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Clinical and Neurosensory Outcomes of Coronectomy for Impacted Mandibular Third Molars in Close Proximity to the Inferior Alveolar Nerve: A Prospective Clinical Study

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ABSTRACT

Background: *Surgical removal of impacted mandibular third molars located in close proximity to the inferior alveolar nerve (IAN) is associated with a risk of postoperative neurosensory disturbance. Coronectomy, or intentional partial odontectomy, involves removal of the crown while retaining the roots in situ and has been proposed as a conservative approach for high-risk mandibular third molars.*

Objective: *This study aimed to evaluate the clinical and neurosensory outcomes of coronectomy in patients with impacted mandibular third molars in close proximity to the inferior alveolar nerve.*

Materials and Methods: *A prospective single-arm clinical study was conducted among 20 patients treated at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Sana'a University, Yemen. Patients were aged 20–35 years and had impacted mandibular third molars considered to have a high radiographic risk of inferior alveolar nerve injury. Preoperative assessment included clinical examination, panoramic radiography, and cone-beam computed tomography (CBCT). Coronectomy was performed using a standardized surgical protocol. Postoperative outcomes included pain assessed using the Visual Analogue Scale (VAS), facial swelling assessed using Laskin's scale, and neurosensory status. Patients were followed for 6 months.*

Results: *Of the 20 patients, 15 (75.0%) were female and 5 (25.0%) were male. The mean age was 26.65 ± 4.66 years. The mean VAS pain score decreased significantly from 5.60 ± 1.09 on postoperative Day 1 to 1.05 ± 0.60 on Day 7 ($p < 0.001$). No statistically significant differences in postoperative pain were found between age groups on Day 1 ($p = 0.254$) or Day 7 ($p = 0.771$), or between male and female patients on Day 1 ($p = 0.163$). No statistically significant association was found between age group and postoperative swelling severity (Fisher–Freeman–Halton exact test, $p = 1.000$) or between gender and postoperative swelling severity (Fisher–Freeman–Halton exact test, $p = 0.356$). One patient (5.0%) experienced temporary paresthesia, while 19 patients (95.0%) maintained normal neurosensory status.*

Conclusion: *Within the limitations of this small prospective single-arm study, coronectomy was associated with favorable short- and intermediate-term clinical and neurosensory outcomes in patients with impacted mandibular third molars in close proximity to the inferior alveolar nerve. Further studies with larger samples, appropriate control groups, and longer follow-up are required to evaluate the long-term effectiveness and safety of the procedure.*

Keywords
Coronectomy, Impacted mandibular third molar, Inferior alveolar nerve, CBCT, Postoperative pain, Swelling, Paresthesia, Intentional partial odontectomy.

Introduction
Impacted mandibular third molars are among the most frequently encountered conditions requiring surgical management in oral and maxillofacial surgery. Impaction may result from inadequate arch space, obstruction by adjacent teeth, or an abnormal eruption pathway. Complications associated with impacted mandibular third molars include pericoronitis, dental caries, periodontal disease, and other pathological conditions [1,2].

One of the most important considerations during surgical removal of mandibular third molars is the anatomical relationship between the tooth roots and the inferior alveolar nerve (IAN). Injury to the IAN may result in temporary or permanent sensory disturbances affecting the lower lip and chin. The risk of neurological complications increases when the roots are closely associated with the mandibular canal [3,4].

Panoramic radiography is commonly used for the initial assessment of impacted mandibular third molars. Several radiographic signs, including darkening or narrowing of the roots, diversion or narrowing of the mandibular canal, and interruption of the canal's cortical border, have been associated with increased risk of IAN injury [5]. However, panoramic radiography provides a two-dimensional representation of a three-dimensional anatomical relationship. Cone-beam computed tomography (CBCT) can provide more detailed three-dimensional information regarding the relationship between the tooth roots and the mandibular canal [6,7].

