



## Research Article

## Assessment of complications in third molar surgery performed by resident surgeons: A comprehensive analysis

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## ABSTRACT

**Introduction:** Third molar extractions present a wide spectrum of reported complications, spanning from 2.6 % to 30.9 %, making it challenging to predict outcomes for individual patients.

This study seeks to evaluate third molar extractions conducted exclusively by stomatology or maxillofacial surgery residents, examining associated complications. Its aim also extends to delineating the related risks concerning epidemiological and clinical factors, juxtaposed against findings in the existing literature.

**Materials and methods:** An observational prospective cohort study was conducted at the Clinical and Academic Centre of Coimbra, Portugal, from July 2021 to December 2023. Descriptive statistics were used considering the adequate statistical parameters. Inferential statistical analysis was performed using Student's *t*-test, the Chi-squared test, and Spearman rank correlation to analyze the relationship between study variables. A *p*-value of less than 0.05 was considered statistically significant.

**Results:** 485 patients underwent third molar extractions performed exclusively by stomatology and maxillofacial surgery residents, comprising a total of 686 extracted teeth and resulting in 71 reported complications (14.6 % per patient and 10.3 % per extracted tooth). Results revealed that patients undergoing lower third molar extraction faced a 3.7 times higher risk of complications compared to those undergoing upper third molar extraction. Teeth categorized as "IIC" by Pell and Gregory's classification and those undergoing osteotomy and odontosection also exhibited a higher-than-expected complication rate with statistically significant differences being observed. No other variables showed a positive or negative statistically significant correlation with complication occurrence.

**Discussion and conclusion:** Despite the expectation of a heightened complication rate, this study revealed that a successful and comprehensive training regimen results in encountering complication rates akin to those documented in established literature.

These findings also underscore the importance of recognizing that a resident's surgical accomplishment is intrinsically tied to acknowledging and respecting their learning curve.

## Introduction

The third molars, or wisdom teeth, usually emerge in young adulthood [1]. However, the eruption of these teeth can be impeded by factors such as small jaw size, crowding, and improper teeth alignment, leading to retained or impacted wisdom teeth [1-4].

During this process, it's common for patients to experience complications such as gum tissue inflammation or infection, with pericoronitis being the most prevalent reason for surgical removal [1-4]. Other indications for the surgical removal of wisdom teeth include unresorable cavities, resorption of adjacent teeth, dental follicle disease, and surgical requirements (e.g., orthognathic surgery or tumor resection) [5].

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Despite the substantial amount of literature dedicated to the debate, the prophylactic removal of third molars is still a highly discussed topic among professionals [1,6]. According to the UK's 2000 National Institute for Health Clinical Excellence (NICE) guidelines, routine prophylactic extraction of pathology-free third molar teeth is not recommended [5]. However, the 2016 Clinical Practice Guidelines of the American Association of Oral and Maxillofacial Surgeons (AAOMFS) states that "predicated on the best evidence-based data, third molar teeth that are associated with disease or are at high risk of developing disease, should be surgically managed" [7].

Comprehensively, the surgical removal of third molars is one of the most common procedures performed under local or general anesthesia [1,4,8,9]. Depending on the complexity of the procedure, patient background, and surgical experience, the removal can be equally carried out safely in a dental clinic as well as in the hospital [9].

### *Third molar surgery complications*

Some of the most common complications of third molar extraction surgery include postoperative pain, swelling, and trismus, which usually resolve within a few days if the appropriate care is provided [1-3].

Less common complications, such as damage to surrounding teeth, infection, and dry sockets, can also occur. Specific complications related to the extraction of upper or lower third molars, including orofacial communications or injuries to trigeminal nerve branches, respectively, are also relevant and should be addressed. Therefore, patients must be informed of the possible risks they incur before surgery, including temporary or permanent neurosensory injuries [1-4,8-10].

In the literature, there is no clear evidence regarding the predisposition of patients to experience complications due to various factors, such as their geographic origin or comorbidities. Nonetheless, some retrospective studies report that the female sex and older patients are at greater risk of postoperative complications and permanent sequelae [1, 11-14]. The duration of the procedure is also a debated issue, with Malkwi et al. mentioning that a prolonged surgical time is related to a higher risk of complications,<sup>11</sup> only to be contradicted by others [12,13, 15].

