



BE PREPARED Preparation and organization are important factors in tooth extraction, as completing extractions in a consistent, orderly manner will decrease the incidence of complications.

INSIGHTS IN DENTISTRY

Oral Surgery to Remove Teeth in Cats

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Exodontia, or extraction of teeth, is a commonly performed oral surgery procedure in cats. The objective with extractions is to remove the entire tooth and root without causing unnecessary damage to the surrounding soft tissue or bone.¹ Performing extractions in a consistent, orderly manner will decrease the incidence of complications.² The easiest way to avoid surgical complications is through adequate preparation, as described in the following tips:

- **Always consider your skill and knowledge.** If a procedure is beyond your capability based on your knowledge, skill, and/or the pathology present, it is best to refer the patient to a board-certified veterinary dentist.
- **Understand basic anatomy (FIGURE 1).** To avoid damaging key structures during extractions, you must be familiar with tooth anatomy and location of neurovascular bundles, the mandibular canal, nasal cavity, and the orbit.
- **Always obtain full-mouth intraoral radiographs.** Radiographs enable you to carefully evaluate the entire tooth, the periapical area, and the surrounding bone in order to formulate a treatment plan.
- **Consider all information.** To make an appropriate treatment decision for each tooth, combine what you see clinically, what you see radiographically, and clients' commitment to their pet's oral health care.

- **Use preemptive multimodal pain management.** Doing so will provide oral surgery patients with a more comfortable intra- and postoperative period.
- **Use controlled forces and a short finger stop (FIGURE 2).** Using a short finger stop prevents

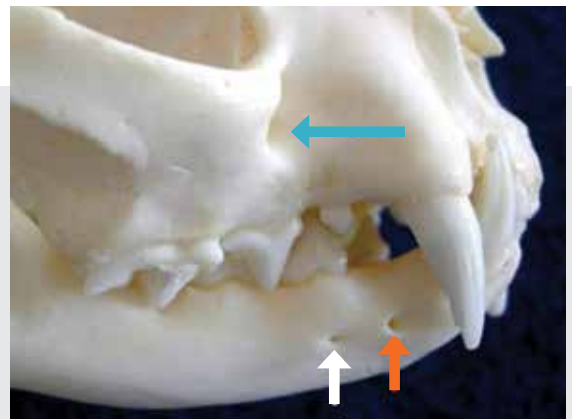


FIGURE 1. Foramina. The inferior alveolar neurovascular bundle exits the mandibular canal at the mental foramina. The middle mental foramen is in the interdental space between the mandibular canine tooth and third premolar tooth in the ventral half of the mandible beneath the lip frenulum (orange arrow). The caudal mental foramen is ventral to the mandibular third premolar (white arrow). The infraorbital neurovascular bundle exits from the infraorbital foramen, located apical to the maxillary third premolar where the zygomatic arch meets the maxilla (blue arrow).

inadvertent penetration of the sublingual space, mandibular canal, nasal cavity, and orbit, should the elevator slip during extraction.

- **Use appropriately sized, sharp instruments (FIGURE 3).** Although the oral cavity is not considered a sterile surgical site, surgical instruments that are used to penetrate soft tissue or bone should always be sterilized before each use.³
- **Use magnification and lighting.** By preventing awkward postures and supporting a neutral spine, head-mounted lighting and magnification reduce the surgeon's eye, neck, and shoulder strain.⁴
- **Be one with the periodontal ligament!** The periodontal ligament has fibers that attach to the cementum of the tooth root and to the alveolar bone surrounding the tooth root (FIGURE 4). Stretching and breaking down the periodontal ligament is the key to successful tooth extraction.¹ For everything you do while extracting teeth from cats (creating flaps, removing alveolar bone, sectioning of multirooted teeth), the end goal is straight-line access to the periodontal ligament space with your dental elevator or luxator.

