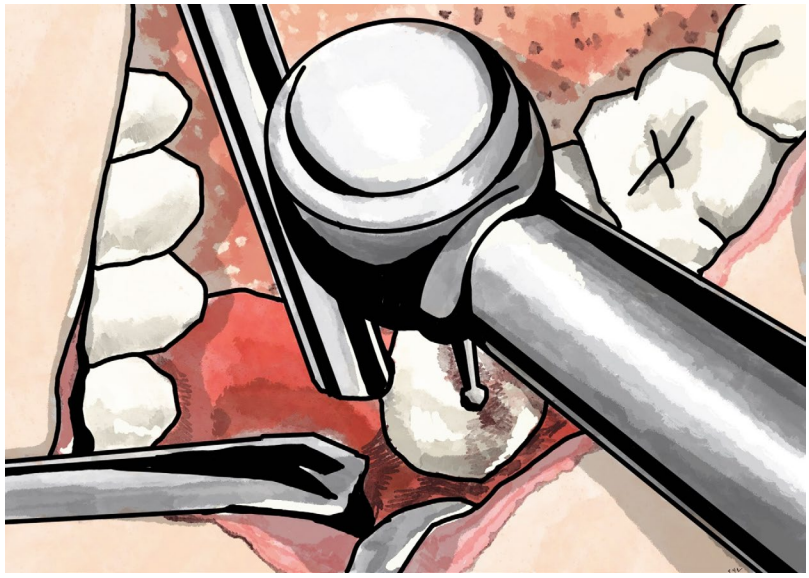
Advanced Strategies for Tooth Extraction in Dentistry



(Jee Ho Lee, DDS, PhD)

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Advanced Strategies for Tooth Extraction in Dentistry

Beyond Basics

Springer

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Preface

Tooth extraction, a procedure frequently practiced by dentists, is often covered as a subsection in oral and maxillofacial surgery textbooks. While some atlases provide detailed, step-by-step guides to tooth extraction, these resources, though valuable for beginners, may not fully address the complexities encountered in daily practice. The reality is that tooth extraction can be complicated by a patient's unique conditions, emphasizing the need to consider the tooth not just as an isolated entity, but as a part of the body influenced by overall health. Understanding a patient's systemic condition is crucial for a smooth and uneventful procedure.

Recognizing these challenges, *Advanced Strategies for Tooth Extraction in Dentistry: Beyond Basics* has been meticulously crafted to cater to the nuanced needs of dental students, trainees, and examinees. This book goes beyond the basics, aligning with dental curricula and examination requirements, and focuses on imparting the knowledge and skills necessary for advanced tooth extraction procedures. It provides comprehensive coverage of the subject, preparing readers to navigate the challenges of their dental education and examinations effectively.

Each chapter in *Advanced Strategies for Tooth Extraction in Dentistry* is systematically structured, concentrating on essential areas frequently included in dental curricula and examinations. The content is presented clearly and concisely, facilitating efficient learning and a deep understanding of advanced tooth extraction techniques. Case examples and clinical scenarios are integrated throughout the book, bridging theory with practical application. These scenarios not only reinforce learning but also simulate the types of questions that appear in dental examinations, offering valuable practice and insight into examination techniques.

A cornerstone of this book is its commitment to evidence-based principles. *Advanced Strategies for Tooth Extraction in Dentistry* is up-to-date with the latest advancements in oral and maxillofacial surgery, ensuring the content adheres to both academic and clinical standards in dental education. Readers can trust that the strategies and practices presented are rooted in rigorous research and reflect the highest standards of patient care.

In conclusion, *Advanced Strategies for Tooth Extraction in Dentistry: Beyond Basics* is an invaluable resource that enhances the learning experience for dental students, trainees, and examinees. It not only addresses the educational and examination needs of dental professionals but also serves as an indispensable guide for their success in the demanding field of dentistry.

We wish to extend our heartfelt gratitude to our families and colleagues. Their unwavering support and contributions were instrumental in the completion of this work. Without them, this book would not have been possible.

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Seong-Gon Kim, D.D.S., Ph.D., is a distinguished Professor at the Department of Oral and Maxillofacial Surgery, School of Dentistry, Gangneung-Wonju National University, Republic of Korea. With a dental degree and Ph.D. from Seoul National University, Dr. Kim has forged an illustrious career, marked by significant academic and professional achievements. His expertise is rooted in oral pathology, and he has held various esteemed positions, including a Fellowship at Seoul National University Hospital and an instructor role at Hallym University.

Dr. Kim's scholarly contributions are substantial, having authored numerous influential publications in international journals. His research spans a wide range of topics in oral and maxillofacial surgery, demonstrating his commitment to advancing the field. As an Editor-in-Chief and a member of various editorial committees, he has significantly influenced academic discourse. His dedication to his field is further exemplified by his role as Vice President of the Korean Society of Sericultural Science since 2021.

Dae-Seok Hwang, D.D.S., Ph.D., is a distinguished Professor at the Department of Oral and Maxillofacial Surgery, School of Dentistry, Pusan National University, Republic of Korea. With a dental degree and Ph.D. from Pusan National University, Dr. Hwang has forged an illustrious career, marked by significant academic and professional achievements. His expertise is rooted in Oral and Maxillofacial Surgery, and he has held various esteemed positions, including a Fellowship and instructor at Pusan National University Hospital.

Dr. Hwang's scholarly contributions are substantial, having authored numerous influential publications in international journals. His research spans a wide range of topics in oral and maxillofa-

cial surgery, demonstrating his commitment to advancing the field. As an Editor of *Maxillofacial Plastic and Reconstructive Surgery* (MPRS) and a member of various editorial committees, he has significantly influenced academic discourse.

Ji-Hyeon Oh, D.D.S., Ph.D., is a distinguished oral and maxillofacial surgeon, bringing a wealth of knowledge and expertise to the field. Dr. Oh graduated with a D.D.S. from the College of Dentistry at Yonsei University, Republic of Korea, and continued to pursue academic excellence by earning a Ph.D. from the Graduate School of Yonsei University, Republic of Korea. Dr. Oh has built a robust career in oral and maxillofacial surgery, demonstrating a commitment to both education and clinical practice.

