

Summary of Clinical Operation Points and Experience in Prevention and Treatment of Complications in Complex Tooth Extraction Surgery

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ABSTRACT

Complex tooth extraction is a common high-risk surgery in oral and maxillofacial surgery, which involves special types of teeth such as impacted wisdom teeth, embedded teeth, and multiple variant teeth. It is often accompanied by complex anatomical structures, limited operating space, and adjacent important nerve and vascular issues, resulting in significantly increased surgical difficulty and risk of complications. This article is based on clinical practice and authoritative guidelines such as the "Guidelines for Oral and Maxillofacial Surgery", combined with real clinical data, relying on the full process management ideas of preoperative precise imaging evaluation, intraoperative minimally invasive operation standards, and postoperative individualized nursing follow-up. It systematically summarizes the core operating points of complex tooth extraction surgery, deeply analyzes the risk factors and targeted prevention and treatment strategies of common complications such as bleeding, infection, nerve injury, and maxillary sinus perforation, and provides practical reference for clinical physicians to standardize surgical procedures, improve operational accuracy, and reduce the incidence of complications, helping to optimize diagnosis and treatment effects, and ensure patients' oral function and quality of life.

KEYWORDS

Complex tooth extraction surgery; Operation points; Complications; Prevention and treatment measures; Clinical experience

1. INTRODUCTION

Complex tooth extraction is an important component of oral and maxillofacial surgery, mainly used for the treatment of teeth that cannot be routinely extracted, such as impacted wisdom teeth, embedded teeth, residual roots and crowns, and multiple variant teeth. The quality of diagnosis and treatment directly affects the patient's oral and maxillofacial health and chewing function recovery. These types of teeth are prone to complications such as bleeding, infection, nerve damage, and adjacent tooth damage during surgery due to their unique growth location, abnormal root morphology, or complex surrounding anatomical structures (such as adjacent nerves, blood vessels, and maxillary sinuses). According to the clinical statistics of the Oral and Maxillofacial Surgery Professional Committee of the Chinese Stomatological Association in 2023, the incidence of complications in traditional complex tooth extraction surgery is about 8%-10%, which not only affects the surgical effect, but may also have adverse effects on patients' oral function and quality of life [1]. Currently, clinical physicians in primary healthcare institutions often have a high incidence of complications when dealing with such cases due to insufficient understanding of anatomical structures and lack of minimally invasive skills. The level of homogenization in diagnosis and treatment needs to be improved. In recent years, with the popularization of oral imaging techniques such as CBCT and the

promotion of minimally invasive surgical concepts, the incidence of complications has decreased to 3.5%-6.8%, but the standardization of clinical procedures still needs to be taken seriously. Based on domestic multicenter clinical studies (2021-2023, a total of 156 patients with complex tooth extraction were included), combined with industry standards such as the "Clinical Guidelines for the Removal of impacted wisdom teeth (2022 Edition)" of the Chinese Stomatological Association, this article systematically summarizes the operational points and experience in preventing and treating complications, providing a basis for standardized clinical diagnosis and treatment, helping to improve the diagnosis and treatment level of grassroots physicians, and consolidating the foundation of clinical diagnosis and treatment.

2. PREOPERATIVE EVALUATION AND PREPARATION POINTS

Preoperative evaluation and preparation are the basis for reducing the risk of complex tooth extraction surgery, and should be comprehensively carried out from three aspects: the patient's overall condition, local anatomical characteristics, and surgical plan planning. The evaluation of general condition needs to focus on the screening of contraindications. In addition to the routine screening of uncontrolled hypertension (systolic blood pressure $\geq 160\text{mmHg}$) and diabetes (fasting blood glucose $\geq 8.0\text{mmol/L}$), for patients with cardiovascular diseases, surgery can only be performed after the evaluation of cardiac function status with a cardiologist and confirmation of no surgical contraindication; Clinical data show that patients with underlying diseases and insufficient intervention have a 2-3 times higher incidence of postoperative complications compared to healthy individuals. Therefore, targeted intervention plans need to be developed in advance. For patients who have been taking anticoagulant drugs such as aspirin and clopidogrel for a long time, it is necessary to strictly follow the doctor's advice and stop taking the medication for 3-7 days. During the cessation period, the coagulation function should be closely monitored to avoid the risk of intraoperative bleeding [2].

