

Original Research

Received 22 May 2026

Revised 18 June 2026

Accepted 30 June 2026

Natural Resources for Human Health 2026, Vol. 6 (4s): 611–628

KEYWORDS:

Dry socket, Impacted mandibular third molar, Pericoronitis, Postoperative complications, Surgical difficulty, Tobacco use, Winter's classification

Community-Based Assessment of Complications Associated with Surgical Removal of Impacted Mandibular Third Molars

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ABSTRACT:

Background:

Surgical removal of impacted mandibular third molars is frequently associated with postoperative morbidity, ranging from pain and swelling to alveolar osteitis and transient nerve disturbances. Identifying patient- and procedure-related factors associated with these complications may assist clinicians in improving preoperative assessment and postoperative management.

Aim:

The present study aimed to assess the frequency and pattern of complications following surgical removal of impacted mandibular third molars and to determine the factors associated with postoperative complications, particularly dry socket.

Materials and Methods:

A community-based assessment was conducted among 200 patients undergoing surgical removal of impacted mandibular third molars. Demographic, radiographic, preoperative, and operative characteristics were documented. Impaction patterns were assessed using Winter's and Pell and Gregory classifications, while surgical difficulty was evaluated using the Pederson Difficulty Index (PDIP). Postoperative complications were recorded clinically, including pain, facial swelling, trismus, dry socket, infection, bleeding, and temporary sensory disturbances. Associations between categorical variables were assessed using the Chi-square or Fisher's exact test. Multivariable binary logistic regression was subsequently performed to identify independent predictors of dry socket. Statistical significance was established at $p < 0.05$.

Results:

The study population had a mean age of 24.6 ± 4.8 years, with female participants

accounting for 59.0% of the sample. Mesioangular impaction was the most commonly observed radiographic orientation (46.0%), while Pell and Gregory Class I and Position A represented the predominant classifications. The average surgical time was 28.4 ± 9.6 minutes. Among postoperative complications, pain was most common (56.0%), followed by facial swelling (48.0%) and trismus (37.0%). Dry socket developed in 14 patients (7.0%). Temporary disturbances involving the inferior alveolar and lingual nerves were reported in 1.5% and 1.0% of patients, respectively, with no permanent sensory impairment observed. A significant relationship was identified between greater impaction depth and the occurrence of postoperative complications ($p = 0.012$). Similarly, patients presenting with preoperative pericoronitis had a significantly higher frequency of postoperative complications ($p < 0.001$). The occurrence of dry socket was significantly associated with surgical difficulty, tobacco consumption, and Winter's classification. Multivariable logistic regression demonstrated that high surgical difficulty (adjusted OR = 2.84; 95% CI: 1.12–7.18; $p = 0.027$), preoperative pericoronitis (adjusted OR = 2.31; 95% CI: 1.01–5.29; $p = 0.047$), and distoangular impaction (adjusted OR = 2.34; 95% CI: 1.12–5.56; $p = 0.039$) were independently associated with an increased risk of developing dry socket.

Conclusion:

Postoperative complications following impacted mandibular third-molar removal were relatively common, although most were transient and clinically manageable. Surgical complexity, preoperative pericoronitis, and distoangular impaction were independently associated with an increased likelihood of dry socket. The study underscores the importance of Quality Education Sustainable Development Goals (SDG 4) and continuous professional training in equipping dental professionals with the skills to perform comprehensive preoperative assessment of impaction characteristics, inflammatory status, and surgical difficulty which can enable clinicians to identify patients at increased risk of postoperative complications and to implement appropriate perioperative strategies, thereby promoting safer and more effective patient care.

INTRODUCTION

Impacted mandibular third molars are among the most frequently encountered teeth requiring surgical removal in oral surgical practice. Their extraction may be indicated in the presence of recurrent pericoronitis, dental caries, periodontal disease, pathology involving the adjacent tooth, or other local complications [1]. Although mandibular third molar surgery is routinely performed, the procedure may be technically challenging because the position, depth, angulation, and relationship of the impacted tooth to the mandibular ramus vary considerably among patients. These anatomical characteristics can influence the complexity of the surgical procedure and the likelihood of postoperative morbidity [2].

Postoperative morbidity following mandibular third molar surgery includes a variety of clinical complications, most commonly pain, facial swelling, restricted mouth opening, dry socket or alveolar osteitis, infection, postoperative bleeding, and temporary sensory disturbances involving the inferior alveolar or lingual nerves. Although many of these complications are transient and resolve with appropriate management, they may cause substantial discomfort, interfere with oral function, and adversely affect the patient's postoperative recovery. The occurrence and severity of complications are influenced by several patient-, tooth-, and procedure-related factors, including preoperative inflammation, tobacco use, surgical complexity, and the duration and extent of operative manipulation [3, 4].

Radiographic assessment is an important component of preoperative evaluation because it provides information regarding the anatomical characteristics of an impacted mandibular third molar and helps anticipate the complexity of surgical removal. Winter's classification categorizes impacted third molars according to their angulation [5], whereas the Pell and Gregory classification considers both the relationship of the tooth to the mandibular ramus and its vertical depth relative to the occlusal plane. These classification systems are widely used in clinical practice to describe impaction patterns and assist in preoperative assessment [6]. The Pederson Difficulty Index incorporates radiographic parameters derived from these

classifications to provide an estimate of the anticipated difficulty of third molar removal, although its ability to accurately predict actual surgical difficulty has been questioned in previous studies [7].

Among the complications associated with mandibular third molar surgery, dry socket, also termed alveolar osteitis, is of particular clinical significance. It is characterized primarily by postoperative pain associated with disruption or loss of the blood clot within the extraction socket and may be accompanied by an empty or denuded socket, exposed bone, and halitosis. The condition can prolong postoperative discomfort and may necessitate additional clinical treatment. Several factors have been investigated in relation to its development, including tobacco use, surgical difficulty, local inflammatory conditions, and characteristics of the impacted tooth [8].

Despite the routine nature of mandibular third molar removal, postoperative complications remain an important clinical concern, particularly in patients with unfavorable anatomical characteristics or pre-existing inflammatory conditions. A comprehensive assessment of demographic, radiographic, clinical, and operative variables may assist in identifying individuals who are at greater risk of postoperative morbidity. Such information can contribute to improved preoperative counseling, individualized surgical planning, appropriate preventive measures, and closer postoperative follow-up [9].

Therefore, the present community-based study was undertaken to assess the frequency and pattern of complications following surgical removal of impacted mandibular third molars and to determine factors associated with postoperative complications, with particular emphasis on dry socket. The study evaluated demographic characteristics, radiographic features according to Winter's and Pell and Gregory classifications, preoperative pericoronitis and tobacco use, operative characteristics, and surgical difficulty, with multivariable analysis performed to identify independent predictors of dry socket.