Dr. Oh served as a Fellow in the Department of Oral and Maxillofacial Surgery at Gangneung-Wonju National University's Dental Hospital, Republic of Korea, followed by roles as a Clinical Assistant Professor in the same department. Currently, Dr. Oh holds the position of Assistant Professor in the Department of Oral and Maxillofacial Surgery at Gangneung-Wonju National University, Republic of Korea, contributing her expertise to the academic and clinical aspects.

Introduction to Advanced Tooth Extraction: Surgical Principle

1

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1.1 Introduction

Welcome to the pioneering realm of advanced tooth extraction, an essential surgical procedure that every dental practitioner must master. This book chapter, being the first stepping stone in your journey, strives to offer comprehensive knowledge, strategies, and insights into modern tooth extraction principles, including the incision, suturing, dressing, and closing remarks. Whether you are a dental student just beginning to explore this technique or an experienced dentist seeking to update your skills, this resource is designed to serve as a practical guide to complex tooth extractions, catering to a broad spectrum of learners.

Tooth extraction, at its core, is an integral part of dentistry. Despite advancements in oral healthcare and preventative measures, there are instances where a tooth cannot be saved and must

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be removed. This could be due to severe decay, periodontal disease, orthodontic correction, impaction, or even trauma. Over the years, the procedure has evolved significantly, with advanced techniques that aim to make the extraction process less invasive and more comfortable for patients, while ensuring rapid recovery.

However, the art and science of tooth extraction encompass more than just the physical removal of the tooth. It demands a thorough understanding of dental anatomy, excellent clinical judgment, precise surgical skills, and the ability to manage potential complications. In essence, it requires a delicate blend of knowledge and practice to achieve mastery.

This chapter begins by introducing the fundamental surgical principle behind advanced tooth extraction. This encompasses understanding the rationale for tooth extraction, evaluating patient factors, and the fundamental principle of "atraumatic" extraction, which strives to preserve the surrounding tissue structures as much as possible during the procedure. In subsequent sections, we will systematically explore incision techniques, suturing strategies, and dressing, each critical in their roles for a successful tooth extraction.

The purpose of this chapter is to equip you with the fundamental surgical principles and technical skills, thereby enabling you to perform tooth extractions with greater confidence, precision, and care. In doing so, we hope to contribute to your journey in becoming not only a proficient dentist but also a compassionate caregiver. Your journey toward mastering advanced tooth extraction begins here, and we trust it will be an enlightening and rewarding one.

1.2 Incision

In any surgical procedure, the incision serves as the opening note, setting the tone for the rest of the operation. As it pertains to tooth extraction, a well-planned and precisely executed incision is critical in maintaining the integrity of the surrounding tissue and facilitating subsequent steps of the extraction process [1].

1.2.1 The Principle of Incision

Incisions in dental surgeries are designed with two primary objectives: to provide adequate access to the surgical site and to preserve the function and aesthetics of the oral structures as much as possible. The approach, direction, and depth of an incision, therefore, must be meticulously planned in accordance with these principles. Basic principles can be enlisted as follows:

1. The size and direction of the incision should be parallel to the minimal tension line.
2. The incision should be made at a consistent depth to the full thickness of the skin in one stroke.
3. When using the blade, start at a right angle initially, diagonal in the middle, and finish at a right angle (Fig. 1.1).
4. Generally, incisions are made at a right angle to the skin surface, but modified incisions first make a right-angle cut, then after separating, slightly remove the inner side of the incision margin at an angle with scissors. This means that even if tension is applied after suturing, the wound site does not strain, resulting in fewer scars.
5. If possible, avoid hair follicles, blood vessels, nerves, etc., during the incision, and make an incision parallel to the direction of the hair to avoid cutting the hair roots.
6. Make an incision following Langer's lines.
7. Ensure the incision is of sufficient length for the surgery.

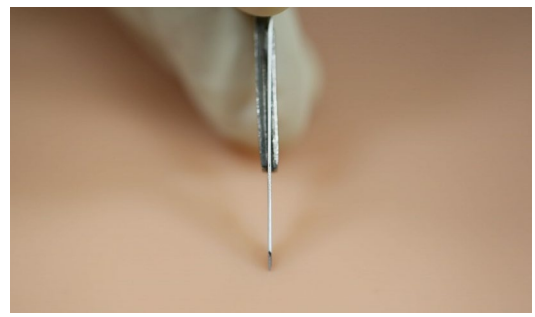


Fig. 1.1 The blade starts at a right angle to the surface

8. Avoid anatomical structures such as nerves, blood vessels, etc.
9. Consider aesthetic aspects.
10. Consider the patient's unique condition (the existence of preexisting scars, injured areas).
11. When using a flap, avoid damaging the feeding vessels by suturing.

When placing an incision, careful consideration should be given to the location of nerves and vessels in the surgical site. For mucosal incisions, the same considerations as skin incisions are necessary in areas exposed to the outside such as the lip area. In other areas like the oral floor, palate, and submucosal tissues, it is essential to consider the direction of vessels, nerves, salivary ducts, and muscles to avoid damaging them. Accidental damage to these structures can lead to complications such as paresthesia, excessive bleeding, or even tissue necrosis. Therefore, a comprehensive understanding of the anatomy of the oral cavity, including bone, soft tissue, and vascular and neural structures, is indispensable.

Furthermore, it is crucial to consider the patient's specific conditions, such as the presence of any underlying disease or disorder that might affect the healing process or increase the likelihood of postoperative complications. For instance, when a patient has a preexisting scar in the oral cavity, it may be advantageous to utilize this area for the incision, thus minimizing additional tissue trauma. Similarly, in patients who have suffered oral trauma, incisions can be planned to use the damaged tissue as an access point to the wounded area, sparing the unaffected tissues.