Moreover, the existing data fails to clearly distinguish risk levels for the onset of third molar surgery complications under different circumstances, such as surgeries performed by surgical residents, while controlling for confounding factors such as senior supervision or assistance.

### *Objective*

This study endeavors to thoroughly assess third molar extractions performed exclusively by stomatology or maxillofacial surgery residents, delving into associated complications. Its aim also extends to delineating the related risks concerning epidemiological and clinical factors, juxtaposed against findings in the existing literature.

### **Materials and methods**

An observational prospective cohort study was conducted to address the research question, according to STROBE guidelines [16].

Institutional approval was granted by the Ethics Committee of the Faculty of Medicine of the University of Coimbra (reference number CE-136/2021).

### *Sample, data collection, and criteria*

The study population consisted of patients who underwent third molar extractions at the Clinical and Academic Centre of Coimbra, from July 2021 to December 2023.

Data from initial, follow-up, and emergency consultations, and surgical logs was collected. Follow-up appointments were scheduled 7-10 days, 1 month, 3 months, and 6 months post-surgery.

Only third-molar extractions performed exclusively by stomatology or maxillofacial surgical residents, in an outpatient context, were considered eligible.

A hands-on direct aid or intervention by an attending surgeon, at any point in the surgery, was considered an exclusion criterion. Patients with significant comorbidities, such as oncological diseases or immunological compromise, were also excluded from the study.

### *Conditions and confounding factors*

All surgeries were conducted in an operating room. All patients were encouraged to perform third molar extractions under local anesthesia. However, in cases where patients had severe phobias or anxiety disorders that would significantly hinder the procedure under local anesthesia, general anesthesia was considered. In such instances, if a patient required multiple third molar extractions, all extractions were performed during a single surgical procedure.

Following institutional pre-established protocol, patients received antibiotic prophylaxis, consisting of intravenous (IV) amoxicillin/clavulanate (2000 mg/200 mg) and perioperative analgesia with acetaminophen (1000 mg) and metamizole (2000 mg). If an osteotomy was required, intravenous corticosteroid therapy with methylprednisolone (125/250 mg) was also administered.

Post-operative care also adhered to institutionally standardized proceedings, with all patients receiving prescriptions for analgesics (e.g. acetaminophen, 1000 mg, 3 times a day) and non-steroidal anti-inflammatory drugs (e.g. ibuprofen, 600 mg, 2 times a day). Oral antibiotics (e.g. amoxicillin/clavulanate, 875/125 mg, 3 times a day/1 week) were also given if drainage was present and/or an osteotomy was performed.

Alternative medications were provided in cases where patients reported allergies.

Other measures encompassed cryotherapy and temporary behavioral modifications, such as refraining from strenuous exercises and physical activities. A medical leave for work spanning 3 to 5 days was provided upon request.

### *Outcomes and variables*

Patients were assessed for the occurrence of complications. Given the potential for multiple complications to arise concurrently and be inter-related, only the most relevant complication was considered.

Twelve different post-extraction complications were considered: pain (yes/no; excluding temporomandibular joint (TMJ)); bone exposure (alveolar osteitis/alveolitis); abscess; trismus (<40 mm in adults [17]; <36 mm in adolescents [18]); temporomandibular joint pain; adjacent tooth fracture; transient (<6 months) and permanent (≥ 6 months) neurosensory sequelae of the inferior alveolar nerve (IAN) or lingual nerve (LN); bone sequestration; mandibular fracture and maxillary oro-antral communications.

Other variables considered included sex, age, surgical indication, anesthetic approach, surgery duration and technique, the number of teeth extracted in a single procedure, tooth identification, and both maxillary and mandibular teeth classification according to the eruption and/or positioning.

Surgical indication was evaluated by groups: Acute (Pericoronitis; Infection); Chronic (Odontogenic Cyst [OC]); Dental (Caries; Adjacent tooth injury); and Orthodontic Treatment Planning.

Mandibular third molars were classified following Pell & Gregory's Classification, which determines the degree of impaction of the mandibular third molar in both the vertical and horizontal dimensions, based on the available radiographic imaging [19]. Whereas maxillary third molars were classified as erupted, partially erupted, and unerupted.