For all but the simplest extractions, consider raising a gingival flap to increase visualization and allow for



FIGURE 2. Short finger stop, used to prevent inadvertent penetration of the sublingual space, mandibular canal, nasal cavity, and orbit if the elevator slips during extraction.

tension-free closure of the gingival tissues.¹ A surgical extraction involves creating a mucoperiosteal flap, removing buccal alveolar bone, sectioning multirooted teeth into single-root segments, and apposing the mucoperiosteal flap and the palatal or lingual gingival tissues after extraction of the tooth.

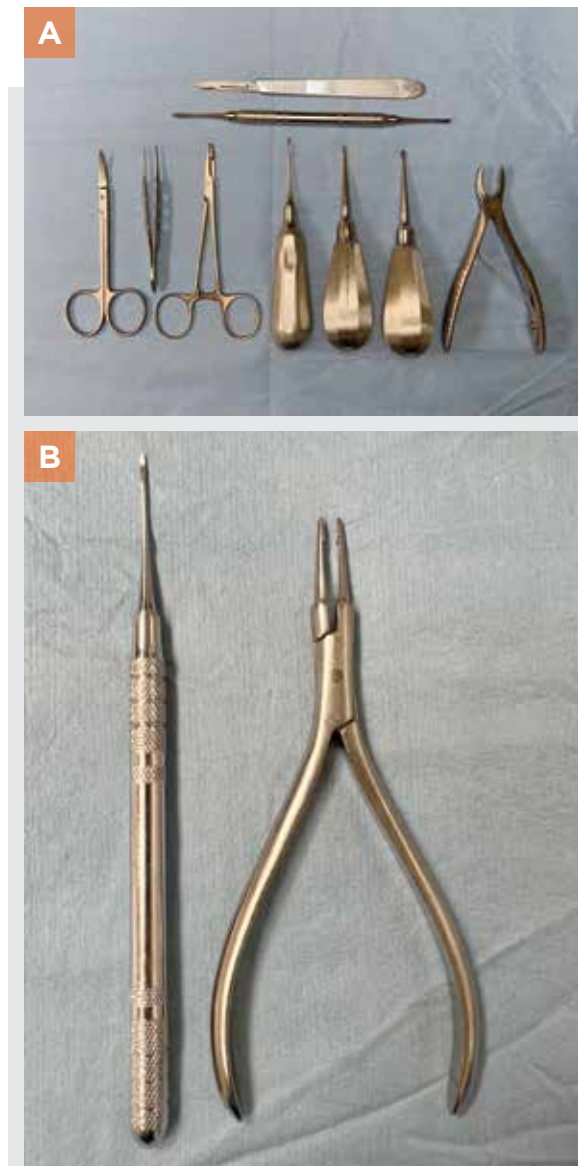


FIGURE 3. Instruments for an oral surgery pack for a cat. **(A)** Top to bottom: 15 or 15C scalpel blade and scalpel handle (either flat or round), periosteal elevator. Left to right: iris scissors (some prefer LaGrange or Metzenbaum), small thumb forceps, small needle holder, small 1.3-mm dental luxator, wing-tipped elevators (sizes 2 and 3), small extraction forceps. Not shown: lip retractors, 5-0 absorbable suture with reverse cutting or taper needle and burs. Burs commonly used during extraction of cat teeth include round burs (Nos. 1/2, 1, and 2), pear-shaped burs, and diamond burs. **(B)** Root tip pick and root tip extraction forceps (both useful for removing fractured root tips).

STEPS FOR SURGICAL EXTRACTION

Following the same steps during all surgical extractions for all patients ensures consistent surgical outcomes.

1. To minimize contamination of the surgical site with calculus and bacteria, complete basic oral care (supragingival and subgingival scaling and polishing) before beginning the oral surgery.¹
2. Obtain full mouth radiographs.
3. Use preemptive multimodal pain management, including intraoral regional nerve blocks.
4. Make an intrasulcular incision around the tooth or teeth to be extracted by using a 15 or 15C scalpel blade.

