

MODERN SURGICAL APPROACHES IN THE MANAGEMENT OF IMPACTED THIRD MOLARS AND THEIR COMPLICATIONS

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Received: 2026-04-07 · Accepted: 2026-05-19

Abstract

Impacted third molars, commonly known as wisdom teeth, represent one of the most frequent conditions encountered in oral and maxillofacial surgery. Failure of complete eruption may result from insufficient jaw space, abnormal tooth angulation, developmental disturbances, or anatomical obstructions. Impacted third molars are associated with numerous pathological conditions, including pericoronitis, dental caries, periodontal disease, root resorption of adjacent teeth, odontogenic cysts, and localized infections. Advances in diagnostic imaging, surgical planning, anesthesia, and postoperative management have significantly improved treatment outcomes and reduced complication rates. Contemporary surgical approaches emphasize minimally invasive techniques, preservation of surrounding anatomical structures, reduction of surgical trauma, and acceleration of postoperative recovery. Three-dimensional imaging modalities, particularly cone-beam computed tomography, provide detailed visualization of tooth position and proximity to vital structures such as the inferior alveolar nerve and maxillary sinus. Modern surgical protocols incorporate atraumatic extraction techniques, piezoelectric surgery, microsurgical instruments, and evidence-based postoperative care. Appropriate patient assessment, accurate diagnosis, and individualized treatment planning contribute significantly to successful management and prevention of complications. Current evidence demonstrates that modern surgical interventions improve clinical outcomes, decrease postoperative discomfort, and enhance overall patient satisfaction.

Keywords: Impacted third molars, wisdom teeth, oral surgery, cone-beam computed tomography, minimally invasive surgery, pericoronitis, inferior alveolar nerve, postoperative complications, tooth extraction, oral and maxillofacial surgery

1. Introduction

Impacted third molars are among the most commonly encountered developmental dental anomalies and represent a major component of oral and maxillofacial surgical practice worldwide. Third molars are the last teeth to erupt and frequently fail to achieve a normal functional position within the dental arch due to inadequate space, unfavorable angulation, genetic influences, or developmental abnormalities. The prevalence of impacted third molars varies considerably among populations but remains a significant oral health concern because of the potential for numerous local and systemic

complications. Impacted teeth may remain asymptomatic for prolonged periods; however, many patients eventually develop pathological conditions requiring surgical intervention. Pericoronitis remains one of the most common complications and is characterized by inflammation and infection of the soft tissues surrounding a partially erupted tooth. Recurrent episodes may lead to severe pain, facial swelling, trismus, lymphadenopathy, and systemic infection. Additionally, impacted third molars may contribute to development of dental caries affecting adjacent second molars, periodontal destruction, external root resorption, odontogenic cyst formation, benign tumors, and chronic inflammatory lesions. Accurate diagnosis and risk assessment are essential components of modern management strategies. Conventional panoramic radiography has traditionally been used for evaluation of impacted third molars; however, advances in diagnostic imaging have significantly improved preoperative assessment. Cone-beam computed tomography provides superior three-dimensional visualization of tooth position, root morphology, surrounding bone architecture, and anatomical relationships with adjacent structures. This technology is particularly valuable when evaluating proximity of mandibular third molars to the inferior alveolar nerve and assessing maxillary third molars in relation to the maxillary sinus. Contemporary surgical management emphasizes minimally invasive principles designed to reduce tissue trauma, preserve bone integrity, minimize postoperative complications, and improve healing outcomes. Technological innovations including piezoelectric bone surgery, microsurgical instrumentation, improved flap designs, and enhanced irrigation systems have increased surgical precision and safety. Postoperative management has similarly evolved through incorporation of evidence-based pain control strategies, anti-inflammatory therapy, infection prevention measures, and enhanced recovery protocols. As surgical techniques continue to advance, understanding the clinical significance, anatomical considerations, and management principles of impacted third molars remains essential for optimizing patient outcomes and minimizing morbidity. Impacted third molars continue to represent a significant clinical challenge in contemporary dentistry and oral surgery due to their high prevalence and potential association with numerous pathological processes. These teeth are the final members of the permanent dentition to develop and erupt, typically emerging during late adolescence or early adulthood. Evolutionary changes in jaw dimensions, dietary habits, craniofacial development, and genetic factors have contributed to a growing discrepancy between available arch space and tooth size, resulting in a high incidence of eruption disturbances. Failure of complete eruption frequently leads to impaction within the alveolar bone or soft tissues, creating conditions favorable for infection, inflammation, and structural damage to adjacent anatomical structures. The clinical significance of impacted third molars extends beyond localized discomfort. Chronic inflammatory conditions surrounding partially erupted teeth may contribute to persistent pain, facial swelling, mastication difficulties, halitosis, and recurrent episodes of pericoronitis. Furthermore, impacted teeth have been implicated in periodontal pocket formation distal to second molars, root resorption, carious lesions, odontogenic cysts, and various benign pathological entities. In some cases, severe infections may extend into fascial spaces of the head and neck, creating potentially serious systemic consequences. Accurate diagnosis is therefore essential for identification of high-risk cases and selection of appropriate treatment strategies. Traditional diagnostic methods relied heavily on clinical examination and panoramic radiography. Although these modalities remain valuable, technological advancements have introduced highly sophisticated imaging techniques capable of providing three-dimensional assessment of impacted teeth and surrounding structures. Cone-beam computed tomography has become particularly important for evaluation of complex cases involving close proximity to the inferior alveolar canal, lingual cortical plate, or maxillary sinus. Enhanced visualization facilitates safer operative planning and contributes to reduction of intraoperative complications. Simultaneously, modern surgical techniques have evolved considerably from conventional extraction methods. Contemporary approaches focus on minimizing tissue injury through precise flap design, conservative osteotomy, controlled tooth sectioning, microsurgical manipulation, and preservation of vascular supply. Development of piezoelectric surgical systems has further improved precision of bone removal while reducing trauma to adjacent soft tissues and neurovascular structures. Advances in anesthesia, pharmacological management, and postoperative rehabilitation have additionally enhanced patient comfort and accelerated recovery. As healthcare increasingly emphasizes evidence-based practice and patient-centered care, understanding the effectiveness of modern surgical approaches in impacted third molar management has become increasingly important. Comprehensive evaluation of clinical outcomes, complication prevention, healing patterns, and postoperative quality of life remains

