

Comparison of Coronectomy and complete extraction for impacted Third Molars in Close Proximity to Inferior Alveolar Nerve

Adnan Haider, Shahid Ali, Shahzad Iqbal Malik, Muhammad Mustafa, Iram Pervaiz, Fatima Imran

ABSTRACT

Objective: To compare the effectiveness and safety of coronectomy versus complete extraction for the removal of impacted mandibular third molars in proximity to the inferior alveolar nerve.

Study Design and Setting: This is a prospective, comparative interventional study that was carried out at the Department of Oral and Maxillofacial Surgery at de'Montmorency College of Dentistry/Punjab Dental Hospital, Lahore. The study occurs within a time frame of six months and begins after the study proposal was approved by the College of Physicians and Surgeons Pakistan (CPSP) and the institutional ethics review board.

Methodology: A total of 160 patients were recruited, with equal allocation into two groups: 80 participants in the coronectomy group and 80 in the complete extraction group. Data collection was done using a structured proforma, and statistical analysis was conducted using SPSS version 27. Independent sample t-tests were applied for comparing mean pain durations, while chi-square tests were used for assessing group differences in paresthesia and swelling. A p-value of = 0.05 was considered statistically significant throughout.

Results: Coronectomy is associated with significantly better postoperative outcomes compared to complete extraction. While both groups were comparable in terms of age, gender, and tooth laterality, the coronectomy group experienced a significantly shorter duration of pain ($p = 0.004$) and markedly lower incidences of paresthesia ($p = 0.0001$) and swelling ($p = 0.0001$).

Conclusion: Coronectomy is associated with fewer postoperative complications, particularly swelling and paresthesia, making it a safer alternative to total extraction in cases where the impacted third molar is close to the inferior alveolar nerve.

Keyword: Alveolar Nerve, Coronectomy, Mandible, Oral Surgical Procedure, Tooth Extraction, Third Molar, Paresthesia

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INTRODUCTION

The third molars, commonly known as wisdom teeth, are arguably the most commonly impacted teeth in the human dentition. The reasons for the impaction of third molars vary, but generally, the impaction is due to limited space in the posterior mandible, an aberration in the eruption path, or anatomic barriers. While some impacted third molars remain asymptomatic for a long period of time, many impactions can develop into clinical issues eventually. These clinical issues can include pain and pericoronitis, or loss of root structure of tooth number 31 or 32 due to resorption of root structure, caries because of food impaction or a combination of the above. For the aforementioned reasons, surgical intervention of third molars in the form of tooth extraction is recommended.

There is a considerable risk of nerve damage when impacted mandibular third molars are extracted routinely, especially if the molar is near the inferior alveolar nerve (IAN). An essential part that travels through the mandibular canal is the IAN, and the IAN's close proximity to the third molar roots increases the risk of trauma during surgical extraction. Paresthesia is a transient or permanent loss of sensation

associated with the lower lip and chin that can be caused by damage to the IAN. Reported rates of IAN injury after third molar extraction vary significantly based on the research methods, ranging from 0.4% to 8.1% in terms of temporary paresthesia, and 0.014% to 3.6% in terms of permanent deficit.

The roles of radiographic assessments with orthopantomogram (OPG) and cone-beam computed tomography (CBCT) are extremely important in assessing the three-dimensional location of third molar roots about the mandibular canal. If this proximity poses a risk (for example, root apex within 1 mm or overlapping the canal), the surgeon must consider a different surgical plan to avoid damage to the nerve.

A coronectomy consists of removing the crown of the impacted third molar while the roots remain undisturbed within the bone. The risk of inferior alveolar nerve trauma is significantly reduced by using coronectomy, and it still allows for the tooth's clinical symptoms or any potential complications to be treated. Coronectomy was first reported in the 1980s, and while the surgical technique is considered uncommon, it emerged as growing evidence confirms a favorable outcome, with significantly lower rates of paresthesia, pain, and swelling compared to complete extraction.