5. Create a mucoperiosteal flap. A mucoperiosteal flap is a full-thickness flap, elevated beyond the mucogingival line to include the periosteum. Mucoperiosteal flaps improve visualization during extractions. Several principles of flap design must be considered when planning the mucoperiosteal flap (BOX 1). The choice of flap—envelope flap, triangular flap (1 vertical releasing incision), or broad-based pedicle flap (2 diverging vertical releasing incisions)—depends on the location of the tooth to be extracted, the patient, and the surgeon's preferences.

- **Envelope flap (FIGURE 5):** The envelope flap provides the least amount of visualization and tissue for closure. It may be used for simple extractions or as the first step in crown amputation with intentional root retention. To create an envelope flap, make a horizontal incision in the gingival sulcus at the crestal bone, and elevate the attached gingival tissue

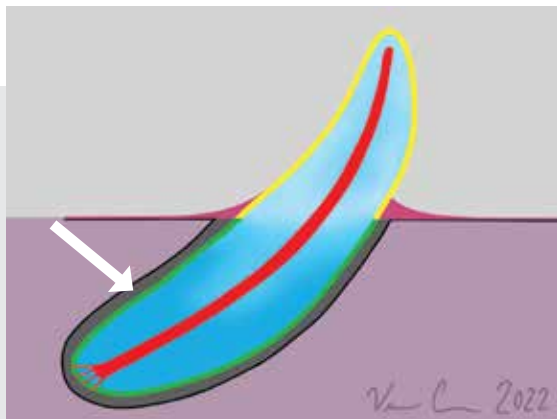


FIGURE 4. Periodontal ligament. The periodontal ligament (white arrow) has fibers that attach to the cementum and to the alveolar bone surrounding the tooth root.

BOX 1 Principles to Be Considered When Planning a Mucoperiosteal Flap

- The apical portion of the flap must be wider than the coronal portion.
- The flap must be large enough to allow for adequate visualization of the surgical area.
- The flap should be gently handled.
- The flap should be approximated (sutured) over healthy bone without tension.

with a periosteal elevator. The horizontal incision may extend only to the mesial and distal aspects of the tooth involved, or it may be extended to incorporate adjacent teeth and allow for greater flap reflection and exposure.⁵ A vertical releasing incision is not made. If the envelope flap is not elevated beyond the mucogingival line, then it is considered a

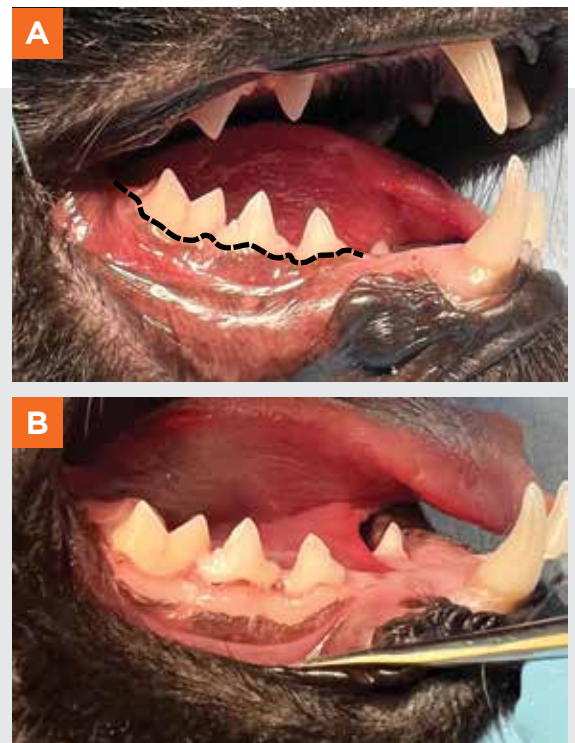


FIGURE 5. Envelope flap. (A) Planned flap elevation (black dashed line); (B) envelope flap after elevation.