MATERIALS AND METHODS

Study Design and Study Population

The present study evaluated 200 patients who underwent surgical removal of impacted mandibular third molars at a tertiary care centre from July to December 2025. The study population comprised 118 females and 82 males, with a mean age of 24.6 ± 4.8 years. Participants were categorized according to age, radiographic characteristics of the impacted mandibular third molar, operative parameters, and postoperative clinical outcomes.

Sampling Strategy

A consecutive sampling strategy was used to recruit patients undergoing surgical removal of impacted mandibular third molars during the study period. Patients presenting for surgical extraction were screened for eligibility, and those fulfilling the predefined inclusion criteria were enrolled consecutively until the required sample size of 200 participants was achieved. Each eligible participant was included only once in the study. The sampling approach was intended to minimize selection based on clinical characteristics and to provide a representative sample of patients undergoing surgical removal of impacted mandibular third molars within the study setting.

Inclusion Criteria

Participants were included if they met the following criteria:

- Patients undergoing surgical removal of an impacted mandibular third molar
- Patients aged 18 years or older
- Patients with radiographically confirmed mandibular third molar impaction
- Patients for whom adequate preoperative radiographic records were available to assess tooth angulation, depth of impaction, and relationship to the mandibular ramus
- Patients who provided informed consent for participation and postoperative assessment
- Patients for whom adequate clinical and operative information was available for analysis

Exclusion Criteria

Patients were excluded if they met any of the following criteria:

- Patients younger than 18 years
- Patients requiring extraction of a mandibular third molar for indications other than impaction
- Patients with incomplete or inadequate preoperative radiographic records
- Patients with incomplete clinical or operative records
- Patients with pre-existing conditions that could substantially influence postoperative healing or the assessment of postoperative complications
- Patients who had previously undergone surgical intervention involving the study tooth or the surrounding surgical site
- Patients who were unable or unwilling to comply with the planned postoperative assessment.
- Patients whose postoperative outcome data were insufficient to determine the presence or absence of complications or dry socket.

Radiographic Assessment

The impacted mandibular third molars were evaluated using preoperative panoramic radiographs. The angulation of each impacted tooth was assessed according to Winter's classification and categorized as mesioangular, vertical, horizontal, or distoangular. The relationship of the impacted tooth to the mandibular ramus was assessed according to the Pell and Gregory classification and categorized as Class I, Class II, or Class III. The vertical depth of impaction in relation to the occlusal plane was also recorded as Position A, Position B, or Position C.

Assessment of Preoperative Clinical Factors

The presence or absence of preoperative pericoronitis was recorded before surgical removal of the impacted mandibular third molar. Tobacco use was also documented and categorized as present or absent. These variables were subsequently evaluated as potential risk factors for postoperative complications and dry socket.

Assessment of Operative Characteristics

The duration of surgery was recorded in minutes for each extraction. Operative duration was additionally categorized as less than 20 minutes, 20–30 minutes, 31–45 minutes, or more than 45 minutes. The requirement for additional surgical procedures, including bone removal and tooth sectioning, was also documented.

Surgical difficulty was assessed using the Pederson Difficulty Index (PDI). Cases were categorized as low difficulty (PDI 1–4), moderate difficulty (PDI 5–7), or high difficulty (PDI ≥8). This classification was subsequently used to evaluate the relationship between operative difficulty and postoperative dry socket.

Assessment of Postoperative Complications

Patients were evaluated for postoperative complications following mandibular third molar removal. The recorded outcomes included pain, facial swelling, trismus, dry socket, postoperative infection, postoperative bleeding, temporary inferior alveolar nerve disturbance, and temporary lingual nerve disturbance. The occurrence of persistent or permanent sensory deficits was also recorded. Postoperative pain was further categorized as mild, moderate, or severe. Trismus was similarly classified into mild, moderate, and severe categories. These outcomes were used to characterize the severity of postoperative morbidity within the study population.

Assessment of Dry Socket

Dry socket was evaluated as a specific postoperative outcome. The clinical characteristics recorded among affected patients included the time of onset, pain associated with an empty extraction socket, halitosis, and the presence of exposed or denuded bone.

Outcome Measures

The primary postoperative outcomes were the occurrence of complications following mandibular third molar removal and the development of dry socket. Secondary assessments included the severity of pain and trismus, operative duration, requirement for bone removal or tooth sectioning, and the association of radiographic and clinical characteristics with postoperative morbidity.

Statistical Analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Appropriate descriptive and inferential statistical methods were applied according to the type and distribution of the data. Categorical variables were expressed as frequencies and percentages, while continuous variables such as age and duration of surgery were summarized as mean $\pm$ standard deviation. Associations between categorical variables, including Winter's classification, Pell and Gregory classification, surgical difficulty, preoperative pericoronitis, smoking/tobacco use and postoperative complications or dry socket, were assessed using the Chi-square test or Fisher's exact test, as appropriate. Multivariable binary logistic regression was performed to identify independent predictors of dry socket, with results expressed as adjusted odds ratios (OR) with 95% confidence intervals (CI). A p-value <0.05 was considered statistically significant.

RESULTS

Table 1 and Figure 1 present the demographic characteristics of the study population. The study comprised 200 participants, with a mean age of 24.6 ± 4.8 years. The 21–25-year age group represented the largest proportion, accounting for 92 participants (46.0%), followed by the 26–30-year group, which included 52 participants (26.0%). Participants aged 18–20 years constituted 36 cases (18.0%), while 20 participants (10.0%) were aged above 30 years. Regarding gender distribution, 118 participants (59.0%) were female and 82 (41.0%) were male, indicating a slight female predominance within the study population.

Table 1: Demographic characteristics of the study population

Parameter	Value
Age (years), mean $\pm$ SD	24.6 $\pm$ 4.8
Age 18–20 years	36 (18.0%)
Age 21–25 years	92 (46.0%)
Age 26–30 years	52 (26.0%)
>30 years	20 (10.0%)
Male	82 (41.0%)
Female	118 (59.0%)