In high-risk circumstances, coronectomy is a safe substitute for total extraction, according to several international studies. Research studies by Hamad et al. (2024) and Kostares et al. (2024) documented a statistically significantly lower incidence of IAN injury following coronectomy. Based on the international body of evidence, it is clear that coronectomy as a surgical technique, whether undertaken as a day case or inpatient, is effective as well as safe.¹²

Unfortunately, the evidence from the Pakistani population remains low. In Pakistan, third molar extraction is a public and private sector enterprise in which the risk of nerve damage must be mitigated through appropriate planning before intervention in patients who are at a greater risk due to proximity to the inferior alveolar nerve (IAN). There is a pressing need to assess coronectomy as an appropriate and evidence-based option within our clinical framework. When we consider patients who have a high-risk anatomical relationship to the IAN, we could therefore adopt a policy of coronectomy versus complete extraction. Whether we can develop appropriate clinical guidelines for practitioners to deliver patient care in a safer surgical capacity or mitigate postoperative complications is another consideration. This study aimed to compare the effectiveness and safety of coronectomy versus complete extraction for the removal of impacted mandibular third molars in proximity to the inferior alveolar nerve.

METHODOLOGY

This is a prospective, comparative interventional study that

was carried out at the Department of Oral and Maxillofacial Surgery at de'Montmorency College of Dentistry/Punjab Dental Hospital, Lahore. The study occurs within a time frame of six months and begins after the study proposal was approved by the College of Physicians and Surgeons Pakistan (CPSP) and the institutional ethics review board and the ERC number is 2222.

One hundred sixty patients were randomly recruited and divided equally into two groups, with 80 participants in the coronectomy group and 80 in the whole extraction group. The sample size has been determined at a 95% confidence level, with 80% statistical power, and a previously recorded prevalence rate of colectomy at 35.9%. The selection of patients was made on a non-probability purposive basis, with 13.

Inclusion criteria were adults aged 22–40 years of either gender with impacted mandibular third molars that were either partially or completely unerupted and located in close proximity to the inferior alveolar nerve (IAN).¹³ Proximity was defined radiographically as being less than 1 mm between the root apex and the inferior dental canal on a 100% scale orthopantomogram (OPG). Eligible patients were required to be systemically healthy and unmedicated with antibiotics or NSAIDs in the 2 weeks before surgery. Patients with active infection in their third molars, a systemic medical condition (e.g., diabetes, hypertension, cardiovascular or renal disease) or who were pregnant were not included in the study.

The patients were also excluded in case the affected third molars were destructively pathological, such as root caries, periapical lesions, cystic or neoplastic masses or in circumstances where the retained roots were movable or weak.¹⁴ Additional exclusion criteria included acute infections, diseased conditions in which medicine interfered with surgical procedures (e.g., poorly controlled diabetes, coagulation disorders), and pregnancy or breastfeeding, as well as the unwillingness or incapacity to visit the scheduled follow-up sets of appointments.

All participants had a signed informed consent form and underwent a complete clinical and radiological examination, including OPG and CBCT, to cross-check the diagnosis and anatomical relationship with the IAN. Age, gender, medical, and medication history data were also recorded. The participants were subsequently randomly allocated into the coronectomy or complete extraction group by lottery.

To prevent possible harm to nearby neurovascular structures, the coronectomy group underwent a standardized surgical procedure in which the roots of the mandibular third molar were left in situ and only the crown section was removed. Patients in the complete extraction group, on the other hand, had the entire tooth, including the crown and roots, removed. Under aseptic conditions, skilled oral and maxillofacial surgeons carried out every surgical procedure. (See Figure

1)