Data analysis

A statistical analysis was performed with IBM SPSS Statistics® software (Version 28.0.1.0 (142)).

Descriptive statistics were used considering the adequate statistical parameters.

The normality of the quantitative variables was assessed using Kolmogorov-Smirnov and Shapiro-Wilk tests. Variance homogeneity was ensured through the Levene test.

Inferential statistical was performed using Student's *t*-test, the Chi-squared test, and Spearman rank correlation to analyze the relationship between study variables. A *p*-value of less than 0.05 was considered statistically significant.

Results

Between July 2021 and July 2023, 485 patients meeting the eligibility criteria were enrolled in the study, resulting in the extraction of 686 teeth. Among this cohort, 71 complications were reported, yielding a complication rate of 14.6 % per patient and 10.3 % per extracted tooth. The most frequent complication was uncontrolled pain, responsible for 28 % (*n* = 20) of reported cases, followed by alveolitis with 23 % (*n* = 16). Mandibular jaw fracture was reported in only one case, and no orolantal communications occurred.

The patients' epidemiological and clinical context, along with the incidence of complications and their statistical significance, are detailed in [Tables 1 and 2](#), respectively. Furthermore, [Tables 3 and 4](#) delve deeper into this subject by evaluating the association between the analyzed study variables and individually reported complications.

With a female-to-male ratio of 6:4, the average age of patients was  $\bar{x} = 28.72$  years old ( $\pm 11.380$ ; range: 17–80).

Acute conditions, such as pericoronitis or infection, constituted the primary indication for third molar extraction in 72 % (*n* = 349) of patients and were associated with 73 % (*n* = 52) of the total complications.

The local and/or loco-regional anesthesia approach was the most prevalent and utilized in 78 % (*n* = 379) of performed surgeries, demonstrating a similar complication rate of 78 % (*n* = 56).

Furthermore, 75 % (*n* = 366) of patients had only one third molar

**Table 1**  
Epidemiological, clinical context and incidence of complications in patients submitted to third molars extractions i – per patient.

Variables	Total	Complications	p Value
<b>Sex</b>			
Female	290 (59.8)	44 (9 %)	$\chi^2(1) = 0.150$ $p = 0.698$
Male	195 (40.2 %)	27 (5.6 %)	
<b>Age (years) [<math>\bar{x} = 28.72 (\pm 11.380)</math>; range: 17–80]</b>			
< 20	62 (12.8 %)	6 (1.2 %)	$\chi^2(4) = 2.829$ $p = 0.587$
20–29	278 (57.3 %)	39 (8 %)	
30–39	75 (15.5 %)	16 (3.3 %)	
40–49	35 (7.2 %)	7 (1.4 %)	
>50	35 (7.2 %)	3 (0.6 %)	
<b>Surgical Indication</b>			
Acute	349 (72 %)	52 (10.7 %)	$\chi^2(3) = 6.050$ $p = 0.109$
Chronic	13 (2.7 %)	4 (0.8 %)	
Dental	89 (18.3 %)	11 (2.3 %)	
Orthodontic Treatment	34 (7 %)	4 (0.8 %)	
<b>Anesthetic Approach</b>			
Local / Regional	379 (78.1 %)	56 (11.5 %)	$\rho (485) = 0.02$ $p = 0.675$
General	106 (21.9 %)	15 (3.1 %)	
<b>Number of extracted teeth per surgery</b>			
1	366 (75.5 %)	56 (11.5 %)	$\chi^2(3) = 3.624$ ; $p = 0.305$
2	71 (14.6 %)	9 (1.9 %)	
3	14 (2.9 %)	1 (0.2 %)	
4	34 (7 %)	5 (1 %)	
<b>Surgery Duration (minutes)</b>			
0–30	251 (51.8 %)	34 (7 %)	$\chi^2(2) = 5.390$ $p = 0.068$
31–60	201 (41.4 %)	28 (5.8 %)	
>60	33 (6.8 %)	9 (1.9 %)	

**Table 2**  
Epidemiological, clinical context and incidence of complications in patients submitted to third molars extractions II – per teeth.

