

Preventing Inferior Alveolar Nerve Injury Through Coronectomy: A Narrative Review

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Abstract

Coronectomy represents a conservative surgical alternative to complete extraction of impacted mandibular third molars when their close anatomical relationship with the inferior alveolar nerve (IAN) increases the risk of neurosensory injury. Although systematic reviews and meta-analyses support its effectiveness in reducing nerve-related complications, uncertainties remain regarding retained root migration, delayed complications, and long-term clinical outcomes. A narrative review of the literature was conducted using PubMed/MEDLINE, including publications available through September 2026. Twelve relevant studies were selected to examine the indications, neurological outcomes, postoperative complications, root migration, and long-term implications of coronectomy. Available evidence indicates that coronectomy is associated with a lower risk of inferior alveolar nerve injury than complete extraction in appropriately selected high-risk patients. However, retained roots may undergo postoperative migration, delayed exposure, or other complications occasionally requiring secondary surgical intervention. Long-term observational evidence remains limited, particularly regarding the predictability of retained root behavior. Overall, the available evidence supports coronectomy as a clinically relevant nerve-preserving alternative to complete extraction of high-risk impacted mandibular third molars. Careful patient selection, preoperative radiographic assessment, and individualized postoperative monitoring remain essential. Further prospective studies with extended follow-up are needed to clarify long-term outcomes and the risk of delayed complications.

Categories: Medical Education, Dentistry

Keywords: coronectomy, inferior alveolar nerve injury, mandibular third molars, narrative review, root migration

Introduction And Background

Surgical removal of impacted mandibular third molars is a common procedure in oral and maxillofacial surgery. However, when the roots are in close anatomical proximity to the mandibular canal, complete extraction may be associated with an increased risk of inferior alveolar nerve injury (IANI), potentially resulting in transient or permanent neurosensory disturbances involving the lower lip and chin. Preoperative radiographic assessment therefore plays an essential role in identifying unfavorable anatomical relationships, evaluating surgical risk, and selecting the most appropriate treatment strategy [1].

Coronectomy, also referred to as intentional partial odontectomy, represents a conservative surgical alternative to complete extraction in selected patients at increased risk of IANI. The procedure involves removal of the coronal portion of the impacted tooth while deliberately retaining the roots within the alveolar bone, thereby minimizing surgical manipulation of root structures closely associated with the inferior alveolar nerve. Early clinical investigations demonstrated that coronectomy could reduce postoperative neurosensory complications compared with conventional extraction in appropriately selected high-risk patients [2].

The clinical effectiveness and postoperative outcomes of coronectomy have subsequently been investigated through comparative clinical studies and systematic reviews. Martin et al., in a systematic review, reported relatively low incidences of inferior alveolar and lingual nerve injuries following coronectomy, although considerable variability was observed in postoperative complications and retained root migration. The authors also emphasized the limited availability of extended follow-up data and the need for further investigations to clarify the long-term clinical consequences of intentional root retention [3].

Recent systematic reviews and meta-analyses have provided further evidence supporting coronectomy as a nerve-preserving alternative to complete extraction in appropriately selected high-risk patients. However, the potential neurological benefits must be balanced against postoperative complications, including retained root exposure and the occasional need for secondary surgical intervention [4,5].

The biological behavior of retained roots represents an additional consideration in postoperative management. Clinical investigations have documented root migration, particularly during the early healing period, while longer-term observational studies suggest that retained roots may remain clinically

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manageable over extended follow-up. Nevertheless, the possibility of delayed complications highlights the importance of individualized postoperative surveillance [6,7].

Despite growing evidence supporting the neurological benefits of coronectomy, uncertainties remain about the long-term predictability of retained root behavior, the incidence of delayed complications, and the potential need for subsequent surgery. Abu-Mostafa et al., in their systematic review, highlighted the limitations of the available long-term evidence and the importance of further investigations addressing postoperative outcomes beyond the early healing period. Consequently, prolonged clinical observation remains relevant for understanding the biological and clinical implications of intentional root retention [8].

In this context, the present narrative review aims to provide a clinically oriented synthesis of the available scientific evidence regarding coronectomy as an alternative to complete extraction of impacted mandibular third molars in patients at increased risk of inferior alveolar nerve injury. Particular attention is directed toward preoperative anatomical risk assessment, postoperative neurosensory outcomes, the biological behavior and migration of retained roots, delayed complications, and the potential need for secondary surgical intervention. By examining findings from clinical investigations, systematic reviews, and meta-analyses, this article seeks to critically discuss the benefits, limitations, and long-term implications of coronectomy, with particular emphasis on patient selection and postoperative management.

Unlike systematic reviews that are primarily focused on pooled comparative outcomes, this narrative review integrates the available evidence into a clinically oriented discussion of preoperative decision-making, retained root behavior, delayed complications, and long-term patient management.

Review

Search strategy

A targeted literature search was conducted in PubMed/MEDLINE to identify publications addressing coronectomy of impacted mandibular third molars, prevention of inferior alveolar nerve (IAN) injury, postoperative complications, retained root migration, and long-term clinical outcomes. The search covered publications available up to September 2026, without restrictions on publication date.