Coronectomy, also referred to as intentional partial odontectomy, was introduced as an alternative to complete extraction for mandibular third molars considered to be at high risk of IAN injury. The technique involves removal of the crown while leaving the roots undisturbed within the alveolar bone [8]. The rationale is to minimize manipulation of the roots and consequently reduce the possibility of direct or indirect trauma to the IAN.

Previous systematic reviews and meta-analyses have reported a lower incidence of IAN injury following coronectomy compared with complete removal in appropriately selected high-risk cases, although postoperative pain, infection, root migration, and the possibility of secondary surgery remain important considerations [9-12].

The present study was therefore undertaken to evaluate the clinical and neurosensory outcomes of coronectomy in patients with impacted mandibular third molars located in close proximity to the inferior alveolar nerve.

Aim of the Study
The aim of this study was to evaluate the clinical and neurosensory outcomes of coronectomy in the management of impacted mandibular third molars in close proximity to the inferior alveolar nerve.

Specific Objectives
The specific objectives were:
1. To evaluate postoperative neurosensory status following coronectomy.
2. To assess postoperative pain using the Visual Analogue Scale.
3. To assess postoperative facial swelling using Laskin's scale.
4. To evaluate the relationship between demographic characteristics and postoperative clinical outcomes.
5. To assess the short- and intermediate-term clinical outcomes following coronectomy.

Materials and Methods
Study Design and Setting
A prospective clinical study was conducted in the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Sana'a University, Yemen.

The study followed patients from the preoperative assessment through a 6-month postoperative follow-up period.

Study Population and Sample Size
The study included 20 patients (n = 20) with impacted mandibular third molars located in close proximity to the inferior alveolar nerve.

The thesis describes the sample size as being selected according to the rule of thumb for pilot clinical studies, in which approximately 12–30 participants may provide preliminary clinical data [13].

Inclusion Criteria
Patients were included if they met the following criteria:
1. Adults aged 20–35 years.
2. Presence of an impacted mandibular third molar with high radiographic risk of IAN injury confirmed by CBCT.
3. Absence of preoperative neurosensory deficits in the distribution of the IAN.
4. Willingness to comply with the postoperative follow-up schedule.

Exclusion Criteria
Patients were excluded if they had:
1. Systemic diseases that contraindicated minor oral surgery or impaired bone healing.
2. Active local infection, including acute pericoronitis or abscess.
3. Teeth with apical pathology or extensive dental caries involving the root complex.
4. Pregnancy or lactation.

Preoperative Assessment
A comprehensive clinical assessment was performed for each participant, including medical history and intraoral examination.

Panoramic radiography was initially performed to assess the position of the impacted mandibular third molar and identify radiographic signs indicating close proximity to the IAN.

CBCT examination was subsequently performed for three-dimensional anatomical assessment. The relationship between the mandibular third molar roots and the inferior alveolar canal was evaluated in the relevant planes to assist surgical planning [6,7].

Surgical Technique

The coronectomy procedure was performed according to a standardized surgical protocol.

Local anesthesia consisted of 2% lidocaine with 1:80,000 epinephrine.

A mucoperiosteal flap was reflected to expose the surgical field. Buccal bone was removed conservatively using a surgical handpiece and bur, with copious irrigation using 0.9% sterile saline.

The crown was sectioned using a surgical bur while attempting to avoid movement or manipulation of the retained roots. The crown segment was removed and the remaining root portion was left in situ.

The surgical field was thoroughly irrigated, and the mucoperiosteal flap was repositioned and primarily closed using 4-0 silk sutures.

The surgical approach was based on established principles of coronectomy, particularly maintaining root stability and positioning the retained root segment below the level of the alveolar crest [8,14].

Data Collection

Data were collected prospectively using a structured case report form.

Baseline data included:

- Age;
- Sex;
- Medical history;
- Clinical findings;
- Panoramic radiographic findings;
- CBCT findings;
- Position and angulation of the impacted tooth;
- Relationship between the tooth and mandibular canal.

Postoperative data included:

- Pain intensity;
- Facial swelling;
- Neurosensory status;
- Postoperative complications.