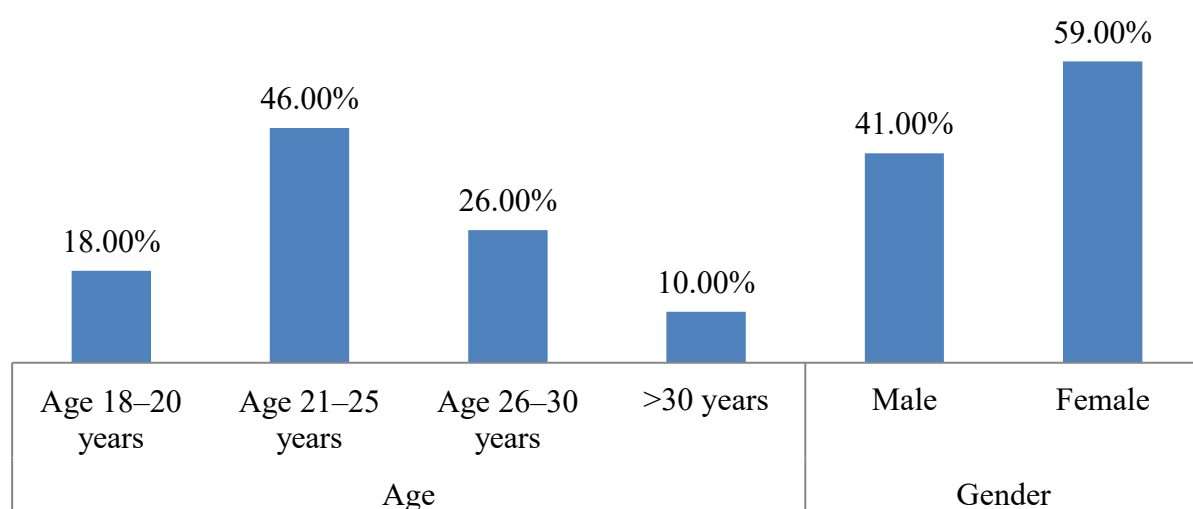


Figure 1: Age-group and gender distribution of the study participants

Table 2 & Figure 2 summarize the radiographic characteristics of the 200 impacted mandibular third molars based on established classification systems. According to Winter's classification, mesioangular impaction was the most frequently observed pattern, occurring in 92 cases (46.0%). Vertical impaction was identified in 54 cases (27.0%), while horizontal and distoangular orientations were present in 32 (16.0%) and 22 (11.0%) cases, respectively.

Assessment using the Pell and Gregory classification for ramus relationship demonstrated that Class I was the predominant category, accounting for 118 cases (59.0%). Class II was recorded in 64 cases (32.0%), whereas Class III was observed in 18 cases (9.0%). With respect to the depth of impaction, Position A was most common, comprising 104 cases (52.0%), followed by Position B in 70 cases (35.0%) and Position C in 26 cases (13.0%). Overall, the findings indicate that mesioangular, Class I, Position A impactions constituted the predominant radiographic pattern among the impacted mandibular third molars.

Table 2: Radiographic characteristics of impacted mandibular third molars

Classification	Category	n (%)
Winter's classification	Mesioangular	92 (46.0%)
	Vertical	54 (27.0%)
	Horizontal	32 (16.0%)
	Distoangular	22 (11.0%)
Pell and Gregory ramus relation	Class I	118 (59.0%)
	Class II	64 (32.0%)
	Class III	18 (9.0%)
Pell and Gregory depth	Position A	104 (52.0%)
	Position B	70 (35.0%)
	Position C	26 (13.0%)

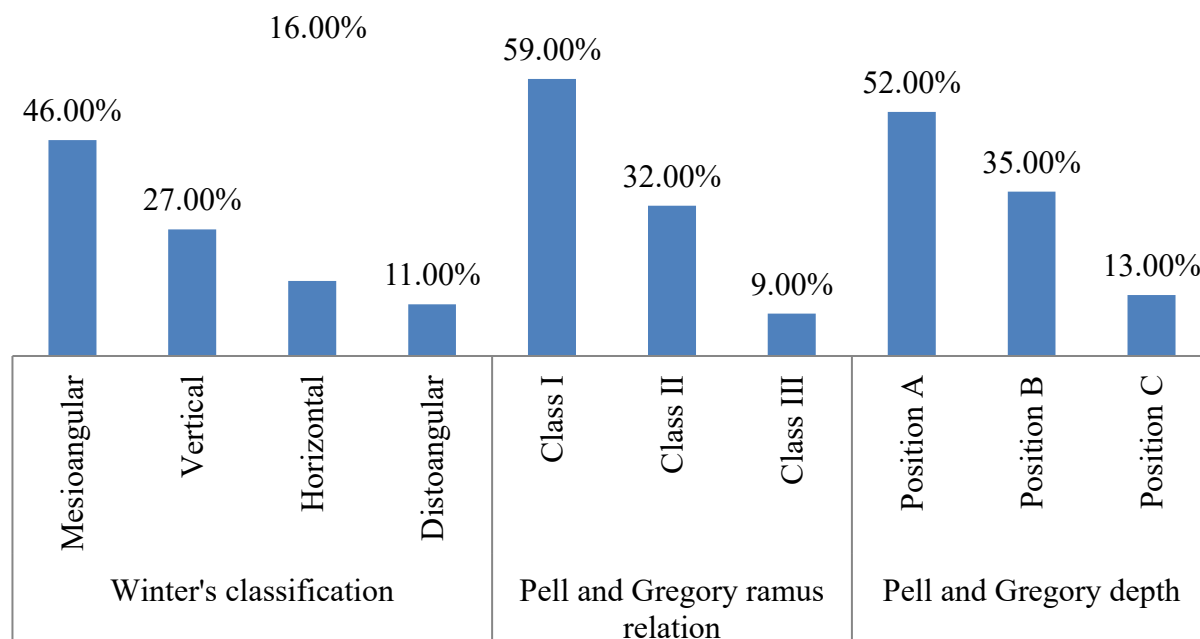


Figure 2: Radiographic distribution of impacted mandibular third molars according to Winter's and Pell and Gregory classifications

Table 3 and Figure 3 describe the operative parameters observed during removal of the impacted mandibular third molars. The mean surgical duration was 28.4 ± 9.6 minutes. The largest proportion of procedures, comprising 86 cases (43.0%), was completed within 20–30 minutes. This was followed by 52 procedures (26.0%) that required 31–45 minutes. Surgical extraction was completed in less than 20 minutes in 42 cases (21.0%), while 20 cases (10.0%) required more than 45 minutes.

Additional surgical procedures were frequently necessary. Bone removal was performed in 118 cases (59.0%), whereas tooth sectioning was required in 94 cases (47.0%). Overall, most extractions were completed within 30 minutes; however, a considerable number of cases required adjunctive procedures, particularly bone removal and tooth sectioning.