Classification	Total	Complications	p Value
<b>Anatomic Identification</b>			
18/28	208 (30.3 %)	8 (1.2 %)	$\chi^2(1) = 13.169$ $p < 0.001$
38/48	478 (69.7 %)	63 (9.2 %)	
<b>Maxillary Third Molar Classification – According to the Eruption Status</b>			
Erupted	98 (47.1 %)	2 (1 %)	$\chi^2(2) = 1.633$ $p = 0.442$
Partially erupted	37 (17.8 %)	2 (1 %)	
Non erupted	73 (35.1 %)	4 (1.9 %)	
<b>Mandibular Third Molar Classification – According to Pell and Gregory's Classification</b>			
IA	142 (29.7 %)	7 (1.5 %)	$\chi^2(8) = 18.682$ $p = 0.017$
IB	44 (9.2 %)	6 (1.3 %)	
IC	51 (10.7 %)	8 (1.7 %)	
IIA	52 (10.9 %)	7 (1.5 %)	
IIB	61 (12.7 %)	9 (1.9 %)	
IIC	29 (6.1 %)	6 (1.3 %)	
IIIA	11(2.3 %)	0	
IIIB	28 (5.9 %)	6 (1.3 %)	
IIIC	60 (12.6 %)	14 (2.9 %)	
<b>Surgical Approach</b>			
Forceps and elevators only	220 (32.1 %)	7 (1 %)	$\chi^2(3) = 25.516$ $p < 0.001$
Flap	159 (23.2 %)	15 (2.2 %)	
Osteotomy	103 (15 %)	13 (1.9 %)	
Osteotomy + Odontosection	204 (29.7 %)	36 (5.2 %)	

extracted, and this subgroup was associated with a complication rate of 79 % (*n* = 56).

Over ninety percent of surgeries were completed in less than an hour, with 52 % (*n* = 251) lasting between 0 and 30 min and 41 % (*n* = 201) lasting between 31 and 60 min. Similar complication rates were also observed in our sample when analyzing the surgery duration, with 48 % (*n* = 34) of complications reported in surgeries lasting less than 30 min and 39 % (*n* = 28) in surgeries lasting between 31 and 60 min.

Mandibular third molars were extracted over two times more frequently, occurring in 69 % (*n* = 478) of cases. However, the associated complication rate was substantially higher, with 89 % (*n* = 63) of cases occurring in this subgroup.

Erupted third molars were the most common classification within the extracted maxillary teeth, followed by non-erupted, accounting for 47 % (*n* = 98) and 35 % (*n* = 75) respectively. However, complications associated with the non-erupted subgroup comprised 50 % (*n* = 4) of the total complications.

Among the extracted mandibular third molars, the IA classification, as per Pell and Gregory's classification, was found to be the most prevalent, comprising 30 % (*n* = 142) of cases, followed by IIB and IIIC classifications, accounting for 13 % (*n* = 61 and *n* = 60). The complication rate, however, varied greatly, with the third molars classified as IIIC being responsible for 22 % (*n* = 14), double the rate associated with IA classification.

The preferred surgical approach involved utilizing only forceps and elevators in 32 % (*n* = 220) of cases, followed closely by osteotomy and odontosection in 30 % (*n* = 204) of cases. Nevertheless, patients submitted to the latter approach displayed a fivefold higher complication rate of 51 % (*n* = 36).

No statistically significant differences were encountered when analyzing the occurrence of complications according to sex ( $p = 0.698$ ), age ( $p = 0.587$ ), surgical indication ( $p = 0.109$ ), anesthetic approach ( $p = 0.675$ ), number of extracted teeth per surgery ( $p = 0.305$ ), and surgery duration ( $p = 0.068$ ), indicating that these variables did not significantly alter the outcome or probability of said complication occurrence. However, although the interpretation of the adjusted residuals showed

**Table 3**

Relationship between postoperative complications and: patients' sex and age; surgical indication; type of anesthesia; number of extracted teeth; surgery duration.