Outcome Measures

Postoperative Pain

Pain intensity was evaluated using a 10-cm Visual Analogue Scale (VAS), where 0 represented no pain and 10 represented the worst possible pain [15].

Pain was assessed on postoperative Days 1 and 7.

Postoperative Swelling

Facial swelling was assessed using Laskin's four-grade scale [16]:

- Grade 0: No visible or palpable swelling.
- Grade 1: Mild swelling.
- Grade 2: Moderate swelling.
- Grade 3: Severe swelling.

Neurosensory Status

Neurosensory status was evaluated according to the presence or absence of altered sensation, including paresthesia, anesthesia, or dysesthesia in the distribution of the inferior alveolar nerve.

Follow-up

Patients were followed clinically for 6 months following surgery. Postoperative pain was assessed on Days 1 and 7, while facial swelling was assessed during the postoperative period. Neurosensory status was monitored during the follow-up period, with particular attention to the occurrence and persistence of paresthesia or other sensory disturbances. No permanent neurosensory deficit was reported during the 6-month follow-up period. Root migration was not included as an outcome variable in the final analysis.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics version 26.0. Continuous variables were summarized as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Changes in VAS pain scores between postoperative Days 1 and 7 were assessed using a paired-samples t-test. Differences in mean VAS pain scores between age groups and between male and female patients were assessed using independent-samples t-tests. Associations between postoperative swelling severity and age group or sex were evaluated using the Fisher–Freeman–Halton exact test because of the small sample size and low expected cell frequencies. A two-sided p-value < 0.05 was considered statistically significant.

Results

Demographic Characteristics

A total of 20 patients were included in the study.
Fifteen patients (75.0%) were female and five (25.0%) were male.

Table 1: Frequency Distribution of Patients by Gender (n = 20).

Gender	Frequency (n)	Percentage (%)
Female	15	75.0
Male	5	25.0
Total	20	100.0

The age distribution showed that 12 patients (60.0%) were aged 20–27 years, whereas 8 patients (40.0%) were aged 28–35 years.

The overall mean age was 26.65 ± 4.66 years.

Table 2: Frequency Distribution of Patients by Age Group.

Age group	Frequency (n)	Percentage (%)
20–27 years	12	60.0
28–35 years	8	40.0
Total	20	100.0

Twelve patients (60.0%) were single and eight (40.0%) were married.

Table 3: Marital Status of the Patients.

Marital status	Frequency (n)	Percentage (%)
Single	12	60.0
Married	8	40.0
Total	20	100.0

Regarding medical history, 18 patients (90.0%) had no systemic disease or relevant medical history, whereas two patients (10.0%) reported a controlled systemic condition.

Table 4: Medical History of the Patients.

Medical history	Frequency (n)	Percentage (%)
No systemic disease	18	90.0
Presence of systemic disease	2	10.0
Total	20	100.0

Postoperative Pain According to Age

The mean VAS pain score on postoperative Day 1 was 5.83 ± 1.11 among patients aged 20–27 years and 5.25 ± 1.04 among patients aged 28–35 years.

By postoperative Day 7, the mean scores had decreased to 1.08 ± 0.51 and 1.00 ± 0.76, respectively.

The differences between age groups were not statistically significant on either Day 1 ($p = 0.254$) or Day 7 ($p = 0.771$).

Table 5: Comparison of Mean VAS Pain Scores between Age Groups.

Postoperative time	Age 20–27 years, mean ± SD	Age 28–35 years, mean ± SD	p-value
Day 1	5.83 ± 1.11	5.25 ± 1.04	0.254
Day 7	1.08 ± 0.51	1.00 ± 0.76	0.771

Independent-samples t-test; $p < 0.05$ was considered statistically significant.