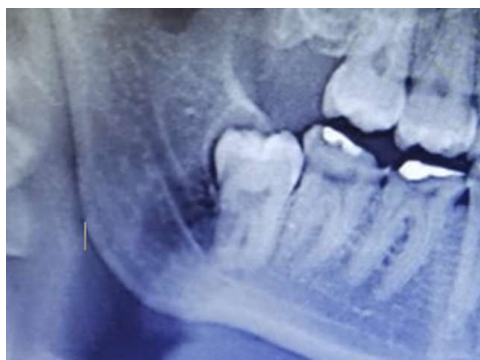
Mean duration of Pain, paresthesia, and swelling/edema were among the postoperative outcomes evaluated. The Visual Analogue Scale (VAS), which goes from 0 (no pain) to 10 (worst conceivable agony), was used to quantify the intensity of the discomfort. Pain duration was recorded in days until the VAS score remained below 1 for more than 24 hours. Paresthesia was evaluated one week after surgery and defined as a burning, tingling, or numb sensation in the IAN distribution area; it was recorded as either present (1) or absent (0). Swelling was assessed by comparing facial measurements taken before surgery and on the 3rd and 7th postoperative days. A difference of 5 mm or more between preoperative and postoperative measurements was considered positive for swelling. Swelling was recorded as present if detected on either follow-up day.

Data collection was done using a structured proforma, and statistical analysis was conducted using SPSS version 27. Continuous variables such as age and pain duration were summarized as means and standard deviations, while categorical variables like paresthesia and swelling were presented as frequencies and percentages. Independent sample t-tests were applied for comparing mean pain durations, while chi-square tests were used for assessing group differences in paresthesia and swelling. Confounding variables such as age, gender, and side of impaction were addressed through stratification and appropriate post-stratification statistical analysis. A p-value of = 0.05 was considered statistically significant throughout.

RESULTS

The study included 160 patients in total, who were split equally into two groups: the full extraction group (n = 80) and the coronectomy group (n = 80). Participants in the total

Figure 1: A–E: Sequential steps of coronectomy in a patient with an impacted mandibular third molar in close proximity to the inferior alveolar nerve (IAN). A: Preoperative radiograph showing mandibular third molar in close proximity to the IAN. B: Flap raised with surgical exposure of the tooth. C: Bone removal around the crown to create space for sectioning. D: Completion of coronectomy with crown removal, leaving roots in situ. E: One-month postoperative radiograph showing retained roots without symptoms of IAN injury.



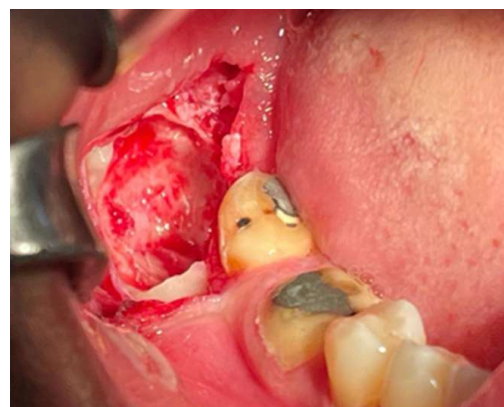
B-Flap raised and exposure done



C-Space around crown made by bone removal



D-coronectomy done



E-1 Month follow up radiograph with no symptoms of IAN injury.



extraction group were 35.9 ± 5.8 years old on average, whereas those in the coronectomy group were 36.2 ± 6.3 years old. The two groups' mean ages did not differ statistically significantly ($p = 0.4658$), suggesting that they were age-matched. (Table 1)

In terms of gender distribution, the coronectomy group's participants were 46.3% ($n = 37$) female and 53.7% ($n = 43$) male. Men made up 48.7% ($n = 39$) and women made up 51.2% ($n = 41$) of the entire extraction group. (Figure 2) There was no discernible difference in the gender distribution between the groups ($p = 0.526$), indicating equal distribution by sex. In a similar vein, the tooth undergoing treatment had almost equal laterality. Of the surgeries performed in the coronectomy group, 47.5% ($n = 38$) were on the left side and 52.5% ($n = 42$) on the right. There was no discernible difference in laterality between the whole extraction group's 55% ($n = 44$) right-sided and 45% ($n = 36$) left-sided individuals ($p = 0.751$). (Table 1)