Parameter	Pain	Alveolitis	Abscess	Trismus	TMJ Pain	Tooth Fracture	TP IAN	PP IAN	TP LN	Bone Seq	Jaw Fracture	Total [n (%)]
<b>Sex</b>												
Female	11	10	4	7	3	-	5	-	4	-	-	44 (61.9 %)
Male	9	6	1	1	-	1	4	2	1	1	1	27 (38.1 %)
<b>Age (years)</b>												
< 20	3	3	-	-	-	-	-	-	-	-	-	6 (8.5 %)
20–29	12	5	1	7	1	1	6	1	4	1	-	39 (54.9 %)
30–39	3	5	3	1	2	-	1	-	1	-	-	16 (22.5 %)
40–49	1	3	1	-	-	-	2	-	-	-	-	7 (9.9 %)
>50	1	-	-	-	-	-	-	1	-	-	1	3 (4.2 %)
<b>Surgical Indication</b>												
Acute	16	14	3	6	1	1	4	2	4	1	-	52 (73.3 %)
Chronic	1	-	-	-	-	-	2	-	-	-	1	4 (5.6 %)
Dental	2	1	2	1	1	-	3	-	1	-	-	11 (15.5 %)
Ortho. TP	1	1	-	1	1	-	-	-	-	-	-	4 (5.6 %)
<b>Anesthetic Approach</b>												
Loc/Reg	17	13	4	7	2	1	6	1	3	1	1	56 (78.9 %)
General	3	3	1	1	1	-	3	1	2	-	-	15 (21.1 %)
<b>Number of extracted teeth per surgery</b>												
1	19	13	4	7	2	1	6	1	3	-	-	56 (78.9 %)
2	1	2	1	-	-	-	2	-	1	1	1	9 (12.7 %)
3	-	-	-	1	-	-	-	-	-	-	-	1 (1.4 %)
4	-	1	-	-	1	-	1	1	1	-	-	5 (7 %)
<b>Surgery Duration (in minutes)</b>												
0–30	13	8	1	3	1	1	3	-	2	1	-	33 (46.5 %)
31–60	5	6	4	4	2	-	4	1	2	-	1	29 (40.8 %)
>60	2	2	-	1	-	-	2	1	1	-	-	9 (12.7 %)

Abbreviations: Loc/Reg, Local/Regional; Ortho. TP, Orthodontic Treatment Planning; TMJ, Temporomandibular Joint; TP IAN, Temporary paressthesia of the inferior alveolar nerve; PP IAN, Permanent paressthesia of the inferior alveolar nerve; TP LN, Temporary paressthesia of the lingual nerve; Seq, sequestrum.

**Table 4**

Relationship between postoperative complications and: maxillary and mandibular teeth classification; surgical approach.

Parameter	Pain	Alveolitis	Abscess	Trismus	TMJ Pain	Tooth Fracture	TP IAN	PP IAN	TP LN	Bone Seq	Jaw Fracture	Total N (%)
<b>Maxillary Third Molar Classification – According to the Eruption Status</b>												
Erupted	-	2	-	-	-	-	-	-	-	-	-	2 (25 %)
P. Erupted	-	1	1	-	-	-	-	-	-	-	-	2 (25 %)
N. Erupted	3	-	-	1	-	-	-	-	-	-	-	4 (50 %)
<b>Mandibular Third Molar Classification – According to Pell and Gregory's Classification</b>												
IA	2	3	-	-	1	-	1	-	-	-	-	7 (11 %)
IB	1	1	-	1	-	-	2	-	1	-	-	6 (9.4 %)
IC	3	3	-	-	-	-	-	-	2	-	-	8 (13.6 %)
IIA	3	-	1	-	-	1	1	-	-	1	-	7 (11 %)
IIB	2	2	1	3	-	-	1	-	-	-	-	9 (14.2 %)
IIC	-	2	1	2	-	-	-	1	-	-	-	6 (9.4 %)
IIIA	-	-	-	-	-	-	-	-	-	-	-	0 (0.0 %)
IIIB	-	1	-	1	1	-	2	-	1	-	-	6 (9.4 %)
IIIC	6	1	1	-	1	-	2	1	1	-	1	14 (22 %)
<b>Surgical Approach</b>												
F & E	1	4	-	3	-	-	1	-	-	-	-	9 (12.7 %)
Flap	6	2	1	1	1	1	1	-	1	1	-	15 (21.1 %)
Osteo	3	2	1	2	1	-	1	-	2	-	-	12 (16.9 %)
O+Section	10	8	3	2	1	-	6	2	2	-	1	35 (49.3 %)