Table 3: Operative characteristics

	Parameter	n (%) / Mean $\pm$ SD
	Duration of surgery, mean $\pm$ SD (min)	28.4 $\pm$ 9.6
Duration of surgery	<20 min	42 (21.0%)
	20–30 min	86 (43.0%)
	31–45 min	52 (26.0%)
	>45 min	20 (10.0%)
	Bone removal required	118 (59.0%)
	Tooth sectioning required	94 (47.0%)

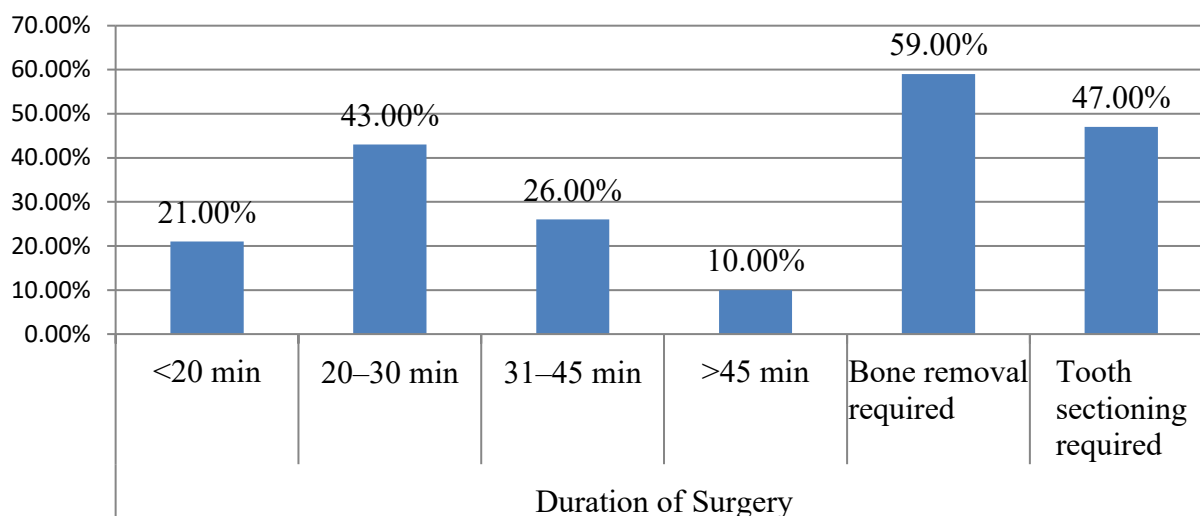


Figure 3: Distribution of operative duration and surgical interventions during impacted mandibular third molar extraction

Table 4 & Figure 4 summarize the postoperative complications observed after mandibular third molar extraction. Pain was the most commonly reported complication, affecting 112 patients (56.0%), followed by facial swelling in 96 patients (48.0%) and trismus in 74 patients (37.0%). Dry socket occurred in 14 patients (7.0%), whereas postoperative infection and bleeding were documented in 8 (4.0%) and 6 patients (3.0%), respectively.

Temporary inferior alveolar nerve disturbance was noted in 3 patients (1.5%), while temporary lingual nerve disturbance occurred in 2 patients (1.0%). Importantly, no persistent or permanent sensory disturbances were observed during the study period. Overall, 78 patients (39.0%) experienced no postoperative complications, indicating that a substantial proportion of patients had an uncomplicated postoperative course.

Table 4: Postoperative complications of 3rd Molar Removal

Complication	n (%)
Pain	112 (56.0%)
Facial swelling	96 (48.0%)
Trismus	74 (37.0%)
Dry socket/alveolar osteitis	14 (7.0%)
Postoperative infection	8 (4.0%)
Postoperative bleeding	6 (3.0%)
Temporary inferior alveolar nerve disturbance	3 (1.5%)
Temporary lingual nerve disturbance	2 (1.0%)
Persistent/permanent sensory deficit	0 (0.0%)
No Complication	78 (39.0%)

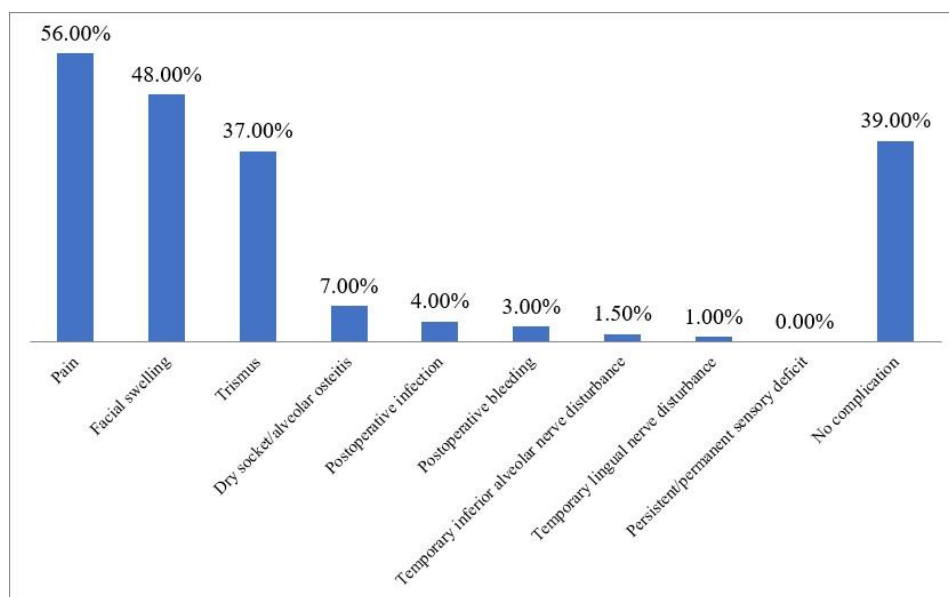


Figure 4: Distribution of postoperative complications following mandibular third molar extraction

Table 5& Figure 5 illustrate the severity patterns of postoperative pain and trismus among the 200 patients who underwent mandibular third molar removal. Mild pain was the most commonly observed category, reported by 58 patients (29.0%), followed by moderate pain in 42 patients (21.0%) and severe pain in 12 patients (6.0%). For postoperative trismus, 48 patients (24.0%) exhibited mild limitation of mouth opening, while 22 patients (11.0%) experienced moderate trismus and 4 patients (2.0%) had severe trismus. Overall, mild postoperative symptoms were the predominant severity category for both pain and trismus.

Table 5: Severity of postoperative pain and trismus

Outcome	Severity	n (%)
Pain	Mild	58 (29.0%)
	Moderate	42 (21.0%)
	Severe	12 (6.0%)
Trismus	Mild	48 (24.0%)
	Moderate	22 (11.0%)
	Severe	4 (2.0%)

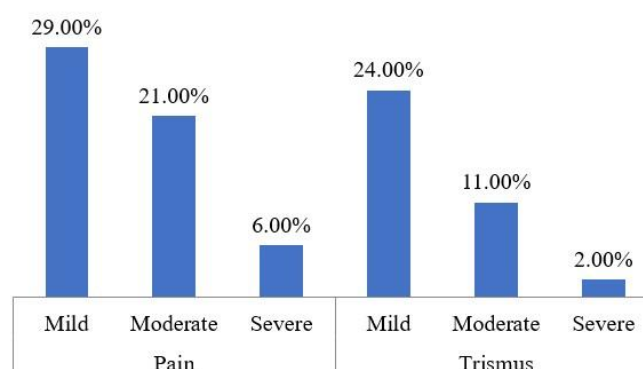


Figure 5: Severity distribution of postoperative pain and trismus following mandibular third molar removal

Table 6 & Figure 6 present the clinical profile of the 14 patients who developed dry socket after mandibular third molar extraction. Most cases, 10 patients (71.4%), became clinically evident within 48 hours of the procedure. Dry socket developed between 49 and 72 hours in 3 patients (21.4%), while 1 patient (7.1%) developed the condition after 72 hours. Pain associated with an empty extraction socket was reported in all 14 cases (100.0%). Exposed or denuded bone was identified in 11 patients (78.6%), whereas halitosis was present in 10 patients (71.4%). Overall, the dry socket cases were predominantly characterized by early clinical onset, postoperative socket pain, exposed bone, and halitosis.