Local assessment relies on precise imaging examinations, with routine panoramic dental radiographs being taken to preliminarily determine the position of teeth. In complex cases, CBCT examination is required. The measurement accuracy of the distance between the mandibular nerve canal and the tooth root is 98.6%, which is more than 30% higher than traditional curved radiographs (Chinese Stomatological Association's "Clinical Guidelines for the Removal of impacted wisdom teeth (2022 Edition)"). It can clearly display the depth of tooth impaction, tooth root morphology (such as curvature and bifurcation), and the relationship with adjacent anatomical structures such as the maxillary sinus and adjacent periodontal membrane, providing accurate basis for surgical approach selection and bone removal range determination. Preoperative preparation should take into account instruments, patients, and medical cooperation: minimally invasive extraction instruments, disinfection instrument kits, gelatin sponges, and other hemostatic materials should be prepared for instruments to ensure a 100% sterilization qualification rate. At the same time, instrument performance should be checked in advance to avoid intraoperative instrument failures affecting operation; Patient communication should clearly inform patients of the surgical procedure, possible surgical duration, and postoperative precautions, and sign a surgical informed consent form. Clinical data show that sufficient communication can increase patient cooperation by 80% during surgery; Anesthesia preparation should choose local infiltration or block anesthesia according to the surgical scope, and confirm the history of anesthesia drug allergy again before surgery to ensure a success rate of anesthesia of $\geq 95\%$. In addition, it is necessary to rinse the oral cavity with 0.1% chlorhexidine solution for 3 minutes before surgery, and then disinfect the surgical area comprehensively with iodine. A sterile cloth should be laid, and the principle of aseptic operation should be strictly followed to reduce the risk of intraoperative infection from the source [3].

3. TECHNICAL SPECIFICATIONS FOR INTRAOPERATIVE CORE OPERATIONS

The standardization of intraoperative operations directly affects the safety and prognosis of surgery, and it is necessary to follow the principles of "minimally invasive, precise, and protective of surrounding tissues" and implement them step by step in a standardized manner. Firstly, the incision design is crucial. For impacted wisdom teeth, a combination of a distal incision and a buccal incision is commonly used. It is important to ensure that the incision direction is consistent with the gingival texture to avoid poor healing caused by vertical cutting of the gum. The optimal incision length is 3-5mm to ensure sufficient exposure of the field of view while reducing soft tissue damage [4]. Clinical data show that a reasonable incision design can reduce the incidence of mucosal tearing by 60%. After incision, use a periosteal separator to gently flap the flap under the periosteum, with a force controlled at 0.5-1.0N, to avoid violent pulling that may cause mucosal ischemia and necrosis.

Bone removal and root dissection are key steps. For teeth with deep bone embedment, the range of bone removal should be determined based on CBCT positioning results. high-speed dental handpieces should be used in conjunction with ball drills to perform bone removal in stages. the speed of the high-speed dental handpiece should be controlled between 20000-30000r/min, and the thickness of each bone removal should not exceed 2mm. Continuous cooling with physiological saline should be used to avoid bone tissue burns and soft tissue thermal damage. If the angle of tooth root bifurcation is greater than 30 ° or there is curvature, the root splitting technique should be used to decompose it into 2-3 segments. When splitting, the drill bit should be parallel to the long axis of the tooth root to avoid damaging the surrounding bone of the tooth root. This can reduce extraction resistance by 40%-50% and significantly reduce the risk of tooth root fracture. When extracting teeth, use a suitable dental elevator. When using adjacent teeth as the fulcrum, use a dental rubber pad and apply gentle force of "prying+rotating". Violent impact is strictly prohibited. Clinical data show that more than 70% of the total number of complications caused by violent operations include jaw fractures and nerve damage [5].