1.2.2 Classification of Incisions

Broadly, incisions can be categorized into two types: envelope (or sulcular) and three-cornered (or triangular) incisions (Fig. 1.2).

1. Envelope incisions: This incision type is commonly used in simple extractions where there is minimal bone removal. It involves a horizontal cut along the sulcus of the tooth, thereby forming an "envelope" around the tooth.
2. Three-cornered incisions: Used in more complex cases, such as impacted teeth or when significant bone removal is anticipated, this incision provides greater access to the surgical site. It involves a sulcular incision and a vertical releasing incision, forming a triangular flap.

The choice between the two primarily hinges on the complexity of the extraction and the dentist's judgment.

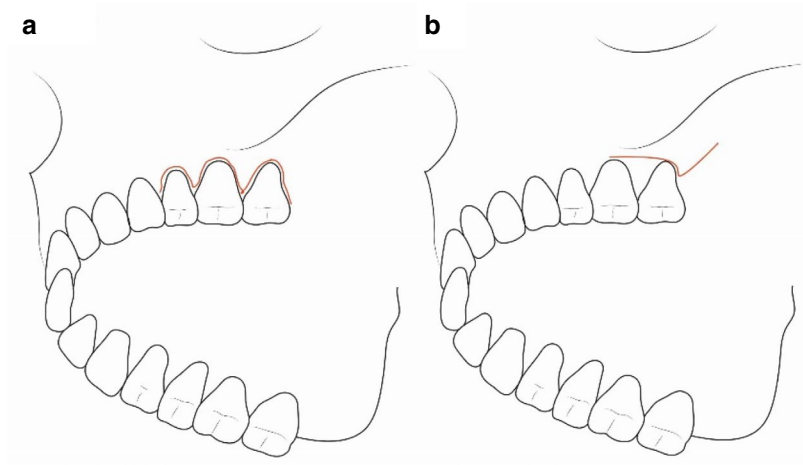


Fig. 1.2 Design of incision. (**a**) envelope incision. (**b**) three-cornered incision

Fig. 1.3 The scalpel blades. From left, No. 10, No. 11, No. 12, No. 12D, No. 15, and No. 15C

1.2.3 The Kind of Scalpel Blades

Regardless of the incision type, tooth extraction surgeries often result in what might be perceived as a "scalpel blade"—a disrupted oral environment characterized by the displacement of soft tissues, bone removal, and bleeding. Managing this "scalpel blade" is crucial in ensuring a smooth surgical procedure and optimal healing postoperation (Fig. 1.3).

In most intraoral surgeries, a #15 blade is commonly utilized. Its small, curved cutting edge allows for precise, delicate incisions, making it versatile for a variety of procedures, including tooth extraction. However, in situations where the area for incision is anatomically challenging, such as in the narrow interdental spaces or near the gingival margin, a #12 blade with its pointed, crescent-shaped edge may be more appropriate. This blade is specifically designed for making incisions in confined spaces and for periodontal and gingival surgeries. In contrast, when treating an abscess where a straight, puncture-style incision is required for drainage, a #11 blade is often the instrument of choice. Its long, straight, and pointed cutting edge makes it ideal for puncturing and draining abscesses.

Lastly, for longer incisions or when more extensive tissue removal is necessary, such as in some types of impacted tooth extraction, a #10 blade may be considered. Its larger, curved cutting edge is designed for making long, sweeping incisions.

In all cases, the proper scalpel holding technique is crucial (Fig. 1.4). There are two common grips: the "pen grip" and the "palm grip." The pen grip offers precision and control and is useful for delicate, shallow incisions. The palm grip, on the other hand, provides strength and stability, making it suitable for deeper, more forceful cuts. The choice of grip should be determined by the nature of the incision and the dentist's comfort level. Regardless of the grip, it is essential to always hold the scalpel with a steady hand, have a clear view of the surgical site, and make the incision with decisive, controlled movements. In all cases, safety should be the foremost concern—to avoid slips or accidental cuts, never use a scalpel in a way that feels unstable or uncomfortable.

This process involves various steps, starting with the gentle and careful retraction of the incised flap to minimize tissue damage. The removal of bone (if necessary) should be performed cautiously, and the extracted tooth needs to be handled with care to prevent any further damage. In all cases, it is essential to consider the nature of the procedure, the specific oral anatomy of the patient, and the surgeon's comfort with the blade in question when selecting the appropriate surgical instrument. The key takeaway is that while a certain degree of "scalpel blade" is an inherent part of surgical procedures, it can be effectively managed through appropriate planning, skilled execution, and careful postoperative care.

1.2.4 Bleeding Control

Bleeding control is an integral part of the incision process and overall surgical management. The source of bleeding should be swiftly identified and controlled using appropriate hemostatic tech-

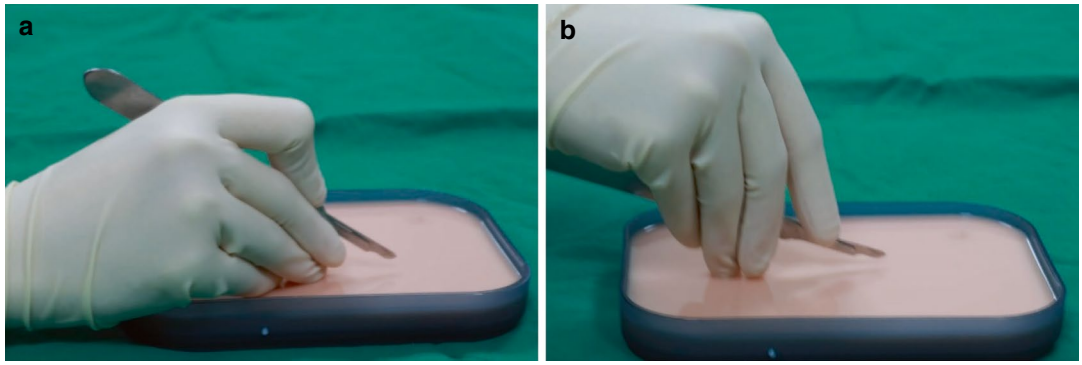


Fig. 1.4 Scalpel holding technique. (**a**) pen grip and (**b**) palm grip

niques. These can include the use of pressure packs, hemostatic agents, sutures, or even electrocautery, depending on the severity and source of bleeding. The hemostatic agents can be enlisted as follows:

1. Epinephrine
2. Oxidized cellulose (Oxycel®, Surgicel®)
3. Microcrystalline collagen (Avitene®)
4. Absorbable gelatin sponge (Gelfoam®)
5. Tissue thromboplastin

The treatment of bleeding points during an incision can vary depending on whether the bleeding is capillary or due to the severing of small arteries or veins. For capillary bleeding, a mosquito-type hemostat can be used or a hemostatic agent can be applied. In the case of the severing of small arteries or veins, the blood vessels are clamped with a hemostat and then ligated or electrocauterized. Understanding that some amount of bleeding is normal and expected during and after tooth extraction can also help in setting appropriate patient expectations and in planning postoperative care. After tooth extraction, mild oozing from the extraction socket is common, even while biting down on gauze. This blood can mix with saliva, and if the patient spits it out, the clot in the extraction socket may be disrupted, leading to prolonged bleeding. Therefore, patients should swallow saliva while biting on gauze to aid in hemostasis.

In conclusion, the incision step, despite being the preliminary stage in tooth extraction, holds paramount importance. Mastery of incision techniques and principles is fundamental for dental practitioners to ensure the success of the extraction process and to minimize postoperative complications.

1.3 Suture

Suturing is an essential skill in oral surgery, used to close incisions and promote healing. It requires the understanding and correct application of several fundamental principles [2].

1.3.1 Classification of Needle

Needles used in dental surgery can be broadly classified into three categories: round-bodied, cutting, and reverse cutting (Fig. 1.5). Round-bodied needles are generally used for soft tissues as they separate rather than cut tissue. Cutting needles have a triangular cross-section and a sharp edge and are used for tougher tissue, like the oral mucosa. Reverse cutting needles are like cutting needles but have a cutting edge on the outer curve, reducing the risk of cutting through tissue.

1.3.2 The Requirement of Ideal Suture Material

Ideal suture materials should have several key properties: high tensile strength, good knot security, minimal tissue reaction, sterility, and if

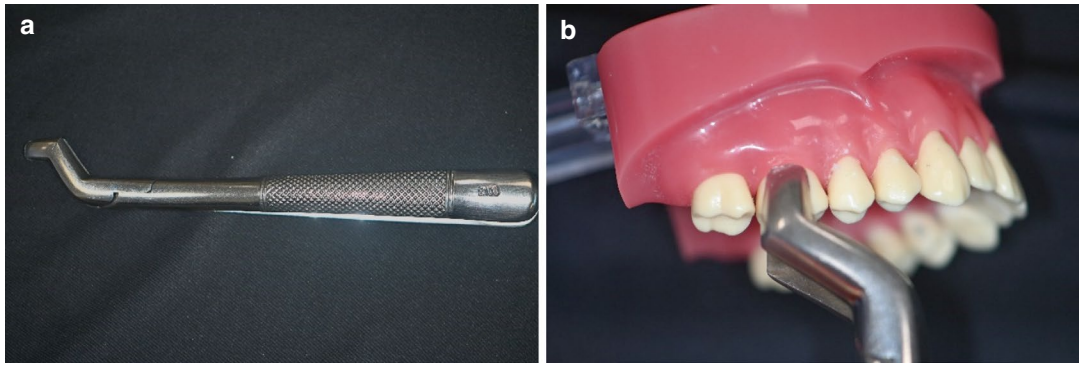


Fig. 3.6 (**a**) Maxillary molar forceps, (**b**) applying forceps to a dental model

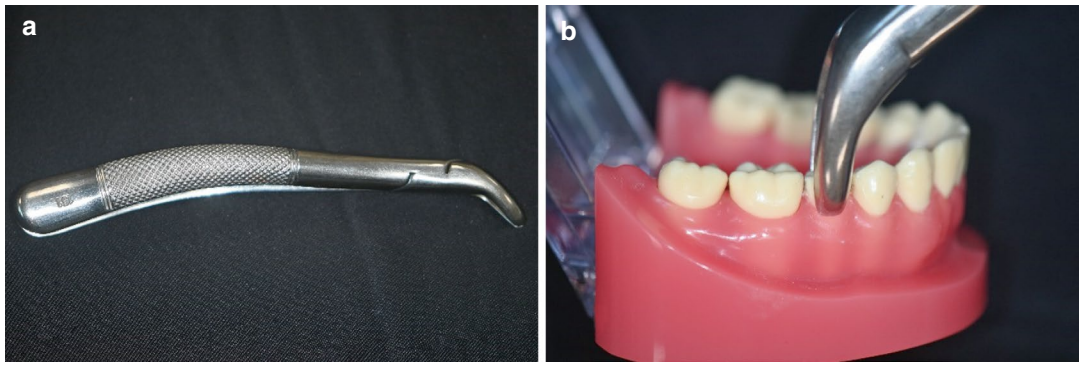


Fig. 3.7 (**a**) Universal mandibular forceps, (**b**) applying forceps to a dental model