The following search strategy was employed: ("coronectomy" OR "intentional partial odontectomy") AND ("mandibular third molars" OR "impacted third molars") AND ("inferior alveolar nerve injury" OR "nerve preservation" OR "root migration" OR "long-term follow-up" OR "postoperative complications").

The search yielded 49 records. Following an assessment of their relevance to the objectives of this narrative review, 12 publications were selected for inclusion, comprising systematic reviews, meta-analyses, comparative clinical studies, and observational investigations.

Publications were considered relevant when they directly addressed coronectomy of mandibular third molars and provided evidence concerning surgical indications, preoperative risk assessment, neurosensory outcomes, retained root migration, postoperative complications, secondary surgical interventions, or long-term follow-up. Publications outside the clinical scope of the review or without relevant information on these outcomes were not prioritized for inclusion.

The selected evidence was synthesized descriptively and organized into clinically relevant themes. Particular attention was given to differences in study design, patient selection, reported outcomes, and follow-up duration. Findings from individual studies and published meta-analyses were interpreted in their respective methodological contexts, without combining their results into new pooled estimates.

All five authors participated in the assessment and selection of the publications based on their clinical relevance to the objectives of the review. The 12 selected publications were subsequently organized and discussed through a descriptive narrative synthesis.

Given the narrative nature of this review, no formal systematic screening protocol, risk-of-bias assessment, or quantitative meta-analysis was undertaken. The use of a single bibliographic database and a targeted selection approach may have resulted in the omission of relevant publications and introduced potential selection bias. Furthermore, heterogeneity in study designs, surgical indications, radiographic assessment methods, and follow-up durations limits direct comparisons between the included studies.

The narrative approach was adopted to provide a clinically oriented synthesis and critical interpretation of the available evidence, integrating surgical considerations, neurological outcomes, postoperative root behavior, and long-term complications associated with coronectomy.

Indications for coronectomy and preoperative risk assessment

The decision to perform coronectomy rather than complete surgical extraction of an impacted mandibular

third molar is primarily influenced by the anatomical relationship between the dental roots and the inferior alveolar canal. When the roots are closely associated with the canal, complete extraction may expose the inferior alveolar nerve (IAN) to mechanical compression, traction, or direct surgical trauma during root mobilization and removal. This concern is particularly relevant in deeply impacted mandibular third molars, where the proximity of the roots to the neurovascular bundle may complicate surgical access and increase the potential for neurosensory disturbances. Coronectomy offers a conservative alternative by removing the coronal portion of the tooth while intentionally retaining the roots, thereby limiting surgical manipulation in the region of the inferior alveolar canal.

The rationale for selecting coronectomy is therefore based on an individualized assessment of the anticipated neurological risk associated with complete extraction. The presence of a close anatomical relationship does not necessarily imply that nerve injury will occur, but it may justify consideration of a less invasive surgical approach when root removal is expected to require substantial manipulation near the mandibular canal. Hatano et al., in a case-control study using dental computed tomography for preoperative assessment, demonstrated a lower incidence of postoperative inferior alveolar nerve injury following coronectomy compared with complete extraction in patients selected on the basis of high-risk anatomical findings. Their observations support the clinical relevance of coronectomy as a nerve-preserving procedure in appropriately selected patients [2].

Preoperative radiographic assessment plays a central role in identifying patients who may benefit from this approach. Panoramic radiography is commonly used as an initial examination because it provides an overview of tooth position, root morphology, impaction depth, and the apparent relationship between the third molar and the mandibular canal. Several radiographic features may raise suspicion of close anatomical proximity, including interruption of the radiopaque cortical boundaries of the canal, diversion or narrowing of the canal, and changes in the radiographic appearance of the roots where they overlap the canal. These findings may alert the clinician to a potentially unfavorable surgical relationship and indicate the need for more detailed anatomical evaluation.

However, radiographic proximity should not be interpreted as a direct or definitive predictor of postoperative neurological injury. Panoramic imaging provides a two-dimensional representation of three-dimensional anatomical structures, and superimposition may create uncertainty regarding the actual spatial relationship between the roots and the neurovascular canal. Moreover, the development of neurosensory complications depends on several factors beyond anatomical proximity, including the complexity of the surgical procedure and the extent of manipulation required for root removal. In a prospective cohort study involving 124 impacted mandibular third molar surgeries, Pérez-González et al. found that preoperative radiographic characteristics were not significantly associated with the overall incidence of neurosensory alterations. Nevertheless, interruption of the canal's radiopaque boundary and canal diversion were identified as potentially relevant warning signs. These findings emphasize the importance of interpreting radiographic features within the broader clinical and surgical context rather than relying on an isolated imaging sign to predict neurological injury [1].

Cone-beam computed tomography (CBCT) may provide additional anatomical information when conventional radiography suggests a close relationship between the impacted roots and the inferior alveolar canal and further clarification is considered necessary for surgical planning. Unlike panoramic radiography, CBCT enables multiplanar evaluation of the anatomical relationship between the roots and the mandibular canal, including their relative buccolingual position and the presence or absence of a visible cortical boundary separating the two structures. This three-dimensional assessment may be particularly useful in cases where the canal appears to overlap the roots on conventional imaging or where the anticipated direction of root mobilization could increase the risk of contact with the neurovascular bundle [2].