essential for optimizing treatment strategies and improving long-term oral health.

2. Materials and Methods

This study was based on a comprehensive evaluation of patients presenting with impacted third molars requiring surgical intervention. Clinical examination included assessment of symptoms, eruption status, soft tissue conditions, periodontal health, adjacent tooth involvement, and presence of pathological lesions. Radiographic evaluation was performed using panoramic radiography and cone-beam computed tomography to determine tooth angulation, depth of impaction, root morphology, bone coverage, and anatomical proximity to vital structures. Surgical treatment protocols included minimally invasive flap designs, controlled osteotomy techniques, tooth sectioning when indicated, atraumatic extraction procedures, and careful wound closure. Modern surgical instruments, piezoelectric devices, and microsurgical techniques were utilized when appropriate. Postoperative monitoring included evaluation of pain intensity, swelling, trismus, wound healing, infection rates, nerve disturbances, and recovery time. Clinical outcomes were analyzed to determine effectiveness and safety of contemporary surgical approaches.

3. Results

Clinical assessment demonstrated that mesioangular and vertical impactions represented the most frequently observed patterns among mandibular third molars, while maxillary impactions commonly presented with distoangular orientations. The most common indications for surgical removal included recurrent pericoronitis, pain, caries involving adjacent teeth, periodontal destruction, and prevention of future pathological complications. Cone-beam computed tomography significantly improved identification of anatomical risk factors and enhanced preoperative surgical planning. Application of minimally invasive extraction techniques resulted in reduced operative trauma, decreased postoperative pain, lower incidence of soft tissue injury, and improved healing outcomes. Piezoelectric surgery demonstrated superior preservation of surrounding bone and soft tissues while minimizing risk of nerve damage. Most patients experienced satisfactory wound healing within the expected recovery period. Postoperative complications were generally mild and included transient swelling, discomfort, limited mouth opening, and localized inflammation. Serious complications such as inferior alveolar nerve injury, excessive bleeding, dry socket, deep infection, and mandibular fracture occurred infrequently. Patients managed with modern surgical protocols demonstrated faster recovery, lower complication rates, and greater overall satisfaction compared with outcomes traditionally associated with conventional extraction methods. Clinical evaluation demonstrated that impacted mandibular third molars were encountered more frequently than maxillary impactions and were commonly associated with mesioangular, vertical, and horizontal orientations. Recurrent inflammatory episodes, pain, periodontal involvement of adjacent teeth, and radiographic evidence of pathological changes represented the most frequent indications for surgical intervention. Advanced imaging significantly improved preoperative assessment by enabling accurate determination of root morphology, angulation, depth of impaction, and anatomical relationships with surrounding neurovascular structures. Application of minimally invasive surgical principles resulted in substantial reduction of operative trauma and postoperative discomfort. Patients treated using modern extraction techniques experienced lower levels of pain, swelling, and trismus during the early postoperative period. Utilization of piezoelectric devices and microsurgical instruments facilitated precise bone removal and reduced risk of injury to surrounding tissues. Wound healing progressed favorably in the majority of cases, with rapid epithelialization and satisfactory restoration of function. Postoperative infection rates remained low when evidence-based surgical and pharmacological protocols were followed. Temporary sensory disturbances involving the inferior alveolar or lingual nerves were observed infrequently and generally resolved without permanent neurological deficits. Functional recovery, including mastication and mouth opening, occurred more rapidly among individuals managed with contemporary surgical approaches compared with traditional extraction methods. Overall clinical outcomes demonstrated high levels of procedural safety, patient satisfaction, and long-term preservation of oral health.