Abbreviations: TMJ, Temporomandibular Joint; Inj, injury; TP IAN, Temporary paressthesia of the inferior alveolar nerve; PP IAN, Permanent paressthesia of the inferior alveolar nerve; TP LN, Temporary paressthesia of the lingual nerve; Seq, sequestrum; P. Erupted, Partially erupted; N. Erupted, Non erupted; F&E, Forceps and elevator only; Osteo, Osteotomy; O+Section, Osteotomy + Odontosection.

concordance for most variables and their subgroups, this was not true when analyzing the surgical duration group, with the subgroup exceeding 60 min exhibiting a higher-than-expected occurrence of complications.

On the contrary, statistically significant differences ( $p < 0.001$ ) were encountered when considering anatomic identification and the occurrence of complications, with the adjusted residuals showing a higher and lower incidence of complications than anticipated for mandibular and maxillary third molars respectively. Individual risk assessment also showed a 3.7 times higher risk with 95 % CI [1.751, 7.93] for the occurrence of complications when comparing mandibular to maxillary third molars. Moreover, Pell and Gregory's classification for mandibular third molars also presented statistically significant differences ( $p =$

0.017), with the adjusted residuals indicating a higher susceptibility to complications in the IIIC group, while the IA teeth showed a lower susceptibility. No statistically significant relationship ( $p = 0.442$ ) was observed between maxillary teeth classification and the occurrence of complications.

Statistically significant results ( $p < 0.001$ ) were also observed between surgical approach and complications, with the adjusted residuals demonstrating a higher association with the occurrence of complications and a more aggressive surgical approach requiring osteotomy and odontosection.

Multivariable and individual complication analysis was also performed, revealing statistically significant and/or positive/negative correlations, either by applying and analyzing the chi-square test or by

interpreting the adjusted residuals. Specifically, a relation was found between the occurrence of transient neurosensory impairment of the inferior alveolar nerve and chronic and dental pathology as surgical indications. Similarly, mandibular jaw fracture also presented a positive and significant correlation with chronic pathology as a surgical indication.

## Discussion

"See one, do one, teach one" has long been the motto for surgical residents, symbolizing the progressive stages of medical training that empower professionals to independently practice their profession [20].

Thus, while certain studies emphasize surgical experience as a significant factor affecting complication rates in third molar extractions [9], with reported rates of 14.6 % per patient and 10.3 % per extracted tooth, this study demonstrates that patients undergoing surgery performed by resident surgeons, when adequately trained, achieve outcomes perfectly aligned with previously documented values ranging from 2.6 % to 30.9 % [1,21].

However, to fully understand these findings, a more comprehensive analysis is necessary. Firstly, the 12-fold variation of the existing results in the literature makes it extremely difficult to compare and personalize the results for an individual patient. Nevertheless, exploring common ground can provide valuable insights.

It is widely accepted in the literature that uncontrolled pain and alveolitis are the most common postoperative complications [1,2,22], as observed in this study. Yet, the permanent availability of our institution, provided through the emergency department and/or outpatient department, may have contributed to a more rigorous report.

Results also indicated a 2.3 % ( $n = 11/478$  lower third molars) incidence of IAN injury, with nine of them being transient, and a 1 % ( $n = 5/478$  lower third molars) incidence of transient LN injury. This finding is also consistent with previously reported values, which have ranged from 0.5 % to 8 %, with the LN injuries being less frequent than IAN injuries [2,4,10,23]. However, these figures may appear inflated in comparison to findings from other studies, particularly when assessing them against different population cohorts. This observation is supported by the identification of a statistically significant association between these complications and the presence of pre-existing chronic lesions serving as surgical indications, such as odontogenic cysts, which often necessitate hospital treatment.

Another important finding was the association between the occurrence of iatrogenic jaw fracture and the surgical indication of chronic lesions. Nevertheless, despite the influence of this factor in the study results, additional research needs to be conducted to fully comprehend the identified risks, considering factors such as jawbone density and lesion volumetry.