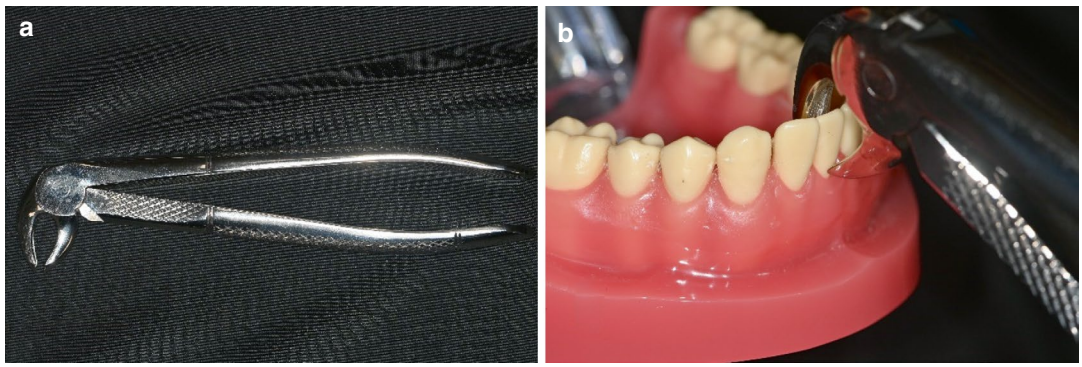


Fig. 3.8 (**a**) Mandibular anterior forceps, (**b**) applying forceps to a dental model

- Mandibular molar forceps (No. 17 or No. 222) (Fig. 3.9.): These are specific for lower molars, designed to navigate around the tongue and lower jaw structure.
- Cowhorn forceps (No. 23): These are designed for lower molars, especially when the crowns are severely decayed or broken down. The "cowhorn" shape allows the forceps to grip the roots for more effective extraction.

• Pediatric forceps: Smaller in size, these forceps are specifically designed for

Surgeons must exercise caution to avoid damage to the incisive nerve and permanent teeth. Following the extraction, it is imperative to completely remove the surrounding follicular sac to prevent potential cyst formation or recurrence. Achieving adequate hemostasis and closing the surgical site with absorbable 4-0 sutures ensure proper healing and reduces the risk of postoperative complications (Fig. 4.4).

(c) Extraction Technique for Labially Located Mesiodens

For mesiodens located on the labial side, a vestibular incision is preferred. The Partsch method can also be employed, which involves creating a mucoperiosteal flap at the gingival margin. This approach is favored for labially located mesiodens, especially in the anterior maxilla, due to aesthetic considerations. Minimizing visible scarring and preserving the gingival architecture are crucial in these areas, given their visibility and impact on the patient's smile and overall appearance.

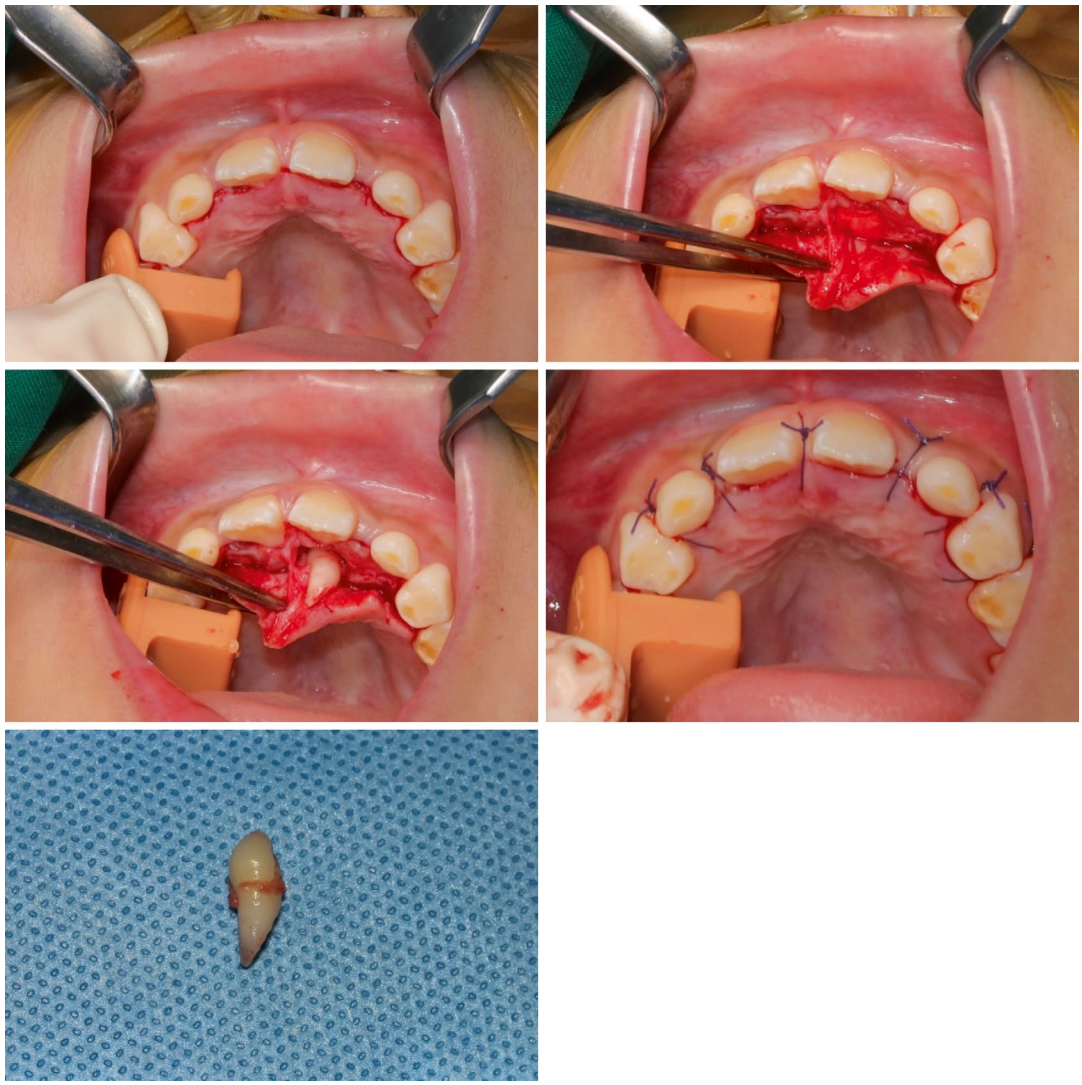


Fig. 4.4 Mesiodens extraction

Fig. 5.5 Impacted maxillary canine and premolars—multiple surgical exposure clinical case (by Courtesy of prof. Kim SH)