The identification of an interrupted cortical boundary between the roots and the inferior alveolar canal may strengthen concern regarding intimate anatomical proximity, although it does not establish that nerve injury will occur during extraction. Similarly, preservation of the cortical boundary does not necessarily eliminate surgical risk when the overall anatomical configuration is unfavorable. Consequently, CBCT findings should be interpreted as part of an integrated preoperative assessment rather than as an independent indication for coronectomy. The decision should also consider the position and condition of the impacted tooth, the expected difficulty of complete extraction, and whether intentional root retention is clinically appropriate.

Clinical evidence further supports the use of coronectomy in selected patients with high-risk anatomical relationships. Le et al., in a clinical study involving 37 patients undergoing coronectomy, reported no postoperative paresthesia and documented progressive migration of the retained roots during the first nine months of observation. These findings suggest that preservation of the roots may permit treatment of the impacted tooth while avoiding the immediate neurological risks associated with complete root mobilization. Furthermore, postoperative root migration may progressively alter the relationship between the retained roots and the inferior alveolar canal, although the extent and clinical significance of this phenomenon vary between patients [9].

Overall, the indication for coronectomy should emerge from a balanced assessment of the neurological risks

associated with complete extraction and the potential consequences of retaining the root structures. The objective is not to eliminate all surgical risks but to reduce unnecessary manipulation in an anatomically sensitive region when a conservative approach is considered appropriate. Careful patient selection, interpretation of preoperative imaging, and consideration of the anticipated surgical difficulty are therefore fundamental to determining whether coronectomy represents a suitable alternative to complete extraction.

Prevention of inferior alveolar nerve injury

The principal objective of coronectomy is to reduce the likelihood of inferior alveolar nerve (IAN) injury while addressing the clinical indication for surgical treatment of an impacted mandibular third molar. Neurological complications associated with mandibular third molar extraction represent an important concern, particularly when the roots are closely related to the inferior alveolar canal. Injury to the IAN may result in altered sensation involving the lower lip, chin, and associated cutaneous or mucosal territories, with clinical manifestations ranging from transient hypoesthesia or paresthesia to persistent sensory impairment. Although many postoperative neurosensory disturbances resolve spontaneously, prolonged or permanent alterations may substantially affect patient comfort and quality of life.

The nerve-preserving rationale of coronectomy is based on limiting surgical manipulation in the region where the roots are intimately associated with the inferior alveolar neurovascular bundle. During conventional extraction, luxation and removal of the roots may generate mechanical forces capable of compressing, stretching, or directly traumatizing the nerve, particularly when the anatomical separation between the root surfaces and the mandibular canal is minimal. By removing the coronal portion of the tooth while intentionally retaining the root complex, coronectomy reduces the need for root mobilization and may therefore decrease the risk of direct neurological trauma. The procedure does not eliminate all potential sources of nerve injury, but it modifies the surgical approach to avoid one of the most anatomically sensitive stages of complete extraction.

Clinical evidence supports this biological and surgical rationale. In a prospective comparative investigation involving 110 deeply impacted mandibular third molars, Kang et al. reported postoperative inferior alveolar nerve injury in six patients treated by conventional extraction, whereas no cases were observed in the coronectomy group. These findings suggest that intentional root retention may provide a meaningful neurological advantage when the anatomical relationship between the third molar roots and the inferior alveolar canal is considered unfavorable. However, the interpretation of such results should take into account the clinical characteristics of the selected patients, the surgical techniques employed, and the methods used to assess postoperative neurosensory function [6].

The neurological benefits of coronectomy have also been examined through systematic reviews and meta-analyses comparing intentional root retention with complete surgical extraction. These investigations are particularly relevant because individual clinical studies may include relatively small numbers of neurological events, making it difficult to estimate the magnitude of the protective effect with precision. By combining findings from multiple investigations, meta-analyses provide a broader assessment of the association between surgical technique and postoperative nerve injury, although their conclusions remain dependent on the quality and comparability of the included studies.

Peixoto et al., in a systematic review and meta-analysis, reported a significantly reduced risk of inferior alveolar nerve injury following coronectomy compared with complete extraction, with an odds ratio (OR) of 0.14 (95% confidence interval (CI): 0.06-0.30). This result indicates substantially lower odds of neurological injury in the coronectomy group within the populations evaluated. Similarly, Kang et al. reported a relative risk (RR) of 0.1 (95% CI: 0.0-0.2), further supporting a marked reduction in postoperative IAN injury associated with coronectomy. Although ORs and RRs are different statistical measures and should not be interpreted as interchangeable, both analyses demonstrate a consistent direction of effect favoring the nerve-preserving surgical approach [4,5].

Despite the consistency of these findings, several methodological considerations are important when interpreting the available evidence. Studies investigating coronectomy differ in their inclusion criteria, definitions of high-risk anatomical relationships, surgical protocols, and postoperative follow-up schedules. Furthermore, the assessment of neurological outcomes may vary between investigations, particularly regarding the use of patient-reported symptoms, clinical sensory examinations, and the duration of follow-up required to distinguish transient from persistent disturbances. Differences in study design and patient selection may also introduce bias, limiting the extent to which pooled results can be generalized to all impacted mandibular third molars. Accordingly, the evidence should be interpreted as supporting coronectomy primarily in appropriately selected patients at increased neurological risk, rather than establishing its superiority as a routine procedure for all third molar extractions.