Table 6: Characteristics of dry socket cases

	Characteristic	n (%)
Onset	Onset $\leq$ 48 hours	10 (71.4%)
	Onset 49–72 hours	3 (21.4%)
	Onset >72 hours	1 (7.1%)
	Pain with empty socket	14 (100.0%)
	Halitosis	10 (71.4%)
	Exposed/denuded bone	11 (78.6%)

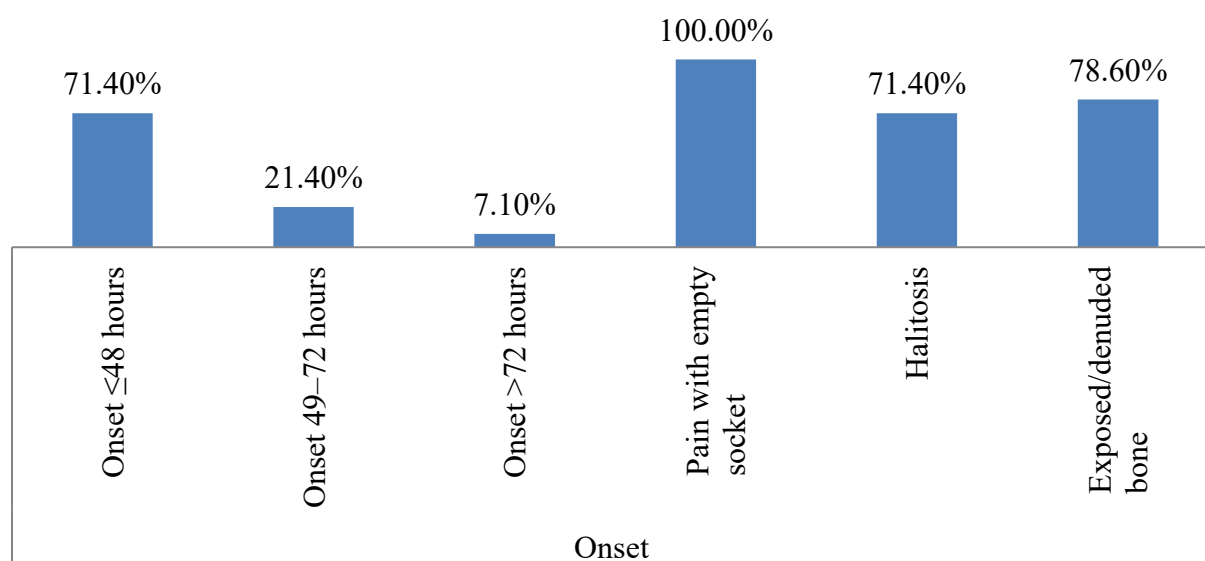


Figure 6: Clinical characteristics and time of onset of dry socket following mandibular third molar removal

Table 7 & Figure 7 demonstrate the relationship between Pell and Gregory impaction depth and the occurrence of postoperative complications. The highest proportion of complications was observed among patients with Position B impactions, with complications occurring in 51 of 70 patients (72.9%). In comparison, complications were reported in 55 of 104 patients (52.9%) with Position A impactions and 16 of 26 patients (61.5%) with Position C impactions.

Overall, postoperative complications were identified in 122 patients (61.0%), whereas 78 patients (39.0%) remained free of complications. Statistical analysis demonstrated a significant association between impaction depth and postoperative complications ($p = 0.012$), suggesting that the depth of mandibular third molar impaction was significantly related to the likelihood of developing postoperative complications.

Table 7: Association of Pell and Gregory depth with postoperative complications

Depth	Total	Complication present n (%)	Complication absent n (%)	p-value
Position A	104	55 (52.9%)	49 (47.1%)	0.012*
Position B	70	51 (72.9%)	19 (27.1%)	
Position C	26	16 (61.5%)	10 (38.5%)	
Total	200	122 (61.0%)	78 (39.0%)	

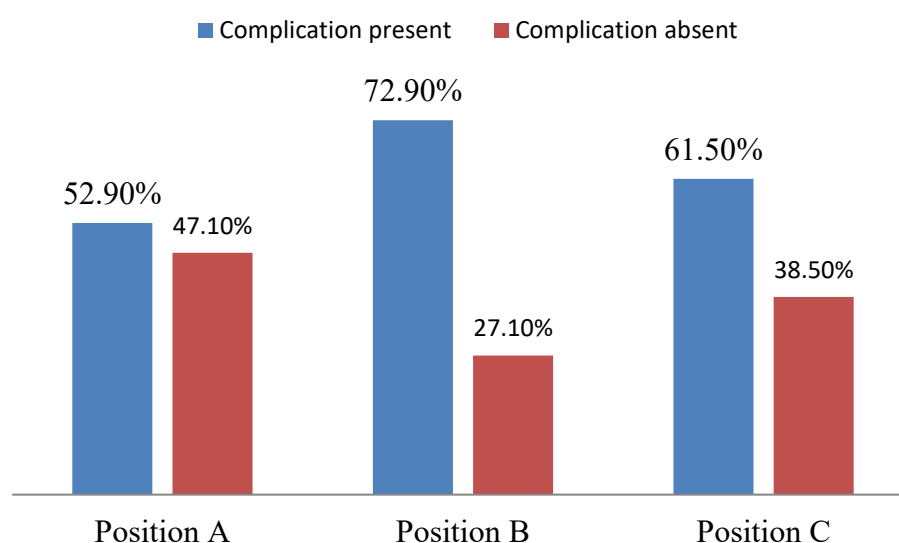


Figure 7: Association between Pell and Gregory impaction depth and postoperative complications following mandibular third molar removal

Table 8 & Figure 8 illustrate the relationship between preoperative pericoronitis and postoperative complications following mandibular third molar removal. Among the 62 patients who presented with preoperative pericoronitis, 47 (75.8%) subsequently developed postoperative complications, whereas 15 (24.2%) had an uncomplicated postoperative course. In contrast, among the 138 patients without preoperative pericoronitis, postoperative complications occurred in 75 patients (54.3%), while 63 patients (45.7%) experienced no complications. Overall, postoperative complications were recorded in 122 patients (61.0%). Statistical analysis demonstrated a highly significant association between preoperative pericoronitis and postoperative complications ($p < 0.001$), indicating that patients with preoperative pericoronitis were significantly more likely to experience postoperative complications.