Pain duration was assessed using the Visual Analog Scale (VAS). The mean duration of postoperative pain in the coronectomy group was 2.62 ± 1.96 days, whereas in the complete extraction group, it was 3.42 ± 1.56 days. The difference in pain duration between the two groups was statistically significant ($p = 0.004$), with the coronectomy group experiencing a shorter duration of pain. (Table 2)

Comparing complications, the coronectomy group showed a noticeably decreased incidence of paresthesia. Compared to 32 patients (40.0%) in the group that underwent a full extraction, only 7 patients (8.8%) in the coronectomy group suffered paresthesia ($p = 0.0001$). Similarly, just two patients (2.5%) in the coronectomy group complained of edema, but 27 patients (33.7%) in the group that underwent a full extraction did. Additionally, there was a statistically significant difference ($p = 0.0001$). These results imply that, in comparison to total extraction, coronectomy is linked to a decreased occurrence of postoperative sequelae such as paresthesia and edema. (Table 3)

DISCUSSION

In order to compare the results of coronectomy and full extraction of impacted mandibular third molars that are strongly associated with the inferior alveolar nerve (IAN),

Table 1: Demographic Distribution of Study Participants ($n = 160$)

Variable	Coronectomy Group (n = 80)	Complete Extraction Group (n = 80)	p-value
Age (Mean ± SD)	36.2 ± 6.3 years	35.9 ± 5.8 years	0.4658 ¹
Gender			
Male	43 (53.7%)	39 (48.7%)	0.526 ²
Female	37 (46.3%)	41 (51.2%)	
Laterality of Tooth			
Right side	42 (52.5%)	44 (55.0%)	0.751 ²
Left side	38 (47.5%)	36 (45.0%)	

Figure 2: A Clustered Column Chart showing the Gender Distribution among Both Groups

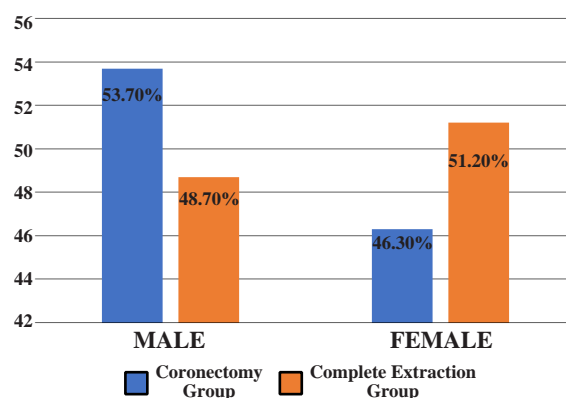


Table 2: Comparison of Postoperative Pain Duration (VAS Score) Between Groups

Group	Mean Duration of Pain (Days)	Standard Deviation	p-value ¹
Coronectomy	2.62	± 1.96	0.004
Complete Extraction	3.42	± 1.56	

¹ Independent samples t-test, $P=0.05$ is considered significant.

Table 3: Incidence of Paresthesia and Swelling Between Groups

Outcome	Coronectomy Group (n = 80)	Complete Extraction Group (n = 80)	p-value
Paresthesia			
Present	7 (8.8%)	32 (40.0%)	0.0001
Absent	73 (91.2%)	48 (60.0%)	
Swelling			
Present	2 (2.5%)	27 (33.7%)	0.0001
Absent	78 (97.5%)	53 (66.3%)	

this study was conducted.¹⁵ The findings showed that, in comparison to total surgical extraction, coronectomy had a much lower incidence of paresthesia, edema, and postoperative discomfort duration.