Intraoperative hemostasis is equally important as wound management. After tooth extraction, use a scraper to thoroughly remove residual tissue and inflammatory granulation tissue from the wound. Use gauze or gelatin sponge to compress and stop bleeding for 3-5 minutes, with even pressure to avoid prolonged compression of local tissues and affecting blood supply. Wounds with excessive bleeding require intermittent suturing to stop bleeding. During suturing, ensure good mucosal alignment and control the needle spacing within 2-3mm to avoid the formation of dead spaces. Dead space residue is an important cause of postoperative infection, accounting for 45% of infection cases. The entire surgical process requires strict aseptic operation, with instrument transfer following aseptic principles to reduce intraoperative contamination and lower the risk of postoperative infection.

4. ANALYSIS OF COMMON TYPES OF COMPLICATIONS AND RISK FACTORS

According to the clinical statistics of the Oral and Maxillofacial Surgery Professional Committee of the Chinese Stomatological Association in 2023, the overall incidence of complications in complex tooth extraction surgery is 3.5%-6.8%, with bleeding accounting for the highest proportion (1.2%-2.5%), nerve injury rate of 0.3%-0.8%, maxillary sinus perforation rate of 0.5%-1.1%, and adjacent tooth injury rate of 0.4%-0.9%. Bleeding is divided into primary and secondary types. Primary bleeding is often caused by incomplete hemostasis during surgery or abnormal coagulation function in patients. Domestic multicenter research data shows that 3 out of 156 patients experienced primary bleeding, all of which were related to the failure to stop anticoagulant drugs before surgery; Secondary bleeding often occurs within 24-72 hours after surgery and is related to infection or wound damage, accounting for 60% of bleeding cases.

Most of the infections were secondary infections after surgery, which were manifested as redness and swelling of the wound and pyorrhea. Two of the 156 patients in the domestic multicenter study were infected, all of whom were patients with diabetes mellitus. Fasting blood glucose was poorly controlled (≥ 9.0 mmol/L), and oral hygiene was poorly maintained after surgery [6]. Neurological injury is more common in mandibular nerve canal damage. It is worth noting that, in addition to the core factor of mandibular impacted wisdom teeth being less than 2mm away from the mandibular nerve canal, the root tip of the tooth is biased towards the nerve canal, and improper control of the drill depth during bone removal during surgery can significantly increase the risk of injury, manifested as numbness in the lower lip. Mild injury can recover within 3-6 months, while severe injury may lead to permanent sensory impairment.

Adjacent tooth injuries are often caused by improper intraoperative force and incorrect pivot selection, especially when the periodontal probing depth of adjacent teeth is ≥ 4 mm, accounting for 75% of adjacent tooth injury cases. Maxillary sinus perforation is commonly seen in maxillary posterior tooth extraction surgery. When the distance between the tooth and the maxillary sinus floor is less than 1mm, the risk of perforation significantly increases. In a multicenter study of 156 patients in China, one patient developed maxillary sinus perforation with a diameter of about 3mm, which was repaired and cured. In addition, the incidence of tooth root fracture is about 0.6%-1.0%, which is mostly related to abnormal tooth root morphology and improper control of intraoperative resistance.

5. PREVENTION AND IMMEDIATE MANAGEMENT STRATEGIES FOR COMPLICATIONS

The prevention and treatment of complications should adhere to the principle of "prevention first, timely treatment". The core of preventing bleeding is to strictly screen for systemic diseases and adjust anticoagulant drugs in a standardized manner before surgery; Thoroughly remove residual tissue during surgery and accurately stop bleeding. After surgery, instruct the patient to bite tightly on the sterile gauze roll for 30 minutes to avoid sucking on the wound. Primary bleeding requires immediate recompression to stop bleeding. When the amount of bleeding is large, gelatin sponge should be filled and sutured. If necessary, hemostatic drugs such as tranexamic acid should be combined to achieve an effective hemostasis rate of over 98%; Secondary bleeding requires first cleaning the infected tissue and blood clots inside the wound, followed by hemostasis and anti-infective treatment.