Postoperative Swelling According to Age

Postoperative swelling was predominantly mild to moderate in both age groups. Among patients aged 20–27 years, 6 (50.0%) had Grade 1 swelling, 5 (41.7%) had Grade 2 swelling, and 1 (8.3%) had Grade 3 swelling. Among patients aged 28–35 years, 4 (50.0%) had Grade 1 swelling and 4 (50.0%) had Grade 2 swelling, while none had Grade 3 swelling. Fisher–Freeman–Halton exact testing showed no statistically significant association between age group and postoperative swelling severity ($p = 1.000$).

Table 6: Distribution of Postoperative Swelling Grades According to Age Group.

Postoperative swelling grade	Age 20–27 years, n (%)	Age 28–35 years, n (%)	Total, n
Grade 1 (mild)	6 (50.0)	4 (50.0)	10
Grade 2 (moderate)	5 (41.7)	4 (50.0)	9
Grade 3 (severe)	1 (8.3)	0 (0.0)	1
Total	**12 (100.0)**	**8 (100.0)**	**20**

Fisher–Freeman–Halton exact test; $p = 1.000$.

Postoperative Pain According to Gender

The mean initial VAS pain score was 6.20 ± 1.64 among male patients and 5.40 ± 0.83 among female patients.

The difference was not statistically significant ($p = 0.163$).

Table 7: Comparison of Initial Pain (VAS Day 1) According to Gender.

Gender	n	Mean VAS ± SD	p-value
Male	5	6.20 ± 1.64	0.163
Female	15	5.40 ± 0.83	
Total	**20**	—	

Independent-samples t-test; $p < 0.05$ was considered statistically significant.

Postoperative Swelling According to Gender

Among female patients, eight (53.3%) had Grade 1 swelling and seven (46.7%) had Grade 2 swelling; none had Grade 3 swelling. Among male patients, two (40.0%) had Grade 1 swelling, two (40.0%) had Grade 2 swelling, and one (20.0%) had Grade 3 swelling. Fisher–Freeman–Halton exact testing showed no statistically significant association between gender and postoperative swelling severity ($p = 0.356$).

Table 8: Distribution of Postoperative Swelling Grades According to Gender.

Postoperative swelling grade	Female, n (%)	Male, n (%)	Total, n
Grade 1 (mild)	8 (53.3)	2 (40.0)	10
Grade 2 (moderate)	7 (46.7)	2 (40.0)	9
Grade 3 (severe)	0 (0.0)	1 (20.0)	1
Total	**15 (100.0)**	**5 (100.0)**	**20**

Fisher–Freeman–Halton exact test; $p = 0.356$.

Neurosensory Outcomes

Nineteen patients (95.0%) maintained normal neurosensory status following surgery.

One patient (5.0%) developed temporary paresthesia. According to the thesis, this case was associated with Grade 3 postoperative swelling.

Table 9: Incidence of Temporary Paresthesia.

Neurosensory status	Frequency (n)	Percentage (%)
Normal sensation	19	95.0
Temporary paresthesia	1	5.0
Total	20	100.0

No permanent neurosensory deficit was reported during the study follow-up.

Overall Pain Resolution

For the entire study population, the mean VAS pain score decreased from 5.60 ± 1.09 on postoperative Day 1 to 1.05 ± 0.60 on Day 7.

The paired t-test demonstrated a highly significant reduction in pain ($p < 0.001$).

Table 10: Paired Comparison of Pain Levels between Postoperative Day 1 and Day 7.

Time interval	Mean VAS score	Standard deviation	p-value
Postoperative Day 1	5.60	1.09	<0.001
Postoperative Day 7	1.05	0.60	

Discussion

The present prospective single-arm clinical study evaluated the clinical and neurosensory outcomes of coronectomy in 20 patients with impacted mandibular third molars located in close proximity to the inferior alveolar nerve. The mean age of the participants was 26.65 ± 4.66 years, and 75.0% were female. Because of the small sample size and single-center design, these demographic characteristics should not be considered representative of the wider population.