Fig. 9.11 Extraction of mandibular primary incisor (by Courtesy of Dr. Jeong CS)

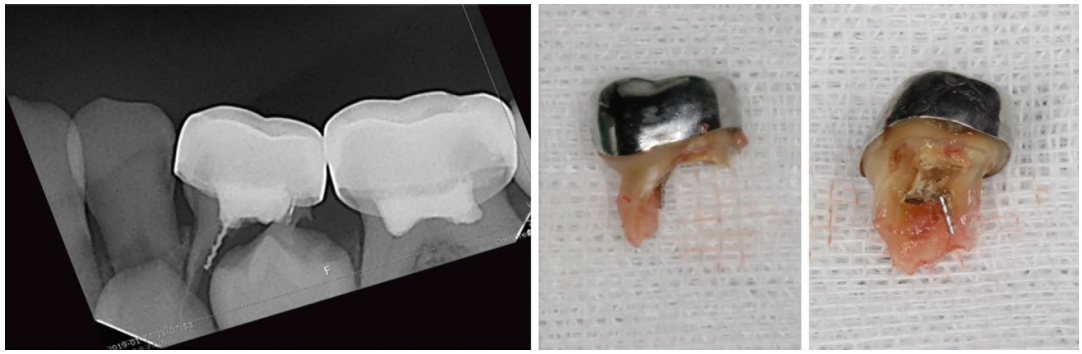
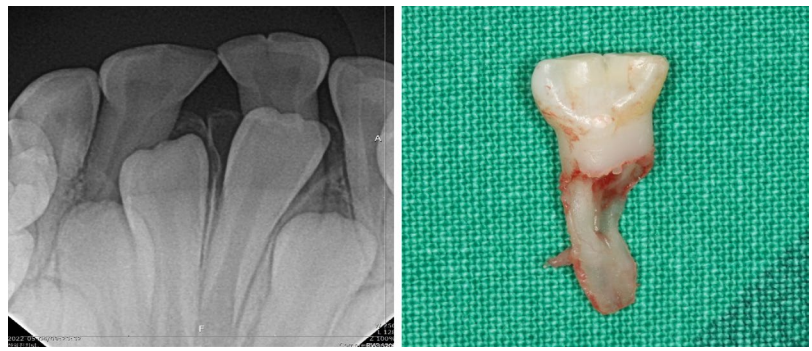


Fig. 9.12 Extraction of mandibular primary molar (by Courtesy of prof. Lee EK)

Fig. 9.13 Extraction of fused tooth (by Courtesy of prof. Lee EK)



9.6 Post-Extraction Care in a Child

The period following the extraction of a primary tooth is critical for a child's recovery and long-term oral health. Children's post-extraction care differs from adults due to their unique physiological and developmental needs. This chapter focuses on the essential post-extraction care strategies to ensure proper healing and comfort for the child.

1. Care of the Extraction Site

   After the extraction, it is crucial to manage the socket with care. Excessive curettage should be avoided to prevent damage to the underlying permanent teeth and to reduce the

planning. The potential for complications, such as resorption or ankylosis, underscores the importance of a thorough diagnostic process, precise surgical technique, and comprehensive postoperative care. It is imperative that patients are well-informed about the procedure, its benefits, risks, and the necessary aftercare to ensure the best possible outcome. As we proceed, we will further explore the methodology, procedural nuances, and care considerations integral to the successful application of intentional replantation in clinical practice.

2. Surgical Procedure

The surgical procedure for intentional replantation is a meticulous process designed to preserve the natural tooth while addressing underlying dental issues. This section outlines the step-by-step approach undertaken during this intricate surgery (Fig. 10.1).

(a) Presurgical preparation:

Prior to surgery, it is vital to establish a healthy environment around the surgical area. This includes caries control and periodontal treatment to ensure that the surrounding teeth and gums are in optimal condition and to minimize the risk of postoperative infection.

(b) Disinfection of the surgical site:

Once the area is prepared, the next step involves thoroughly disinfecting the surgical site. Iodine or chlorhexidine can be used to sterilize the area, significantly reducing the risk of infection during and after the procedure.

(c) Local anesthesia:

To ensure patient comfort and to facilitate a smooth surgical procedure, local anesthesia is administered to the area surrounding the tooth to be replanted. This helps in pain-free extraction and manipulation of the tooth.

(d) Gingival flap elevation:

A gingival flap is carefully elevated to expose the root of the tooth. This is a critical step as it provides access to the tooth and the surrounding bone, allowing for precise extraction and treatment.

(e) Tooth extraction:

The tooth intended for replantation is carefully extracted to preserve as much of the root structure as possible. Once extracted, the tooth is immediately placed