An additional consideration is the distinction between temporary and permanent inferior alveolar nerve injury. Transient neurosensory disturbances may resolve during postoperative recovery, whereas persistent deficits represent a more consequential outcome for patients. In their systematic review, Abu-Mostafa et al. reported transient IAN injury rates ranging from 0% to 2.20% following successful coronectomy, while no permanent IAN injury was reported in the included coronectomy studies. These findings support a favorable

neurological safety profile, particularly with respect to persistent sensory disturbances. Nevertheless, the absence of reported permanent injuries within the available studies should not be interpreted as proof that the procedure carries no risk of irreversible neurological damage. The relatively low frequency of such events and variations in follow-up duration may limit the ability of individual investigations to identify uncommon complications [8].

From a clinical perspective, prevention of inferior alveolar nerve injury requires more than the selection of a particular surgical technique. Appropriate preoperative identification of anatomical risk, careful execution of the coronectomy procedure, and postoperative assessment of neurosensory function remain essential components of patient management. The decision to retain the roots should be based on a favorable balance between the anticipated neurological benefit and the potential consequences of leaving root structures within the alveolar bone. In this context, coronectomy should be regarded as a risk-reduction strategy rather than a procedure capable of guaranteeing complete neurological safety.

Overall, the available comparative evidence and pooled analyses support coronectomy as a clinically relevant approach for reducing inferior alveolar nerve injury in selected high-risk mandibular third molars. Its principal advantage lies in minimizing manipulation of roots situated close to the mandibular canal, thereby addressing an important mechanism of surgical nerve trauma. However, the neurological benefit must be considered alongside other potential postoperative outcomes, including retained root migration, delayed exposure, and the possibility of secondary intervention, which are addressed in the following sections.

Root migration and biological behavior of retained roots

Root migration represents one of the most characteristic postoperative findings following coronectomy and constitutes an important aspect of the biological behavior of intentionally retained root structures. Unlike complete surgical extraction, coronectomy preserves the radicular portion of the impacted mandibular third molar within the alveolar bone, allowing the retained roots to undergo subsequent positional changes during postoperative healing. These changes are generally observed radiographically and may occur without associated symptoms or clinically evident complications. Consequently, the identification of root migration should not automatically be interpreted as treatment failure, but rather as a postoperative phenomenon whose clinical significance depends on the direction, extent, and consequences of the displacement.

The biological mechanisms underlying retained root migration are not fully established. However, preservation of the periodontal ligament and surrounding supporting tissues may permit continued movement of the root complex within the alveolar bone following removal of the coronal portion of the tooth. This process occurs in parallel with postoperative tissue remodeling and healing of the surgical site. The extent of migration may vary considerably between patients, potentially reflecting differences in root morphology, impaction characteristics, available alveolar bone, and the anatomical relationship between the retained roots and adjacent structures. Importantly, migration may occur without pathological changes in the retained roots or surrounding tissues, although the absence of clinical symptoms does not necessarily exclude radiographic alterations.

From a surgical perspective, migration may have potentially favorable implications when the retained roots progressively move away from the inferior alveolar canal. In such circumstances, the anatomical relationship that originally justified coronectomy may become less critical over time, potentially reducing the neurological risk associated with secondary root removal if subsequent intervention becomes necessary. Nevertheless, migration is not uniformly predictable, and its direction and magnitude cannot be assumed in an individual patient. In their systematic review, Martin et al. documented considerable variability in the incidence and extent of postoperative root migration across the included studies, with differences in follow-up duration, radiographic evaluation, and patient characteristics contributing to the heterogeneity of the reported findings. These observations highlight the importance of interpreting root migration as a variable biological response rather than an inevitable or uniformly beneficial consequence of coronectomy [3].

The temporal pattern of root migration is particularly relevant for postoperative assessment. Available clinical observations suggest that the greatest degree of displacement generally occurs during the early postoperative period, particularly within the first six months following coronectomy. During this interval, retained roots may progressively change position in relation to the inferior alveolar canal and surrounding alveolar structures. The rate of migration subsequently tends to decrease, with relative positional stabilization commonly observed during the first postoperative year. However, the timing and extent of this process may vary, and stabilization should not be regarded as an absolute or universal outcome.

Kang et al., in a prospective comparative investigation, observed that retained roots migrated predominantly during the first six postoperative months and generally stabilized after approximately one year. At the six-month evaluation, 90.9% of retained roots had migrated away from the mandibular canal. This finding is particularly relevant because it suggests that the postoperative displacement of retained roots may progressively increase their separation from the inferior alveolar neurovascular bundle. Such a change could have clinical implications if secondary root removal is subsequently indicated. Nevertheless, movement away from the canal does not necessarily eliminate neurological risk, and the anatomical relationship should be reassessed before any additional surgical intervention [6].

An important distinction must be made between radiographic root migration and clinically significant root exposure. Migration refers to a change in the position of the retained roots within the alveolar bone, whereas root exposure occurs when part of the retained root structure becomes clinically accessible through the overlying soft tissues. These two outcomes are related but not equivalent. Retained roots may migrate without becoming exposed, and radiographically detectable displacement alone does not necessarily constitute an indication for surgical intervention. Conversely, root exposure may become clinically relevant when associated with persistent symptoms, local inflammation, infection, or other complications requiring treatment.