Postoperative Pain

A major finding of the present study was the substantial reduction in postoperative pain during the first postoperative week. The mean VAS score decreased from 5.60 ± 1.09 on postoperative Day 1 to 1.05 ± 0.60 on Day 7, with a statistically significant difference ($p < 0.001$). This finding indicates that postoperative pain was greatest during the early postoperative period and decreased substantially by the seventh day.

No statistically significant difference in postoperative pain was detected between the two age groups on either Day 1 or Day 7. Similarly, no statistically significant difference was detected between male and female patients in Day-1 pain scores. These findings indicate that the present study did not demonstrate an association between age group or sex and postoperative pain intensity. However, these comparisons should be interpreted cautiously because of the small sample size, particularly the limited number of male participants.

Previous systematic reviews have reported that postoperative pain following coronectomy is generally manageable and that, in comparative studies, pain may not differ substantially from that following conventional third molar extraction [9-11]. The present findings are consistent with the expected pattern of early postoperative recovery following mandibular third molar surgery.

Postoperative Swelling

Postoperative swelling was predominantly mild to moderate in the present study. Among patients aged 20–27 years, 50.0% had Grade 1 swelling, 41.7% had Grade 2 swelling, and 8.3% had Grade 3 swelling. Among patients aged 28–35 years, 50.0% had Grade 1 swelling and 50.0% had Grade 2 swelling, with no Grade 3 swelling reported. No statistically significant association was detected between age group and postoperative swelling severity (Fisher–Freeman–Halton exact test, $p = 1.000$).

Similarly, no statistically significant association was detected between sex and postoperative swelling severity (Fisher–Freeman–Halton exact test, $p = 0.356$). However, these findings should be interpreted cautiously because of the small sample size and the very low frequency of severe swelling.

Neurosensory Outcomes

The most clinically important outcome in the present study was postoperative neurosensory status. Nineteen patients (95.0%) maintained normal neurosensory status, while one patient (5.0%) developed temporary paresthesia. No permanent neurosensory deficit was reported during the 6-month follow-up period.

The occurrence of temporary paresthesia in one patient should be considered in the context of the high-risk anatomical relationship between the impacted mandibular third molar and the inferior alveolar nerve. The low frequency of neurosensory disturbance observed in this study is consistent with the rationale for coronectomy, which aims to minimize manipulation of roots that are closely associated with the inferior alveolar nerve [8,9]. Previous systematic reviews have also reported relatively low rates of inferior alveolar nerve injury following coronectomy [9,18].

Nevertheless, the present findings should be interpreted cautiously because the study included only 20 patients and did not include a conventional extraction control group. Therefore, the present study cannot establish that coronectomy is superior to complete extraction in preventing neurosensory complications.

Role of CBCT

Accurate preoperative assessment of the anatomical relationship between an impacted mandibular third molar and the inferior alveolar canal is important in high-risk cases. Panoramic radiography provides an initial assessment, whereas CBCT provides three-dimensional information that can assist in evaluating the buccolingual and vertical relationship between the roots and mandibular canal [6,7].

In the present study, CBCT was used to identify cases considered to have a high radiographic risk of inferior alveolar nerve injury and to assist in surgical planning. The use of CBCT should therefore be considered as part of the preoperative assessment of appropriately selected high-risk cases, while recognizing that the present study was not designed to evaluate the diagnostic accuracy or clinical superiority of CBCT.

Clinical Significance of Coronectomy

The principal rationale for coronectomy is to minimize manipulation of the root complex when the roots are closely associated with the inferior alveolar nerve. The technique was developed as an alternative approach for selected mandibular third molars considered to be at increased risk of nerve injury during

complete extraction [8]. Previous systematic reviews have reported evidence supporting coronectomy as an option for appropriately selected high-risk cases [9-12,19].

However, coronectomy is not free from potential complications. Retained roots may migrate postoperatively, and some patients may subsequently require additional surgical intervention. Root migration and delayed complications are therefore important considerations when discussing the procedure with patients and planning follow-up [20,21]. In the present study, root migration was not included as an outcome variable; consequently, no conclusion regarding the occurrence or absence of root migration can be drawn from these data.