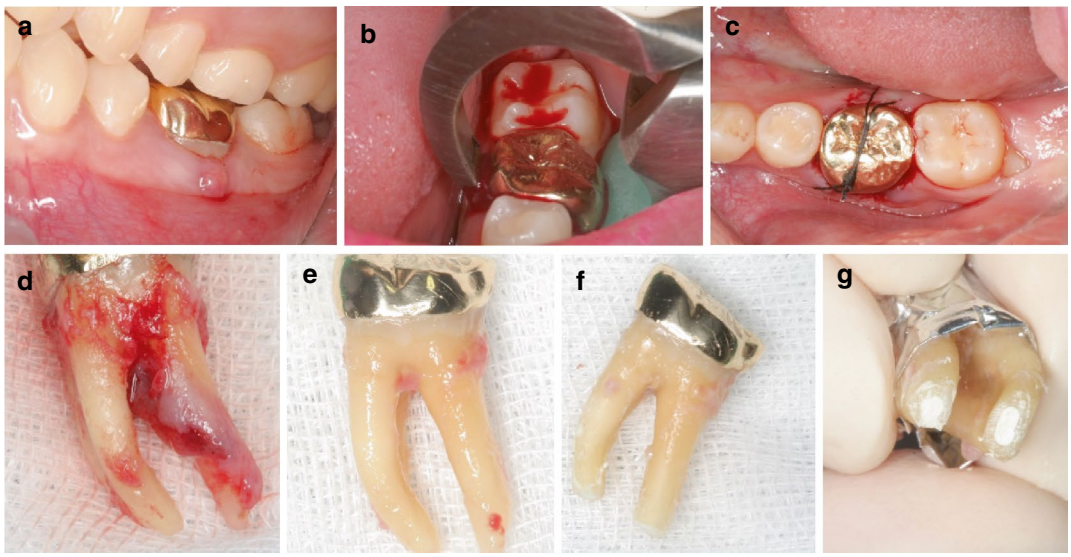


Fig. 10.1 Surgical procedure. (**a**) Preoperative photo, (**b**) intraoperative photo of extraction, (**c**) fixation of the donor tooth using sutures after transplantation, (**d**) extracted tooth, (**e**) after root planning, (**f**) after apicoectomy, (**g**) after retrograde filling using MTA (by Courtesy of prof. Son SA)

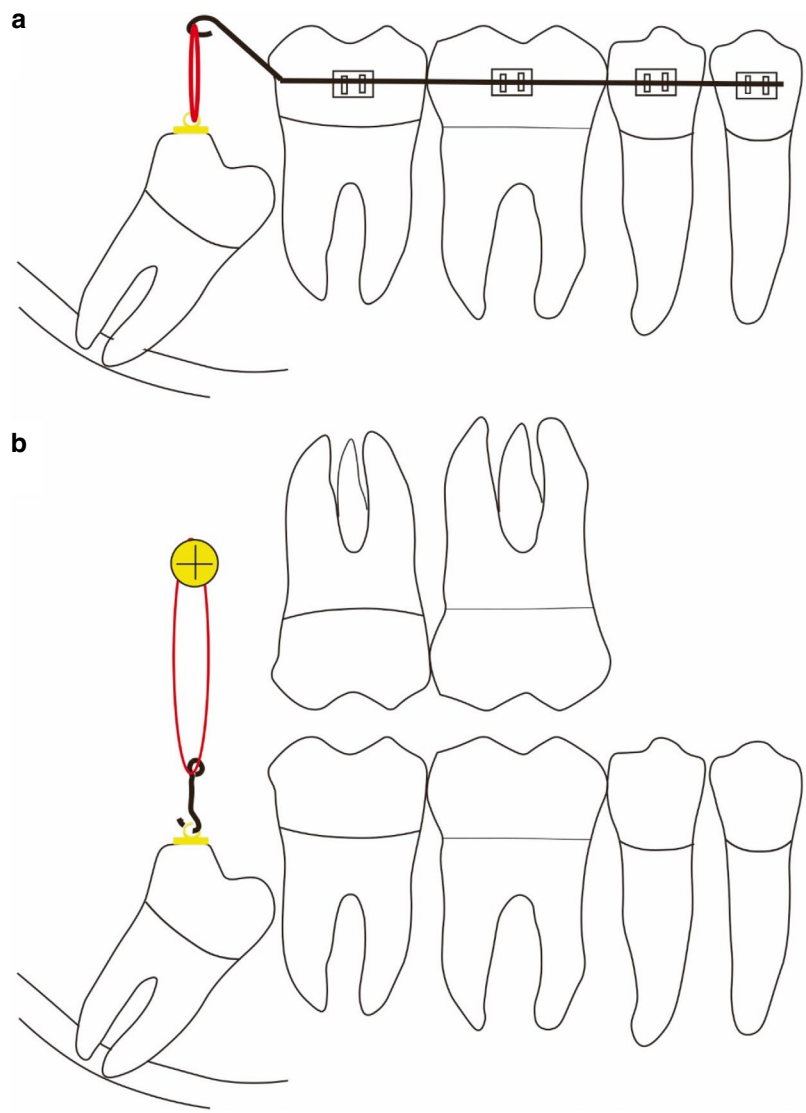


Fig. 11.3 Orthodontic force application for the traction of impacted third molar. (**a**) Orthodontic appliances can be used for the traction of impacted tooth, (**b**) the screw anchorage system for the traction of impacted tooth

health outcomes. This paradigm shift underscores the importance of maintaining jawbone integrity, not only for immediate functional and aesthetic needs but also for future dental interventions. As we continue to explore the intricacies of ridge preservation, this practice has become an integral component of modern dental care, reflecting a deep understanding of oral physiology and a commitment to preserving the natural structure of the mouth for long-term health and wellness.

Post-extraction, the alveolar ridge is subject to a natural resorption process, where the bone that previously supported the tooth begins to diminish both in volume and density [32]. This phenomenon is most pronounced within the first few months following an extraction. If unchecked, this resorption can lead to significant structural changes in the jawbone, compromising the integrity and shape of the oral cavity [30]. Preserving the alveolar ridge is critical for several reasons. Structurally, it maintains the jawbone's shape, which is essential for facial aesthetics. Loss of bone can lead to a sunken appearance around the mouth, significantly altering one's facial profile. Functionally, the ridge serves as the foundation

for any future dental prostheses. A well-preserved ridge ensures that options like implants can be securely anchored, providing a stable and durable solution that mimics the natural function of real teeth.

The state of the alveolar ridge post-extraction directly influences the range and success of restorative dental options available to a patient. A well-preserved ridge offers a robust foundation for dental implants, which are increasingly popular due to their natural appearance and functionality. Implants require sufficient bone for placement, and a diminished alveolar ridge can necessitate additional procedures like bone grafting, complicating, and prolonging the treatment process. Furthermore, a preserved ridge aids in maintaining proper alignment and spacing of the remaining teeth. When the ridge deteriorates, adjacent teeth can shift, leading to misalignment issues that affect bite, chewing efficiency, and even speech. These shifts can also create spaces that are difficult to clean, escalating the risk of periodontal disease and tooth decay.