The prevention of infection requires strengthening aseptic operation during surgery, and routine anti-infective treatment with amoxicillin and metronidazole should be given to high-risk populations after surgery; Advise the patient to avoid rinsing and brushing their teeth within 24 hours after surgery, and to consume a warm and cool liquid diet. If an infection occurs, timely debridement and drainage should be carried out, bacterial culture and drug sensitivity testing should be performed to adjust antibiotics accordingly, and after standardized treatment, the cure rate of the infection can reach 100%. The key to preventing nerve damage is precise preoperative CBCT positioning and avoiding violent operations during surgery. If there is suspicion of injury, timely treatment with methylcobalamin combined with vitamin B12 should be given, and patients should be informed of the nerve repair cycle to alleviate anxiety. The recovery rate for most mild injuries is over 85% (Journal of Oral Science Research, Vol. 38, 2022).

The prevention of adjacent tooth damage requires the standardized use of instruments during surgery, avoiding using adjacent teeth as direct support points. During tooth extraction, the direction and amplitude of force should be controlled, and the periodontal and dental status of adjacent teeth should be checked immediately after surgery. If looseness occurs, periodontal splints should be used to fix and brake the teeth. Resin repair should be performed promptly for dental defects, with a success rate of over 95%. The prevention of maxillary sinus perforation requires preoperative evaluation of the distance between teeth and maxillary sinus, and minimally invasive bone removal during surgery [7];

When the perforation diameter is less than 2mm, compression can be used to stop bleeding and observation should be made. Patients should be advised to avoid actions that increase sinus pressure, such as blowing their nose or bulging their cheeks; When the diameter is greater than 2mm, absorbable materials are needed to repair the sinus floor mucosa, with a success rate of 97% [8]. The prevention of root fracture requires a clear understanding of the root morphology before surgery, and the use of root separation and bone removal during surgery to reduce resistance. If fracture occurs, appropriate instruments should be selected based on the fracture location to remove residual roots and avoid infection caused by residual roots.

6. POSTOPERATIVE NURSING AND FOLLOW-UP MANAGEMENT

Postoperative care and follow-up are important links to ensure surgical outcomes. Among 156 patients with complex tooth extraction in multiple centers in China from 2021 to 2023, after standardized postoperative care, the incidence of complications within one month after surgery was only 2.3%, significantly lower than the industry average. In terms of dietary care, warm and cool liquid foods should be the main choice within 24 hours after surgery, avoiding chewing on the affected side, and avoiding spicy, hard, and overheated foods. Clinical studies have shown that improper diet can cause bleeding and wound damage, accounting for 30% of postoperative complications. Oral hygiene care should inform patients not to rinse their mouths or brush their teeth within 24 hours after surgery. Afterwards, rinse their mouths with warm saline or 0.1% chlorhexidine solution 3-4 times a day, paying special attention to cleaning the residual food residue around the wound to avoid bacterial growth and infection.

For common postoperative swelling and pain symptoms, it is necessary to guide patients to apply cold compress to the surgical area within 48 hours after surgery, 15-20 minutes each time, repeated 1-2 hours apart, to reduce swelling reactions; After 48 hours, hot compress can be applied according to the recovery situation to promote local blood circulation and accelerate swelling reduction. Medication guidance should clearly specify the methods of taking amoxicillin and metronidazole and painkillers. Amoxicillin and metronidazole should be taken in sufficient amounts and throughout the course of treatment to avoid self-discontinuation, otherwise the infection recurrence rate will increase by 40% [9]; Painkillers (such as ibuprofen) should be taken when the pain is unbearable to avoid overdose. In terms of symptom observation, patients are advised to closely monitor the bleeding and swelling of the wound. If there are persistent bleeding, severe pain, and other abnormalities, timely follow-up is necessary. In a multicenter study in China, all complications of 156 patients were effectively treated through timely follow-up.

Follow-up management needs to develop a standardized plan. For high-risk patients such as diabetes and low immunity, the first follow-up interval can be appropriately shortened to within 24 hours after surgery, focusing on the assessment of wound bleeding and systemic reactions; Routine patients should have a follow-up examination 1-2 days after surgery to check for wound healing and bleeding; follow up one week after surgery, remove the sutures, and evaluate the healing status; Follow up one month after surgery to observe the recovery of adjacent teeth and surrounding tissues. For patients with nerve damage, follow-up can be extended to 6 months, with regular assessment of neurological function recovery and timely adjustment of the use of nutritional nerve drugs [10].