4. Discussion

The findings emphasize the importance of contemporary diagnostic and surgical strategies in

optimizing management of impacted third molars. Early identification of high-risk impactions allows clinicians to prevent development of significant pathological conditions and reduce long-term oral health complications. Advanced imaging technologies have substantially improved diagnostic accuracy and facilitate safer surgical planning by providing detailed visualization of anatomical relationships. Minimally invasive surgical approaches contribute significantly to preservation of surrounding tissues, reduction of inflammatory responses, and enhancement of postoperative recovery. Piezoelectric surgery and microsurgical techniques offer additional advantages through improved precision and reduced risk of injury to critical anatomical structures. Appropriate surgical training, careful patient selection, and adherence to evidence-based clinical protocols remain essential factors influencing treatment success. Although postoperative complications cannot be completely eliminated, modern surgical advancements have significantly reduced their incidence and severity. Continued development of imaging technologies, surgical instruments, regenerative techniques, and postoperative care strategies will further improve outcomes and patient experiences in third molar surgery. The present findings emphasize the growing importance of advanced surgical concepts in improving management of impacted third molars and reducing procedure-related morbidity. Modern diagnostic technologies have significantly enhanced the clinician's ability to identify anatomical risk factors and develop individualized treatment plans. Three-dimensional imaging provides detailed information that cannot be adequately obtained through conventional radiography alone, particularly in cases involving close relationships with major neurovascular structures. This improvement in diagnostic accuracy contributes directly to safer surgical execution and more predictable outcomes. Minimally invasive operative techniques have emerged as a central component of contemporary third molar surgery. Reduction of tissue manipulation, preservation of bone integrity, and precise surgical access minimize inflammatory responses and accelerate healing processes. Piezoelectric surgery offers particular advantages through selective cutting of mineralized tissues while protecting adjacent soft tissue structures, thereby reducing the likelihood of neurological complications and excessive bleeding. Enhanced postoperative recovery observed following these procedures reflects the cumulative benefits of technological innovation, refined surgical protocols, and improved perioperative care. Another important consideration involves the timing of intervention. Early removal of impacted third molars before development of advanced pathological changes may reduce treatment complexity and lower complication rates. Nevertheless, prophylactic extraction remains a subject of ongoing clinical debate, emphasizing the importance of individualized decision-making based on patient-specific risk assessment. Long-term monitoring of asymptomatic impacted teeth may be appropriate in selected cases when no evidence of disease is present. Contemporary treatment philosophies therefore advocate a balanced approach integrating clinical findings, radiographic evaluation, patient preferences, and anticipated future risks. Continuous advancements in surgical instrumentation, regenerative techniques, digital planning systems, and postoperative management are expected to further improve outcomes and expand therapeutic possibilities in oral and maxillofacial surgery.

5. Conclusion

Impacted third molars remain a common clinical condition requiring careful diagnostic evaluation and individualized surgical management. Modern surgical approaches incorporating advanced imaging, minimally invasive techniques, piezoelectric technology, and evidence-based postoperative care significantly improve treatment outcomes while reducing morbidity and complication rates. Accurate assessment of anatomical relationships and risk factors is essential for safe surgical intervention and preservation of surrounding structures. Contemporary management strategies promote faster healing, improved patient comfort, enhanced functional recovery, and greater long-term oral health outcomes. Ongoing technological and clinical advancements will continue to refine surgical protocols and strengthen the effectiveness of impacted third molar management in modern oral and maxillofacial practice. Modern surgical management of impacted third molars has undergone substantial evolution through integration of advanced imaging technologies, minimally invasive operative techniques, and evidence-based postoperative care strategies. Comprehensive diagnostic evaluation allows accurate identification of anatomical complexities and facilitates individualized treatment planning. Contemporary surgical approaches significantly reduce tissue trauma, postoperative pain, inflammatory reactions, and complication rates while promoting faster healing and functional recovery. Technological innovations such as cone-beam computed tomography,

piezoelectric surgery, and microsurgical instrumentation have enhanced procedural precision and improved patient safety. Early recognition of pathological changes and appropriate intervention contribute to prevention of long-term oral health complications associated with impacted wisdom teeth. Ongoing developments in surgical science and digital healthcare technologies will continue to refine therapeutic protocols and strengthen clinical outcomes in the management of impacted third molars.

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DOI: 10.4103/aams.0498



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