The field of dental surgery has seen significant advancements in the techniques for ridge preservation, each designed to mitigate the effects of bone resorption following tooth extraction. These techniques vary in complexity, materials used, and suitability for different clinical scenarios (Fig. 11.4). The primary objective of all ridge preservation techniques is to maintain the volume

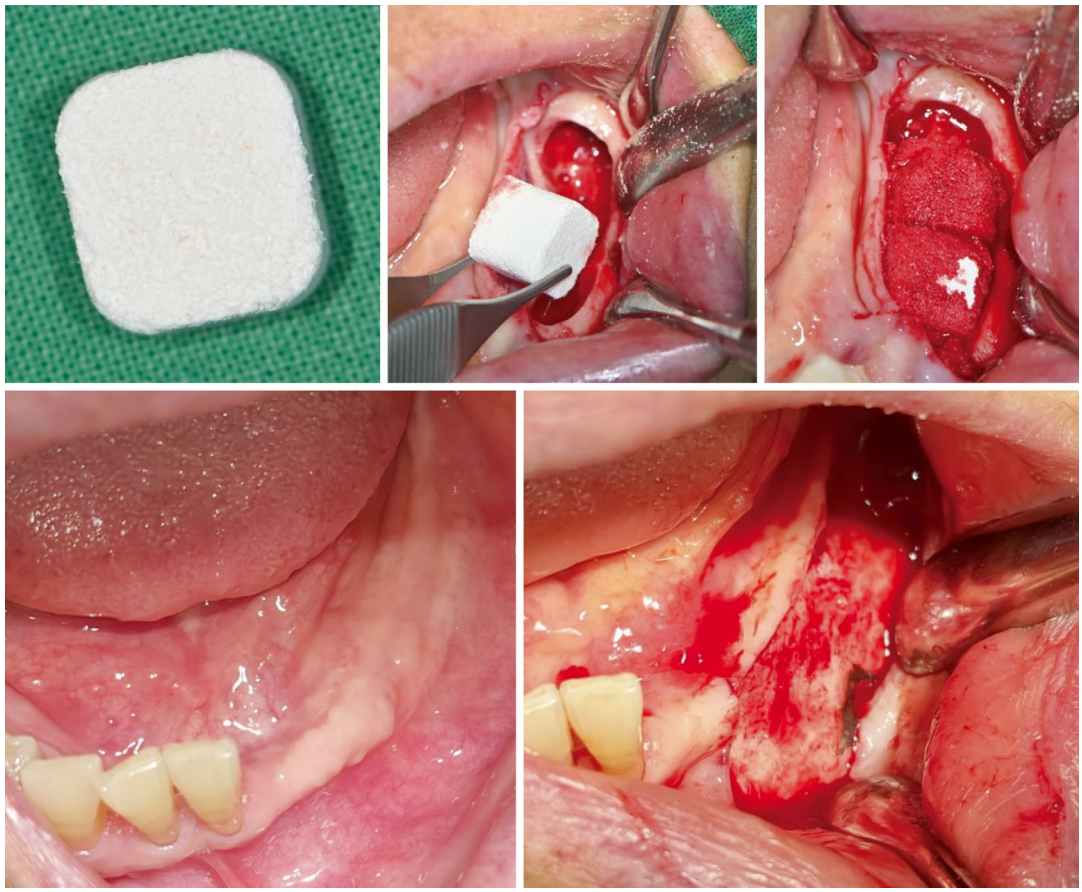


Fig. 11.4 Using a combination graft of porcine-derived hydroxyapatite and type I collagen after tooth extraction. The grafts are prepped for placement into the alveolar ridge defect (upper row). Post blood absorption, the grafts turn red. One-month postoperation, the area is healing smoothly (lower left). Six months post-grafting, during implant installation, significant bone regeneration is observed in the alveolar ridge (lower right)

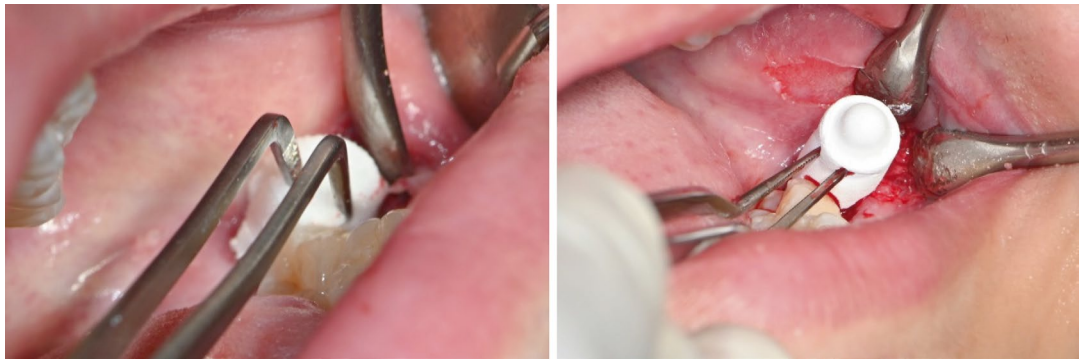


Fig. 11.6 Applying hemostat in the extraction socket. A dental gelatin sponge is used for smaller sockets (left), while a collagen-based sponge suits larger sockets (right)

including natural and synthetic polymers, inorganic materials, and metal-containing materials, are utilized in various forms for wound care and surgeries (Fig. 11.6). Their development aims to improve safety and efficacy in controlling bleeding during dental surgeries [62].

11.6 Conclusion

In conclusion, this chapter underscores the remarkable progress in tooth extraction and grafting techniques. It acknowledges the pivotal role of sustainable practices in dentistry, highlighting the eco-friendly potential of using extracted teeth as graft material. Looking forward, the chapter anticipates further advancements and research in less invasive extraction methods, innovative grafting materials, and sustainable practices. This evolution in dental techniques aligns with the broader healthcare objectives of reducing patient discomfort, enhancing procedural efficiency, and promoting environmental responsibility in dental care.

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