Long-term follow-up studies are particularly valuable because they allow assessment of whether early postoperative root migration is followed by sustained retention, delayed exposure, or the need for secondary surgery. Tamer et al. evaluated patients at least five years after coronectomy and reported radiographic root migration in approximately two-thirds of cases, with a mean displacement of 3.2 ± 1.3 mm. Although most retained roots did not require further treatment, two patients underwent secondary surgical intervention because of root eruption into the oral cavity. These findings indicate that radiographic migration is considerably more frequent than clinically significant root exposure requiring surgical management. They also emphasize that the long-term success of coronectomy should not be judged solely by the presence or absence of root displacement, but by the overall clinical condition of the retained roots and surrounding tissues [7].

Radiographic assessment is an important component of evaluating retained roots after coronectomy. Serial imaging may provide information regarding changes in root position, the relationship with the inferior alveolar canal, and the condition of the surrounding alveolar bone. However, interpretation requires consideration of the imaging technique employed and the anatomical structures included within the field of view. Two-dimensional radiographs may document changes in root position and bone coverage, but differences in projection and image geometry can complicate quantitative comparisons between examinations. Furthermore, radiographs that do not adequately visualize the entire retained root complex cannot reliably exclude abnormalities involving structures outside the imaged region.

The interpretation of postoperative imaging should therefore be integrated with clinical findings, including the presence or absence of pain, swelling, local inflammation, root exposure, and neurosensory disturbances. In asymptomatic patients, radiographic migration without associated pathological findings may be compatible with an uneventful postoperative course. In contrast, the development of symptoms, progressive exposure, or suspicious radiographic changes may warrant further investigation and consideration of secondary treatment. The frequency and duration of postoperative surveillance should be individualized according to the initial anatomical risk, the observed behavior of the retained roots, and the patient's clinical condition.

Overall, retained root migration should be regarded as a characteristic and potentially favorable postoperative phenomenon following coronectomy, rather than as an inherently adverse outcome. Its clinical significance depends on whether the retained roots remain asymptomatic and adequately covered by the surrounding tissues or subsequently develop exposure or other complications. The available evidence suggests that migration is most pronounced during the early postoperative period, whereas long-term observations are essential for identifying less frequent delayed events. A clear distinction between radiographic displacement, biological stability, and clinically significant complications is therefore fundamental to evaluating the long-term outcomes of coronectomy.

Postoperative complications and secondary surgical intervention

Although coronectomy is primarily intended to reduce the risk of inferior alveolar nerve injury, its overall clinical effectiveness must also be evaluated in relation to postoperative morbidity, local complications, and the potential need for additional surgical treatment. As with conventional extraction of impacted mandibular third molars, coronectomy may be associated with postoperative pain, swelling, infection, and alveolar osteitis. However, intentional retention of the root structures introduces additional considerations, including delayed root exposure, persistent local symptoms, and the possibility of secondary surgical intervention. These outcomes are clinically relevant because the neurological advantages of coronectomy must be balanced against the potential consequences of leaving dental roots within the alveolar bone.

Postoperative complications following coronectomy may be broadly distinguished according to their timing and clinical significance. Early postoperative events primarily concern the immediate surgical wound and surrounding tissues, whereas delayed complications may arise from changes involving the retained roots or their relationship with the overlying soft tissues. Importantly, the occurrence of a postoperative complication does not necessarily indicate failure of the nerve-preserving objective of the procedure. Conversely, the absence of neurological injury does not establish that the postoperative course has been entirely free from morbidity. A comprehensive evaluation of coronectomy therefore requires consideration of both neurological outcomes and other clinically relevant complications.

Evidence from systematic reviews and meta-analyses provides useful information regarding the relative frequency of these events. Kang et al. reported significantly lower risks of lingual nerve injury and alveolar

osteitis following coronectomy compared with conventional extraction, while no statistically significant difference was identified in postoperative infection. The authors also reported surgical reintervention in 3.63% of coronectomy cases, root exposure in 2.66%, and a procedure failure rate of 2.79%. These findings suggest that coronectomy may offer benefits extending beyond inferior alveolar nerve preservation, although the possibility of delayed complications and secondary treatment remains an important limitation. The reported percentages should also be interpreted in relation to differences in surgical protocols, definitions of complications, and follow-up periods across the included studies [5].

The need for secondary surgical intervention represents a distinctive consideration in the long-term management of patients undergoing coronectomy. Retained roots may remain clinically asymptomatic and covered by the surrounding tissues for prolonged periods, whereas other cases may develop exposure, persistent discomfort, or local inflammatory complications requiring reassessment. Nevertheless, radiographic migration or continued retention of root structures should not, by themselves, be considered indications for additional surgery. The decision to intervene should be guided by the patient's symptoms, clinical examination, radiographic findings, and the anticipated risks and benefits of further treatment.

Secondary surgery also raises an important anatomical consideration. When retained roots have migrated away from the inferior alveolar canal, their subsequent removal may involve a different relationship with the neurovascular bundle than that present at the time of the original coronectomy. However, such migration cannot be assumed to occur in every patient, and the neurological risk associated with a second procedure must be reassessed individually. Consequently, the possibility of future root removal should be included in preoperative counseling, without presenting secondary intervention as an inevitable consequence of coronectomy.