Table 8: Association of preoperative pericoronitis with postoperative complications

Preoperative pericoronitis	Total	Complication present n (%)	Complication absent n (%)	p-value
Present	62	47 (75.8%)	15 (24.2%)	<0.001*
Absent	138	75 (54.3%)	63 (45.7%)	
Total	200	122 (61.0%)	78 (39.0%)	

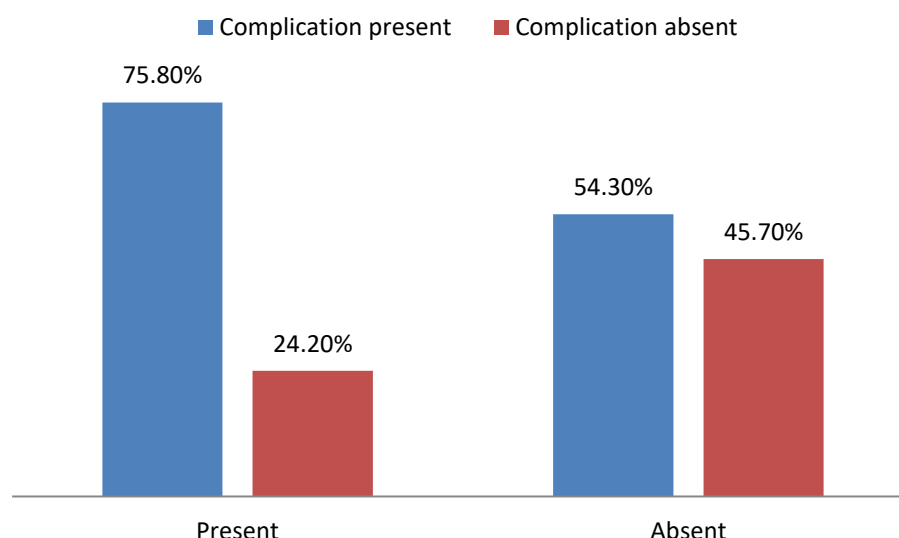


Figure 8: Association between preoperative pericoronitis and postoperative complications following mandibular third molar removal

Table 9 & Figure 9 demonstrate the relationship between surgical difficulty and the occurrence of dry socket following mandibular third molar removal. A progressive increase in the frequency of dry socket was observed with greater surgical difficulty. Among patients with low surgical difficulty (PDI 1–4), dry socket developed in 2 of 78 patients (2.6%). In the moderate-difficulty group (PDI 5–7), 7 of 88 patients (8.0%) developed dry socket. The highest frequency was observed among patients with high surgical difficulty (PDI ≥8), in whom 5 of 34 patients (14.7%) developed the complication. Overall, dry socket was reported in 14 patients (7.0%), while 186 patients (93.0%) did not develop this complication. Statistical analysis revealed a significant association between surgical difficulty and dry socket ($p = 0.018$), indicating that an increase in the difficulty of surgical extraction was associated with a greater risk of developing dry socket.

Table 9: Association of surgical difficulty with dry socket

Difficulty	Total	Dry socket n (%)	No dry socket n (%)	p-value
Low difficulty (PDI 1–4)	78	2 (2.6%)	76 (97.4%)	0.018*
Moderate difficulty (PDI 5–7)	88	7 (8.0%)	81 (92.0%)	
High difficulty (PDI ≥8)	34	5 (14.7%)	29 (85.3%)	
Total	200	14 (7.0%)	186 (93.0%)	

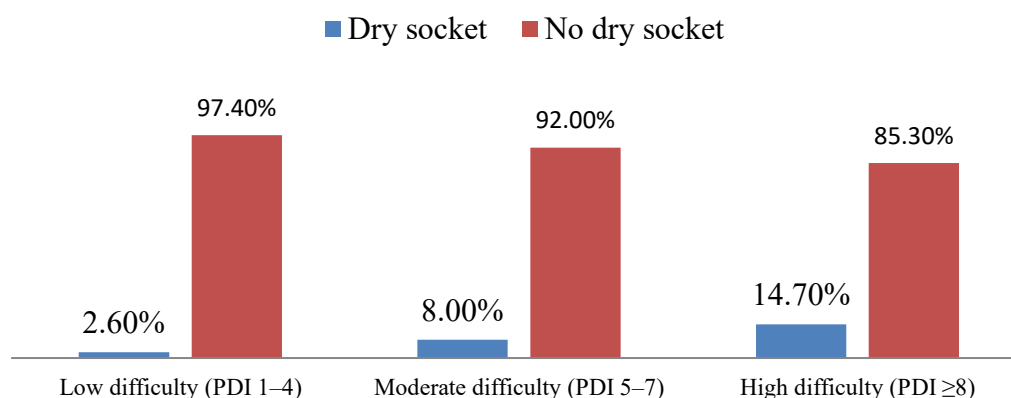


Figure 9: Association between surgical difficulty and the occurrence of dry socket following mandibular third molar removal

Table 10 & Figure 10 demonstrate the relationship between smoking/tobacco use and the occurrence of dry socket following mandibular third molar extraction. Among the 48 patients who reported tobacco use, 7 (14.6%) developed dry socket, whereas 41 (85.4%) did not experience this complication. In comparison, among the 152 non-tobacco users, dry socket was observed in 7 patients (4.6%), while 145 (95.4%) remained free of dry socket.

Overall, 14 patients (7.0%) developed dry socket in the study population. Statistical analysis revealed a significant association between tobacco use and dry socket development ($p = 0.018$), with tobacco users demonstrating a higher frequency of dry socket compared with non-users.

Table 10: Association of smoking/tobacco use with dry socket

Smoking/tobacco use	Total	Dry socket n (%)	No dry socket n (%)	p-value
Yes	48	7 (14.6%)	41 (85.4%)	0.018*
No	152	7 (4.6%)	145 (95.4%)	
Total	200	14 (7.0%)	186 (93.0%)	

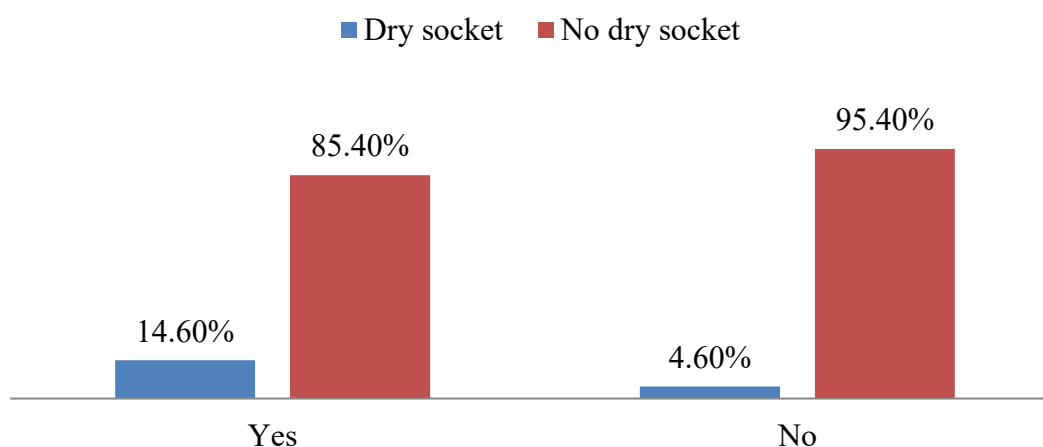


Figure 10: Association between tobacco use and the occurrence of dry socket following mandibular third molar extraction