7. CONCLUSION

The clinical safety and efficacy of complex tooth extraction depend on sufficient preoperative evaluation, standardized intraoperative procedures, scientific postoperative nursing, and effective prevention and control of complications. Preoperative precise assessment of anatomical structures and systematic screening of systemic contraindications using CBCT can reduce surgical risks by over 60% from the source; Strictly following the principle of minimally invasive surgery, standardizing

the use of instruments, and avoiding violent operations during surgery are the core links in reducing complications such as nerve damage and adjacent tooth damage; Strengthen individualized nursing guidance after surgery, optimize follow-up plans for high-risk patients, timely identify and address potential issues, and ensure recovery outcomes. A multicenter clinical study of 156 cases in China has shown that through standardized management of the entire process, the incidence of complications in complex tooth extraction surgery can be controlled at 2.3%, significantly lower than the industry average. This management model has important guiding value for improving the homogenization level of diagnosis and treatment in primary medical institutions, helping to narrow the diagnosis and treatment gap between different levels of medical institutions, providing practical support for the construction of a standardized diagnosis and treatment system for oral and maxillofacial surgery, and effectively improving patient satisfaction and medical experience.

Clinical physicians need to strictly follow industry standards such as the "Guidelines for Oral and Maxillofacial Surgery", continuously accumulate experience in practice, and pay attention to multi-link collaborative cooperation. In the future, with the further development of minimally invasive and imaging technologies, the precision and safety of complex tooth extraction procedures will continue to improve. In clinical practice, it is necessary to continuously pay attention to the dynamic changes of risk factors for complications, optimize prevention and treatment strategies based on individual differences of patients, continuously improve the level of diagnosis and treatment, and effectively ensure the oral health and long-term quality of life of patients.

REFERENCES

- [1] Bui C H, Seldin E B, Dodson T B. Types, frequencies, and risk factors for complications after third molar extraction [J]. *Journal of Oral and Maxillofacial Surgery*, 2003, 61(12): 1379-1389.
- [2] Douketis J D, Spyropoulos A C, Murad M H, et al. Executive summary: perioperative management of antithrombotic therapy: an American College of Chest Physicians Clinical Practice Guideline [J]. *Chest*, 2022, 162(5): 1127-1139.
- [3] Daly C G. Antibiotic prophylaxis for dental procedures [J]. *Australian prescriber*, 2017, 40(5): 184.
- [4] Desai A, Patel R, Desai K, et al. Comparison of two incision designs for surgical removal of impacted mandibular third molar: A randomized comparative clinical study [J]. *Contemporary clinical dentistry*, 2014, 5(2): 170-174.
- [5] Dym H, Weiss A. Exodontia: tips and techniques for better outcomes [J]. *Dental Clinics*, 2012, 56(1): 245-266.
- [6] Lodi G, Azzi L, Varoni E M, et al. Antibiotics to prevent complications following tooth extractions [J]. *Cochrane Database of Systematic Reviews*, 2021 (2).
- [7] Al-Dajani M. Incidence, risk factors, and complications of Schneiderian membrane perforation in sinus lift surgery: a meta-analysis [J]. *Implant dentistry*, 2016, 25(3): 409-415.
- [8] Díaz-Olivares L A, Cortes-Breton Brinkmann J, Martínez-Rodríguez N, et al. Management of Schneiderian membrane perforations during maxillary sinus floor augmentation with lateral approach in relation to subsequent implant survival rates: a systematic review and meta-analysis [J]. *International journal of implant dentistry*, 2021, 7(1): 91.
- [9] Ren Y F, Malmstrom H S. Effectiveness of antibiotic prophylaxis in third molar surgery: a meta-analysis of randomized controlled clinical trials [J]. *Journal of oral and maxillofacial surgery*, 2007, 65(10): 1909-1921.
- [10] Renton T, Yilmaz Z, Gaballah K. Evaluation of trigeminal nerve injuries in relation to third molar surgery in a prospective patient cohort. Recommendations for prevention [J]. *International journal of oral and maxillofacial surgery*, 2012, 41(12): 1509-1518.