The results of our study indicated that the average pain duration was significantly shorter in the coronectomy group (2.62 ± 1.96 days) compared to the complete extraction group (3.42 ± 1.56 days, $p = 0.004$). Our findings are consistent with those of Abu-Mostafa et al. (2021), who concluded that in the coronectomy group, participants indicated they had lower levels of postoperative pain and subsequently required fewer analgesics in the first week of the postoperative period than those in the full extraction group.¹⁶ Likewise, a study by Baudin et al. (2021) supported these findings, illustrating a quick resolution in pain symptoms for the coronectomy group, presumably due to the preserved root structure and avoiding trauma to the nerve.¹⁷

One of the most serious complications following third molar surgery is damage to the inferior alveolar nerve, resulting in paresthesia. The current study found a much lower

incidence of paresthesia in the coronectomy group (8.8%) compared to the complete faction group (40%; $p = 0.0001$). These results reinforce previous findings from Le et al. (2024), who reported that coronectomy significantly reduces the risk of IAN injury when third molar roots are in close anatomical contact with the nerve.¹⁸ Hamad et al. also observed a 0.5% incidence of permanent IAN injury in the coronectomy group, compared to a 5.0% rate in the full extraction group. Our results provide further evidence supporting the nerve-sparing advantage of coronectomy, particularly in cases where radiographic assessments (OPG and CBCT) confirm root proximity to the IAN.

Postoperative swelling was another variable assessed, and our results again favored coronectomy, with only 2.5% of patients experiencing swelling compared to 33.7% in the extraction group ($p = 0.0001$). This could be attributed to less extensive manipulation of hard and soft tissues during coronectomy. These findings are consistent with the study by Lokes et al. (2024), who reported significantly less swelling and facial edema in patients treated with coronectomy versus complete extraction.¹⁹ By leaving the root intact, coronectomy minimizes trauma to surrounding bone and tissues, thereby reducing the inflammatory response.

The overall safety profile of coronectomy, as observed in our study, is consistent with the conclusions of systematic reviews and meta-analyses. A study by Póvoa et al. (2021) analyzed multiple randomized controlled trials and concluded that coronectomy significantly reduces the incidence of inferior alveolar nerve injury without increasing postoperative complications.²⁰ Importantly, none of the patients in our coronectomy group required re-operation due to infection or root migration during the study's follow-up period, supporting the long-term stability of the procedure in selected cases.

While some concerns have been raised in the literature regarding root migration or late infection after coronectomy,²¹ our study did not encounter these issues within the observed timeframe, possibly due to stringent inclusion criteria (i.e., healthy roots without pre-existing infection) and proper surgical technique. To the best of our knowledge, no previous study from Pakistan has directly compared coronectomy and complete extraction in terms of pain duration, paresthesia, and swelling in mandibular third molars closely associated with the IAN. Therefore, our findings contribute important local data to the global evidence supporting the use of coronectomy as a safer alternative to complete extraction in high-risk cases.

The findings of this study suggest that coronectomy can serve as a safer alternative to complete extraction in patients with impacted mandibular third molars, particularly those at high risk for inferior alveolar nerve damage. With

significantly reduced rates of postoperative paresthesia and swelling, coronectomy offers a viable approach that balances surgical success with patient comfort and neurological safety. These results support the inclusion of coronectomy in routine clinical practice where nerve preservation is a priority.

CONCLUSION

Compared to total extraction, coronectomy is linked to fewer postoperative sequelae, especially with regard to swelling and paresthesia. While both methods can be used to treat impacted third molars, coronectomy is a safer option when there is a greater chance of nerve damage due to the tooth's proximity to the inferior alveolar nerve. Additional long-term, multicenter research is necessary to confirm these results and assess the long-term safety and effectiveness of coronectomy.

Authors Contribution:

Adnan Haider: Manuscript Writing Data Collection & Interpretation study design

Shahid Ali: Study Design, Proofread

Shahzad Iqbal Malik: Data Collection, Study Design

Muhammad Mustafa: Data Collection & interpretation

Iram Pervaiz: Data Collection & interpretation

Fatima Imran: Data Collection

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