Table 11 & Figure 11 illustrate the distribution of dry socket according to the Winter's classification of mandibular third molar impaction. Dry socket developed in 4 of 92 mesioangular impactions (4.3%) and 2 of 54 vertical impactions (3.7%). A greater proportion was observed among horizontal impactions, with 4 of 32 cases (12.5%) developing dry socket. The highest frequency was recorded in the distoangular group, where 4 of 22 cases (18.2%) developed dry socket.

Overall, dry socket occurred in 14 of the 200 cases (7.0%), whereas 186 cases (93.0%) did not develop the complication. Statistical analysis demonstrated a significant association between Winter's classification and dry socket occurrence ($p = 0.031$). Dry socket was therefore more frequently observed in horizontal and distoangular impactions compared with mesioangular and vertical impactions.

Table 11: Association of Winter's Classification with Dry Socket

Winter's classification	Total	Dry socket n (%)	No dry socket n (%)	p-value
Mesioangular	92	4 (4.3%)	88 (95.7%)	0.031*
Vertical	54	2 (3.7%)	52 (96.3%)	
Horizontal	32	4 (12.5%)	28 (87.5%)	
Distoangular	22	4 (18.2%)	18 (81.8%)	
Total	200	14 (7.0%)	186 (93.0%)	

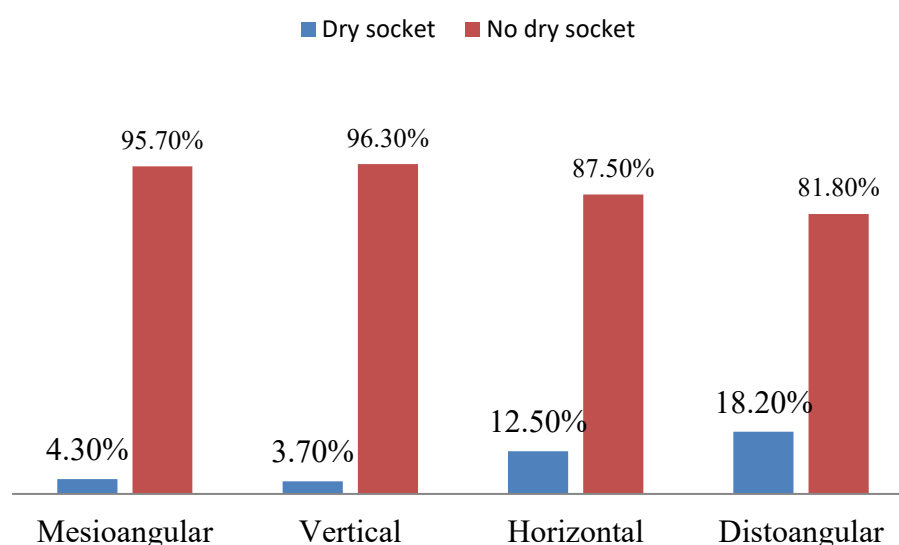


Figure 11: Distribution of dry socket according to Winter's classification of mandibular third molar impaction

Table 12 summarizes the multivariable logistic regression model used to determine which factors independently predicted the development of postoperative dry socket. Following adjustment for potential confounding variables, patients undergoing procedures classified as having high surgical difficulty demonstrated significantly greater odds of developing dry socket (adjusted OR = 2.84, 95% CI: 1.12–7.18; $p = 0.027$). Preoperative pericoronitis was also independently associated with an increased risk, with an adjusted OR of 2.31 (95% CI: 1.01–5.29; $p = 0.047$). Distoangular impaction likewise remained a significant predictor of dry socket, with affected patients showing approximately 2.34-fold higher odds of developing the complication (95% CI: 1.12–5.56; $p = 0.039$). Although smoking or tobacco use was associated with increased odds (adjusted OR = 1.88), the association was not statistically significant ($p = 0.190$). No statistically significant independent association was identified for female sex (adjusted OR = 1.42; $p = 0.397$) or age >25 years (adjusted OR = 1.31; $p = 0.523$). Therefore, after

adjustment for the variables included in the model, high surgical difficulty, preoperative pericoronitis, and distoangular impaction were identified as significant independent predictors of postoperative dry socket.

Table 12: Multivariable logistic regression for dry socket

Predictor	Adjusted OR	95% CI	p-value
Surgical difficulty (high vs low)	2.84	1.12–7.18	0.027*
Preoperative pericoronitis	2.31	1.01–5.29	0.047*
Smoking/tobacco use	1.88	0.73–4.82	0.190
Female sex	1.42	0.63–3.19	0.397
Age >25 years	1.31	0.57–3.02	0.523
Distoangular Impaction	2.34	1.12–5.56	0.039*

DISCUSSION

Surgical removal of impacted mandibular third molars is a commonly performed procedure in oral and maxillofacial surgery; however, the degree of difficulty and the occurrence of postoperative complications can vary considerably among patients. In the present study, postoperative complications were assessed in relation to demographic characteristics, radiographic features, preoperative clinical factors, and operative parameters. The findings emphasize the importance of identifying factors that may contribute to increased surgical difficulty and postoperative morbidity.

Susarla and Dodson (2004) [10] evaluated risk factors associated with the difficulty of third-molar extraction and demonstrated that the anatomical position of the impacted tooth is an important determinant of surgical complexity. Factors such as the depth of impaction, angulation, and relationship of the tooth to the mandibular ramus may increase the technical difficulty of extraction. The findings of the present study are consistent with these observations, as unfavorable radiographic characteristics and greater surgical difficulty were associated with an increased likelihood of postoperative complications. These findings indicate that careful radiographic assessment before surgery can help clinicians anticipate technically challenging extractions.

The influence of surgical experience and operative complexity on postoperative outcomes was examined by Jerjes et al. (2006) [11]. They reported that complication rates following third-molar surgery may be related to the complexity of the procedure and the surgeon's experience. More difficult extractions generally require greater surgical manipulation and may result in increased tissue trauma and prolonged operative time. In the present study, increased surgical difficulty was similarly associated with a greater occurrence of postoperative morbidity. This finding highlights the importance of appropriate case selection, preoperative planning, and adequate surgical expertise when managing deeply positioned or unfavorably angulated mandibular third molars.