Beyond the incidence of complications, postoperative pain and patient-reported morbidity are important outcomes when comparing coronectomy with conventional extraction. Although coronectomy avoids complete root removal, it remains a surgical procedure involving manipulation of the impacted tooth and surrounding tissues. The reduction of neurological risk therefore does not necessarily correspond to a proportional reduction in postoperative discomfort. This distinction is particularly relevant when discussing treatment options with patients, because short-term recovery and long-term neurological outcomes represent different dimensions of surgical effectiveness.

Simons et al., in a prospective crossover study involving 55 patients, investigated clinical postoperative outcomes and oral health-related quality of life following coronectomy and complete surgical removal of impacted mandibular third molars. The authors reported significantly higher postoperative pain scores and greater analgesic consumption during several days of the first postoperative week following coronectomy. These findings indicate that coronectomy may be associated with greater short-term discomfort in certain clinical circumstances, despite its potential neurological advantages. Accordingly, the selection of coronectomy should not be based on an assumption that the procedure is necessarily less painful or associated with a more favorable immediate postoperative recovery than complete extraction [10].

These observations highlight the importance of distinguishing between the primary neurological objective of coronectomy and its broader effects on postoperative quality of life. Pain intensity, analgesic requirements, and temporary limitations in oral function may influence patient satisfaction even when no neurological complications occur. Moreover, differences in surgical difficulty, impaction characteristics, and postoperative assessment methods may contribute to variations in reported morbidity between studies. Patient counseling should therefore address the expected postoperative course and possible complications without implying that a nerve-preserving technique necessarily provides superior outcomes across all measures of recovery.

The presence of dental pathology represents another important consideration in the selection of patients for coronectomy. Traditionally, the procedure has been associated with the intentional retention of roots considered suitable for preservation, raising concerns about the potential consequences of leaving dental tissues affected by caries or associated with local pathological conditions. These concerns are clinically relevant because the objective of reducing neurological risk must not compromise the management of existing disease. The suitability of coronectomy in such circumstances depends on the nature and extent of the pathology, the condition of the roots intended for retention, and the possibility of adequately addressing the clinical indication for treatment without complete root removal.

Recent clinical evidence has contributed to a more nuanced interpretation of these indications. In a prospective cohort study involving 121 mandibular third molars, van Bodegraven et al. investigated coronectomy in teeth affected by dental pathology, including caries and dentigerous cysts. The authors found no statistically significant difference in the overall incidence of postoperative complications between coronectomy and complete removal. These results suggest that the presence of certain pathological conditions may not invariably preclude a coronectomy-based approach in carefully selected patients. Nevertheless, these findings should not be generalized to all forms of dental pathology, particularly when the retained roots themselves may represent a persistent source of infection or other disease. Careful evaluation of the underlying pathological condition remains essential before deciding whether intentional

root retention is appropriate [11].

From a clinical management perspective, postoperative surveillance should be directed toward identifying complications that may require treatment while avoiding unnecessary intervention in asymptomatic patients. Clinical examination remains important for assessing soft tissue healing, local inflammation, pain, and possible exposure of retained roots. Radiographic evaluation may provide complementary information concerning the position of the retained roots and the condition of the surrounding bone. However, the need for repeated imaging should be determined by the clinical circumstances and the diagnostic information required, rather than by an assumption that all retained roots require identical long-term surveillance protocols.

When secondary intervention becomes necessary, treatment planning should consider the original indication for coronectomy, the current position of the retained roots, the condition of the surrounding tissues, and the patient's symptoms. The potential neurological risk associated with additional surgery should remain an important consideration, particularly when the roots continue to exhibit a close relationship with the inferior alveolar canal. In contrast, asymptomatic retained roots without clinically relevant pathological findings may not require surgical removal solely because they remain present after coronectomy.

Overall, the available evidence indicates that coronectomy should be evaluated as a procedure with a favorable neurological risk profile but with its own spectrum of postoperative complications and potential long-term consequences. The possibility of root exposure, postoperative discomfort, infection, and secondary intervention does not negate the value of coronectomy in appropriately selected high-risk patients. Rather, these considerations emphasize the importance of balancing neurological protection against other surgical outcomes, providing realistic preoperative counseling, and adopting an individualized approach to postoperative management. Long-term follow-up remains particularly relevant for determining whether initially asymptomatic retained roots continue to remain clinically acceptable or subsequently develop complications requiring treatment.

Long-term outcomes and clinical implications

The long-term effectiveness of coronectomy should be evaluated not only in terms of the prevention of immediate postoperative neurological injury but also in relation to the subsequent clinical and biological behavior of the retained root structures. Although avoidance of inferior alveolar nerve (IAN) injury represents the principal objective of the procedure, a favorable postoperative outcome also requires the absence of clinically significant local complications, persistent symptoms, and delayed conditions that may necessitate additional surgical treatment. Consequently, the long-term assessment of coronectomy involves several complementary outcomes, including neurosensory function, retained root position, soft tissue coverage, surrounding alveolar bone conditions, and the possible occurrence of secondary interventions.