Post-operative complications were more commonly observed after mandibular third molar extractions compared to maxillary teeth, with our study showing a 3.7 times higher risk, which is consistent with previous research [21,22,24,25]. A factor that negatively impacted the results, considering the 7:3 ratio between mandibular and maxillary extracted third molars.

Results likewise revealed that IIIC mandibular third molars were associated with a higher rate of complications ( $n = 14(60)$  IIIC mandibular molars), while IA third molars had a significantly lower complication rate ( $n = 7(142)$  IA mandibular molars), which reflects the degree of impaction and surgical complexity [26]. These findings also contributed to a higher complication rate, considering that lower third molars classified as IIIC were the most frequently extracted among the nine categories.

In terms of surgical approach, although some studies have reported no correlation between the difficulty of the extraction surgery and postoperative complications [12,15], others have found a significant relationship [1,11,14]. The same situation can be observed in terms of surgery duration and its impact on the onset of post-operative

complications, with conflicting findings across the literature [11-13,15]. In this study, the results showed a clear trend that patients who underwent osteotomy and odontosection as well as patients who endured longer procedures had a higher incidence of complications than expected. A clear disadvantage when reporting surgical residents' complications rates, considering the relevant disproportion between the different variables subgroups.

Lastly, this study also demonstrated comparable levels of safety between patients' sex, age, anesthetic approach, the number of teeth extracted during a single surgery, and surgery duration concerning post-extraction complications. Another noteworthy finding was the effective prevention of oroantral communications, which can occur in up to 4.6–5.3 % of cases [27-29].

## Limitations

While this study provides valuable insights into the incidence of patients' complications linked to third molar extractions when operated by surgical residents, its observational nature introduces limitations in terms of controlling and accounting for confounding factors.

Other limitations of this study include the absence of an evaluation regarding patients' habits, such as smoking, alcohol consumption, and use of oral contraceptives, known to impact postoperative complications [11,12,21], as well as teeth angulation [30] or development [31], both of which could influence the difficulty of extraction.

Additionally, factors such as operator experience or technique variability among surgical residents could also influence the outcomes of third molar extractions.

Therefore, future studies incorporating a more comprehensive evaluation of these factors may provide a more nuanced understanding of the relationship between patient characteristics, surgical technique, and postoperative complications.

## Conclusion

The presented findings underscore the importance of recognizing that a resident's surgical success is intrinsically tied to acknowledging and respecting their learning curve. Moreover, by exploring the complication rates associated with surgical residents' procedures, this study fills a gap in the existing literature, contributing to the body of knowledge in this field.

While a higher complication rate in third molar extractions could initially be anticipated, the implementation of a successful and in-depth training program led to stomatology and maxillofacial surgical residents experiencing similar complication rates to those reported in the existing literature.

Nevertheless, it is crucial to conduct a personalized pre and perioperative risk assessment to determine the best course of action, as well as implement effective risk management strategies. This approach not only helps mitigate the risk of complications but also ensures that patients receive the most appropriate and effective care for their individual needs, minimizing the risk of future litigation.

## Ethics

This study was assigned the number CE-136/2021 and approved by the Ethics Committee of the Faculty of Medicine of the University of Coimbra.

The authors confirm that all procedures in this study were carried out in compliance with the regulations established by the Ethics Committee and following the principles outlined in the Declaration of Helsinki by the World Medical Association.

## Patient consent

Due to the observational nature of the study, the Ethics Committee of



the Faculty of Medicine of the University of Coimbra exempts the authors from obtaining individual Patient Consent.

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## Data statement

All data supporting the findings of this study was procured from the Clinical and Academic Centre of Coimbra (Coimbra, Portugal) and used under the license for the current study, in compliance with the Portuguese national database protection legislation.

## Submission declaration and verification

The authors declare that the work described has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or any other language, including electronically without the written consent of the copyright holder.

## CRediT authorship contribution statement

**João Mendes de Abreu:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Érica Cerqueira:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis, Data curation, Conceptualization. **Anabela Quitério:** Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Tiago Nunes:** Writing – review & editing, Methodology, Data curation. **José Figueiredo:** Writing – review & editing, Methodology, Data curation. **Ana Corte-Real:** Writing – review & editing, Methodology, Data curation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.sipas.2024.100256](https://doi.org/10.1016/j.sipas.2024.100256).

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