Postoperative complications following impacted mandibular third-molar removal are multifactorial. Blondeau and Daniel (2007) [12] reported that complications may be influenced by several patient, tooth, and procedure-related factors. Pain, swelling, trismus, infection, alveolar osteitis, and other postoperative problems may occur following surgery, with their frequency influenced by factors such as tooth position, surgical difficulty, and patient characteristics. The present study similarly demonstrated that postoperative morbidity was not attributable to a single factor but was associated with a combination of clinical and operative characteristics. This supports the need for a comprehensive risk assessment rather than relying on an isolated radiographic or demographic variable.

Radiographic assessment plays an important role in the preoperative evaluation of impacted mandibular third molars. Santosh (2015) [13] emphasized the clinical importance of integrating radiographic and clinical characteristics when assessing impacted mandibular third molars. In the present study, established radiographic parameters were used to systematically evaluate the position, depth, and anatomical characteristics of the impacted teeth. The predominance of particular radiographic patterns observed in the study may reflect the distribution of impaction characteristics within the study population and may also

contribute to variations in surgical difficulty. Such radiographic assessment can assist clinicians in anticipating the complexity of third-molar removal and in planning an appropriate surgical approach.

The association between radiographic characteristics and postoperative wound complications has also been investigated. Yamamura et al. (2024) [14] evaluated radiological findings associated with postoperative wound infection following extraction of impacted mandibular third molars and demonstrated the relevance of radiographic assessment in identifying patients at increased risk of postoperative complications. Their findings support the concept that preoperative imaging can provide clinically useful information beyond simply confirming the presence of an impacted tooth. In the present study, radiographic parameters were incorporated into the assessment of surgical difficulty and postoperative complications, supporting the value of systematic preoperative imaging in treatment planning.

The surgical technique and management of the extraction wound may also influence postoperative recovery. Danda et al. (2010) [15] compared primary and secondary closure following impacted mandibular third-molar removal and evaluated their effects on postoperative pain and swelling. Their findings indicate that wound-management strategies may influence postoperative morbidity. Although postoperative complications in the present study were evaluated in relation to several patient and surgical factors, the findings of Danda et al. emphasize that the postoperative course is also influenced by technical aspects of surgery and wound management. Appropriate flap design, controlled tissue manipulation, adequate irrigation, and suitable wound closure may therefore contribute to improved postoperative recovery.

Dry socket represents an important postoperative complication following mandibular third-molar surgery. The condition is clinically characterized by significant postoperative pain and delayed healing and may require additional treatment. In the present study, particular emphasis was placed on dry socket because of its clinical relevance and its potential association with surgical difficulty. More difficult extractions may require increased bone removal, tooth sectioning, prolonged manipulation, and longer operative duration, all of which may contribute to greater postoperative tissue trauma. The findings therefore emphasize the importance of recognizing patients undergoing technically difficult extractions as a potentially higher-risk group for postoperative complications. The observed relationship between surgical difficulty and postoperative morbidity is clinically relevant because the anticipated complexity of third-molar removal can be assessed before surgery using preoperative clinical and radiographic findings. Assessment of tooth position, depth of impaction, preoperative inflammation, tobacco use, and operative characteristics provides a practical framework for identifying patients who may require closer postoperative monitoring. Susarla and Dodson (2004) [10] and Santosh (2015) [13] similarly emphasized the importance of preoperative assessment in evaluating the complexity of impacted mandibular third-molar removal.

The findings also have implications for patient counseling. Patients with unfavorable impaction patterns or anticipated difficult extractions should be informed about the possibility of increased postoperative pain, swelling, trismus, infection, or alveolar osteitis. Jerjes et al. (2006) [11] and Blondeau and Daniel (2007) [12] highlighted the relationship between operative complexity and postoperative complications, reinforcing the importance of individualized preoperative counseling. Identifying high-risk cases before surgery may allow clinicians to plan appropriate preventive measures and postoperative follow-up.

Overall, the present study demonstrates that postoperative complications following impacted mandibular third-molar surgery are multifactorial and are influenced by the interaction of anatomical, clinical, and operative variables. The observations are broadly consistent with previous studies. Systematic radiographic assessment, accurate estimation of surgical difficulty, careful operative technique, and appropriate postoperative management may help reduce morbidity and improve recovery following mandibular third-molar surgery.

Limitations

This study has several limitations that should be considered when interpreting its findings. It was conducted in a specific community-based clinical setting and included 200 participants, which may limit the generalizability of the results to populations with different demographic, socioeconomic, behavioral, or healthcare characteristics. Although the overall sample size was adequate for the study objectives, only 14 participants developed dry socket, resulting in a relatively small number of outcome events that may have reduced the ability to detect weaker associations and contributed to wider confidence intervals in some regression analyses. The observational study design permits identification of associations between clinical, radiographic, and operative factors and postoperative complications but does not establish definitive causal relationships.

Furthermore, despite the use of multivariable logistic regression, some potentially relevant factors affecting postoperative healing may not have been measured or adequately controlled, and residual confounding therefore cannot be excluded. Tobacco exposure was assessed categorically, without detailed information regarding duration of use, daily consumption, cumulative exposure, or the timing of tobacco use in relation to surgery, which may have influenced the risk of alveolar osteitis. In addition, surgical and operator-related factors, including clinician experience, flap design, degree of bone removal, tooth sectioning, irrigation methods, and other technical variations, may contribute to postoperative morbidity, but their individual effects were not independently evaluated for every complication. The assessment predominantly emphasized early postoperative outcomes; therefore, uncommon or delayed complications may have been underrepresented. Finally, the predictors of dry socket identified in this study, particularly greater surgical difficulty, preoperative pericoronitis, and distoangular impaction, were derived from a single study population and should be validated through larger, prospective, multicenter investigations before being considered broadly applicable predictive factors.

Conclusion

The present study demonstrates that surgical removal of impacted mandibular third molars is associated with considerable short-term postoperative morbidity, with pain, swelling, and trismus being the most common complications. No persistent sensory nerve deficits were observed.

Postoperative outcomes were influenced by the anatomical and clinical characteristics of the impacted tooth. Greater impaction depth, preoperative pericoronitis, unfavorable impaction patterns, and increased surgical difficulty were associated with higher postoperative morbidity and dry socket risk.

The study underscores the importance of Quality Education Sustainable Development Goals (SDG 4) and continuous professional training in equipping dental professionals with the skills to perform comprehensive preoperative assessment of impaction characteristics, inflammatory status, and surgical difficulty to identify patients at high risk for post-operative complications. This might help to implement appropriate strategies like individualized patient counseling, appropriate preventive measures, and closer postoperative monitoring which may help minimize complications, thereby promoting safer and more effective patient care.

Conflicts of Interest: Nil

Financial Support: None

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