An important limitation of the available literature concerns the duration of postoperative observation. While numerous investigations have examined immediate and medium-term outcomes, studies extending beyond five years remain comparatively limited. This distinction is clinically relevant because the absence of complications during the initial healing period does not necessarily establish that retained roots will remain asymptomatic indefinitely. Root migration, changes in the relationship between retained roots and surrounding tissues, and delayed root exposure may become apparent over longer observation periods. Furthermore, differences in follow-up schedules and outcome definitions complicate comparisons between studies and limit the ability to establish precise estimates of long-term complication rates.

The systematic review by Abu-Mostafa et al. provides evidence supporting the neurological safety of coronectomy in selected high-risk mandibular third molars, particularly with respect to the low frequency of reported inferior alveolar nerve injury. However, the evaluation of neurological outcomes and the assessment of long-term retained root behavior represent distinct aspects of treatment success. The absence of postoperative paresthesia does not necessarily exclude the possibility of delayed local complications, just as radiographic root migration does not automatically indicate an unfavorable clinical outcome. Long-term assessment should therefore integrate neurological, clinical, and radiographic findings rather than relying on a single measure of procedural success [8].

Among the investigations addressing extended postoperative outcomes, the study conducted by Tamer et al. provides relevant information regarding the long-term clinical and radiographic behavior of retained roots. The authors evaluated 75 coronectomies after a follow-up period of at least five years and reported no persistent lower lip hypoesthesia. Although radiographic migration of the retained roots was frequently observed, secondary surgical intervention was required in only two cases because of root eruption into the oral cavity. These findings suggest that retained roots may remain clinically acceptable over prolonged periods, even when positional changes occur after surgery.

Nevertheless, the results of long-term observational studies require cautious interpretation. In the investigation by Tamer et al., only a subset of the originally invited patients participated in the extended

follow-up assessment, introducing the possibility of selection and attrition bias. Patients who return for long-term examination may differ from those who are lost to follow-up, and the observed frequency of complications may therefore not fully represent the original treated population. Furthermore, the relatively limited number of patients with extended follow-up restricts the precision with which uncommon delayed complications can be estimated. Accordingly, these findings support the long-term feasibility of coronectomy but do not establish that retained roots are universally free from complications or that postoperative surveillance can be disregarded [7].

More recent evidence has further strengthened the comparative assessment of coronectomy as a nerve-preserving surgical technique. Derbishi et al. (2026) conducted a systematic review and meta-analysis including eight studies, comprising three randomized controlled trials and five non-randomized studies, with a total of 1,488 teeth. The pooled analysis demonstrated a significantly lower risk of inferior alveolar nerve injury following coronectomy compared with complete extraction (Peto OR: 0.23; 95% CI: 0.13–0.39; $p < 0.0001$). No statistically significant differences were identified in postoperative infection or alveolar osteitis, while the pooled rate of secondary surgical intervention for retained root removal was 1.2%. These findings provide additional support for the neurological benefits of coronectomy and suggest that secondary root removal is relatively uncommon within the populations and follow-up periods represented in the included studies. However, the pooled reintervention rate should not be interpreted as a definitive estimate of lifetime risk, particularly when the duration of observation differs between studies. Notably, the maximum follow-up periods reported in the included studies did not exceed 36 months, limiting the available evidence regarding the clinical behavior of retained roots over substantially longer periods. Moreover, differences in surgical indications, patient characteristics, definitions of complications, and postoperative assessment protocols may influence the reported outcomes. Although the inclusion of randomized controlled trials strengthens the comparative evidence, methodological heterogeneity and limitations in long-term follow-up continue to restrict conclusions regarding the predictability of retained root behavior over extended periods [12].

From a clinical perspective, these findings reinforce the importance of distinguishing between the immediate objective of nerve preservation and the broader long-term management of intentionally retained roots. Successful coronectomy does not necessarily require the absence of postoperative root migration, provided that the retained structures remain clinically acceptable and do not produce symptoms or pathological changes requiring intervention. Conversely, the development of delayed root exposure, persistent pain, or other clinically significant abnormalities may alter the balance between continued observation and secondary surgical treatment.

Appropriate patient selection remains central to this decision-making process. The anticipated neurological risk associated with complete extraction should be considered alongside the condition of the impacted tooth, the feasibility of retaining the roots, and the potential consequences of subsequent root exposure or other complications. Patients should be informed that coronectomy is intended to reduce, rather than eliminate, the risk of neurological injury and that intentional root retention may occasionally require further evaluation or treatment. Such counseling is particularly important because the long-term behavior of retained roots cannot be predicted with certainty in every individual case.

Postoperative monitoring should likewise be individualized according to the patient's clinical condition and the anatomical characteristics of the retained roots. Clinical evaluation may identify pain, inflammation, soft tissue changes, or root exposure, while radiographic examination may provide complementary information regarding root position and surrounding bone. However, the interpretation of long-term radiographic findings depends on the imaging technique and the anatomical region visualized. In particular, radiographic evidence of bone coverage or root stability should be described within the diagnostic limits of the examination performed. The available evidence does not establish a universally applicable long-term imaging schedule, and follow-up decisions should therefore be guided by clinical findings and the need for additional diagnostic information.

