of those operated on by a male dentist. This could be

because the female dentists were worse at informing patients about expected postoperative complications, or be due to chance and not represent an actual difference between male and female operators. No dentistry studies were found that consider operator gender in relation to complications. However, a retrospective cohort study performed in Ontario in 2017 examined the different results of medical operations performed by female and male surgeons. That study concluded that patients operated on by female surgeons had less risk of postoperative complications than did those operated on by male surgeons, who also had more cases ending in death than did the female surgeons [24].

The significantly more unplanned follow-up visits made by patients treated by less experienced operators is aligned with the result reported by Jerjes et al. [25] from a hospital in London, UK, that patients of specialized maxillofacial surgeons had fewer complications than did patients of dentists training to become oral and maxillofacial surgeons. Since postoperative complications were found to differ depending on surgeon experience in an oral and maxillofacial clinic where all operators had good surgical skill [25], it is possible that the risk of postoperative complications was related to operator experience in the Public Dental Service in Örebro as well. A possible explanation for the different results depending on operator experience may be that the less experienced operators are less likely to select suitable cases and that it is easier for the experienced surgeons to conduct a preoperative assessment of the severity of the planned tooth extraction procedure. This may indicate that the less experienced operators underestimate the severity of the surgeries they are to perform. In contrast, Susarla and Dodson concluded that preoperative assessment of the third molar did not differ between operators depending on their experience, but that factors such as surgical technique, tissue management and operation duration had more impact on the operation outcome [26].

The present study found that significantly more women than men had unscheduled follow-up visits due to postoperative complications after third molar surgery. This result was consistent with those of Blondeau and Daniel, who studied postoperative complications after third molar surgery, reporting a frequency of postoperative complications of 2.2% for men and 10.2% for women [8]. Another study in which patients were prospectively followed up on their subjective problems after third molar surgery found that women had twice as much trouble with severe pain after surgery as men did [13].

Biological and psychosocial factors are well-debated potential explanations for why women are more sensitive to pain than men. Hormones, endogenous pain systems, gender roles, as well as cognitive and affective factors have been studied in the literature as possible explanations for the gender differences in pain sensitivity [27].

A thesis from the Department of Psychology in Stockholm University found that women's sensitivity to pain can vary depending on where they are in the menstrual cycle [28]. Performing third molar surgery on a woman in the premenstrual phase of her menstrual cycle might increase the risk of

postoperative complications due to low oestrogen levels [28].

Regarding patient age, the present study found that older patients (>25 years old) made more unplanned follow-up visits than did younger patients (≤ 25 years old). In the literature, age is reportedly a recurring risk factor for complications after third molar surgery. Chuang et al. reported an OR of 1.46 for post-extraction complications among patients >25 years old [6]. Grossi et al. [13] reported significantly ($p = .002$) fewer problems with trismus in patients ≤ 22 years old, whereas Chiapasco et al. [3] reported postoperative complications in 2.1% of patients ≤ 24 years old and in 7% and 7.7% of patients 25–34 and 34–43 years old, respectively. In analyses, different cut-off ages have been used, i.e. >24 or >25 years old [3,6]. A prospective cohort study found that the relationship between age and the risk of developing postoperative complications after third molar surgery was statistically significant [6]. This relationship can be explained by the fact that older patients have greater bone density, which may lead to longer surgery time and more manipulation during surgery [7]. Older patients also have fully developed root anatomy, which can complicate the operation, resulting in extended surgery duration, and greater age also means delayed wound healing [29,30].

In the present study, no major difference was found in postoperative complications between teeth without or with different degrees of retention and incline. Others have reported that the tooth inclination significantly affected the occurrence of postoperative complications [10].

Patients who had their third molar surgery performed with bone removal had a greater likelihood of unplanned follow-up visits than did patients who had surgery without bone removal, the difference being significant. Bone removal probably causes more inflammation in the alveolar socket, in turn resulting in more severe symptoms such as swelling, pain and trismus [31].

Patients who had their third molar surgery performed due to a diagnosis of caries made significantly fewer unplanned follow-up visits than did patients with other diagnoses. One possible explanation for this is that teeth removed for other reasons may have been associated with pericoronal infection before the surgery, so postoperative pain was more likely to develop [32].

Knowledge of the frequency and severity of postoperative complications in third molar surgery in the Public Dental Service is important in order to better prepare patients for complications that may be expected.

This study's design has clear limitations. When reviewing the dental charts, a lack of information was noted regarding medical history, cause of surgery, duration of surgery, and extra postoperative follow-up visits. A clear example of this is that the third largest group undergoing third molar surgery had no specific diagnosis for the procedure. The generalizability of these findings can be disputed, since the data were collected retrospectively from dental charts in one county in Sweden. On the other hand, the number of included patients and dental practitioners might make the results generalizable to general dental practitioners with similar education and

clinical training. Acquiring more robust data from a prospective study would probably increase the ability to discriminate factors that affect the outcome, producing more reliable results.

Conclusions

The frequency of unplanned follow-up visits due to postoperative complications after third molar surgery is relatively high in Örebro and could be reduced by scheduling patients for a follow-up visit after their surgery. All patients who made an unscheduled visit were in the group that was not scheduled for a return visit. Operations performed by inexperienced dentists and female dentists were associated with an increased risk of postoperative complications.

Disclosure statement

The authors reported no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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