Six-Month Follow-up and Interpretation of Findings

The present study included a 6-month clinical follow-up period. The documented outcomes demonstrated a substantial reduction in postoperative pain during the first week and no permanent neurosensory deficit during the follow-up period. However, the 6-month observation period and the absence of systematic assessment of retained-root migration limit the ability of the study to evaluate late radiographic complications or the long-term need for secondary surgery. Longer follow-up is therefore required to assess the durability and long-term safety of coronectomy.

Study Limitations

Several limitations should be considered when interpreting the findings. First, the small sample size limited the statistical power to detect potentially meaningful associations between demographic characteristics and postoperative outcomes.

Second, the study did not include a conventional extraction control group. Consequently, direct statistical comparison between coronectomy and complete extraction was not possible, and the present findings cannot establish comparative effectiveness.

Third, the follow-up period was limited to 6 months. Although this period permitted assessment of early and intermediate postoperative clinical and neurosensory outcomes, longer follow-up is required to evaluate late complications, particularly retained-root migration and the possible need for secondary surgery.

Fourth, all patients were treated at a single institution, and the anatomical relationship between the mandibular third molar and the inferior alveolar nerve varied among patients.

Finally, the study primarily evaluated postoperative pain, swelling, and neurosensory status. Other potentially relevant outcomes, including patient-reported quality of life, cost-effectiveness, and long-term radiographic changes, were not comprehensively evaluated.

Conclusion

Within the limitations of this small prospective single-arm study, coronectomy was associated with favorable short- and intermediate-term clinical and neurosensory outcomes in patients with impacted mandibular third molars in close proximity to the inferior alveolar nerve. The mean VAS pain score decreased significantly during the first postoperative week, from 5.60 ± 1.09 on Day 1 to 1.05 ± 0.60 on Day 7 ($p < 0.001$). One patient (5.0%) experienced temporary paresthesia, while no permanent neurosensory deficit was reported during the 6-month follow-up period.

No statistically significant differences or associations were detected in the prespecified comparisons of postoperative pain and swelling according to age group or sex. These findings should be interpreted cautiously because of the small sample size, absence of a control group, single-center design, and limited follow-up.

Appropriate patient selection, careful preoperative radiographic assessment, particularly CBCT evaluation in high-risk cases, and adherence to a standardized coronectomy technique remain important considerations in clinical practice. Larger comparative studies with longer follow-up are required to evaluate the long-term clinical and radiographic outcomes of coronectomy, including retained-root migration and the potential need for secondary surgery.

Recommendations

Based on the findings of the present study, the following recommendations are proposed:

1. **Consider coronectomy as a treatment option** for selected impacted mandibular third molars that are in close proximity to the inferior alveolar nerve, particularly when complete extraction may carry a substantial risk of inferior alveolar nerve injury.
2. **Use CBCT imaging in high-risk cases** when panoramic radiographic findings indicate close anatomical proximity between the mandibular third molar roots and the inferior alveolar canal, to facilitate appropriate treatment planning and patient selection.
3. **Apply a standardized coronectomy technique** with careful removal of the crown while preserving the roots and minimizing manipulation of the surrounding bone and inferior alveolar nerve region.
4. **Provide structured postoperative follow-up**, including assessment of pain, facial swelling, and neurosensory function, particularly during the early postoperative period and throughout the planned follow-up period.
5. **Monitor patients for neurosensory disturbances** following coronectomy, with particular attention to the presence, duration, and resolution of paresthesia or other sensory alterations.
6. **Longer-term follow-up should be incorporated in future studies**, particularly to evaluate root migration, late postoperative complications, infection, and the need for secondary surgical intervention, as these outcomes were not comprehensively assessed in the present study.
7. **Future prospective studies should include larger sample sizes and longer follow-up periods** to provide more robust evidence regarding the clinical effectiveness, safety, and long-term outcomes of coronectomy for mandibular third molars in close proximity to the inferior alveolar nerve.

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