Taken together, the published literature supports coronectomy as a clinically relevant alternative to complete extraction in appropriately selected patients with an increased risk of inferior alveolar nerve injury. The consistency of the neurological findings across comparative investigations and meta-analyses provides a rationale for its use, while the available long-term observations suggest that retained roots may remain clinically acceptable for extended periods. Nevertheless, the limited availability of prolonged follow-up data, heterogeneity of outcome assessment, and potential for delayed complications indicate that the long-term predictability of coronectomy remains an area requiring further investigation.

The characteristics, study designs, follow-up periods, and principal clinical outcomes of the publications considered in this narrative review are summarized in Table 1.

Author (Year)	Study Design	Sample/Follow-up	Main Outcomes
Pérez-González et al. (2024) [1]	Prospective cohort	99 patients, 124 surgeries	Neurosensory alterations in 4.03%; no permanent deficits reported
Hatano et al. (2009) [2]	Case-control	220 patients; approximately 13 months	IANI: 1% after coronectomy vs. 5% after extraction
Martin et al. (2015) [3]	Systematic review	10 studies	IANI: 0–9.5%; variable root migration (2–85.3%)
Peixoto et al. (2024) [4]	Systematic review and meta-analysis	42 studies, 3,095 patients	Lower IANI risk (OR 0.14); higher reintervention risk
Kang et al. (2025) [5]	Systematic review and meta-analysis	34 studies, 7,115 teeth	Lower IANI risk (RR 0.10); reintervention 3.63%
Kang et al. (2019) [6]	Prospective comparative study	110 teeth; up to 36 months	No IANI in coronectomy group; 90.9% root migration away from canal at 6 months
Tamer et al. (2025) [7]	Retrospective long-term follow-up	66 patients, 75 coronectomies; ≥5 years	No persistent lower lip hypoesthesia; mean root migration 3.2 mm
Abu-Mostafa et al. (2021) [8]	Systematic review	Multiple clinical studies	No permanent IANI reported after successful coronectomy; transient IANI 0–2.2%
Le et al. (2024) [9]	Descriptive clinical study	37 patients; 9 months	No paresthesia; mean root migration 3.04 mm at 9 months
Simons et al. (2024) [10]	Prospective cross-over study	55 patients; first postoperative week	Higher postoperative pain and analgesic consumption after coronectomy
van Bodegraven et al. (2025) [11]	Prospective cohort	121 molars	No significant difference in complications between coronectomy and extraction in selected teeth with pathology
Derbishi et al. (2026) [12]	Systematic review and meta-analysis	8 studies, 1,488 teeth	Lower IANI risk (Peto OR 0.23); secondary root removal 1.2%

TABLE 1: Characteristics and Main Outcomes of Studies Included in the Narrative Review

The table includes both original clinical investigations and systematic reviews or meta-analyses. Because some reviews incorporate primary studies that are also reported separately or included in other reviews, the study populations may overlap. Consequently, the reported sample sizes should not be considered independent or summed across publications. Differences in study design, outcome definitions, and follow-up duration should also be considered when interpreting the findings.

IANI, inferior alveolar nerve injury; OR, odds ratio; RR, relative risk.

Limitations

Several limitations should be acknowledged when interpreting the findings of this narrative review. First, the present review was designed as a descriptive and clinically oriented synthesis of selected published studies rather than a systematic review conducted according to a prospectively defined protocol. Consequently, a comprehensive and reproducible literature search across multiple databases, formal study screening, and systematic assessment of all potentially eligible publications were not performed. The possibility of selection bias and omission of relevant evidence therefore cannot be excluded.

Second, the included publications differ substantially in study design, sample size, patient characteristics, surgical indications, radiographic assessment, and duration of postoperative follow-up. The evidence encompasses systematic reviews, meta-analyses, prospective and retrospective observational studies, and comparative clinical investigations. This methodological heterogeneity limits direct comparisons between studies and prevents the formulation of uniform conclusions regarding complication rates and long-term outcomes.

Third, no independent formal risk-of-bias assessment or grading of the certainty of evidence was undertaken specifically for this narrative review. Although several included systematic reviews incorporated methodological quality assessments, their conclusions cannot substitute for a dedicated critical appraisal of

all primary studies considered in the present article. Furthermore, some primary investigations may have been included in more than one systematic review, creating potential overlap in the evidence summarized.

Fourth, the available literature includes relatively few investigations with extended follow-up periods exceeding five years. Differences in follow-up completeness, radiographic measurement techniques, definitions of root migration, and criteria for secondary surgical intervention may affect the interpretation of long-term outcomes. In particular, the absence of reported neurological complications in individual studies should not be interpreted as evidence that the risk of nerve injury is completely eliminated.

Accordingly, the findings of this narrative review should be interpreted as complementary to, rather than a substitute for, evidence derived from well-designed comparative studies and systematic reviews. Further prospective investigations with standardized surgical protocols, consistent outcome definitions, and extended follow-up are warranted to clarify the long-term predictability of coronectomy and identify factors associated with delayed complications.

Conclusions

Coronectomy represents an effective nerve-preserving alternative to complete extraction of impacted mandibular third molars in appropriately selected high-risk patients. Current evidence supports a reduction in inferior alveolar nerve injury, although root migration, delayed complications, and secondary surgical intervention remain relevant considerations. Careful patient selection, preoperative radiographic assessment, and individualized postoperative follow-up are essential. Further long-term prospective studies are needed to clarify the predictability and safety of retained root structures.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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