Figure 4: courtesy Vica Combs

mucogingival flap, not a mucoperiosteal flap.

- **Triangular (3-cornered) mucoperiosteal flap (FIGURE 6):** Create an envelope flap and 1 vertical releasing incision that extends apical to the mucogingival line (FIGURE 6A). Use a periosteal elevator to elevate the flap from the alveolar bone (FIGURE 6B). The attached gingiva is tightly adhered to the underlying alveolar bone. Careful elevation in this area prevents tearing of the flap.
- **Pedicle or broad-based (4-cornered) mucoperiosteal flap (FIGURE 7):** Make an intrasulcular incision around the tooth, and then make 2 diverging vertical releasing incisions at the mesial and distal aspects of the

tooth/teeth to be removed that extends beyond the mucogingival line (FIGURE 7A). Use a periosteal elevator to elevate the flap from the alveolar bone (FIGURE 7B). As with a triangular flap, be careful when elevating the attached gingival tissue at the mucogingival line.

6. Perform alveolectomy (removal of buccal alveolar bone) (FIGURE 8). To facilitate tooth extraction and identify the periodontal ligament space, remove buccal bone from the root surface. Use the alveolar juga (bony prominence over the root) to guide the removal of buccal alveolar bone overlying the tooth root. To remove the buccal bone, use a small round or pear-shaped bur in a high-speed handpiece in a light paintbrush or sweeping motion. Begin by removing the buccal bone from the coronal half of the root surface (approximately 50% of buccal bone). The width of the buccal bone removed

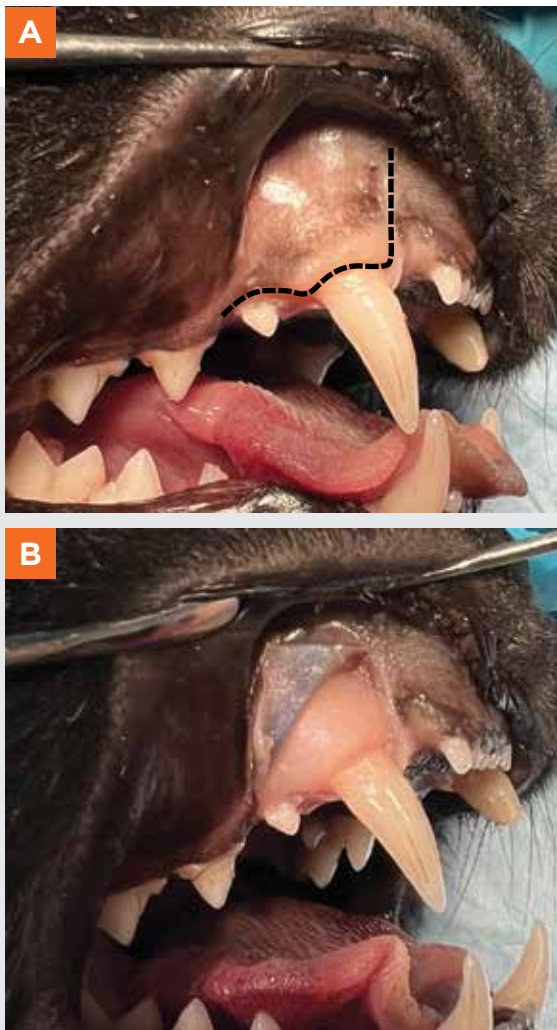


FIGURE 6. Triangular (3-cornered) mucoperiosteal flap. (A) Planned flap elevation (black dashed line); (B) triangular flap after elevation. Note the extension of the vertical releasing incision beyond the mucogingival line.



FIGURE 7. Pedicle or broad-based (4-cornered) mucoperiosteal flap. (A) Planned broad-based flap (black dashed line); (B) broad-based flap after elevation. Note the extension of the vertical releasing incisions beyond the mucogingival line.

should be the same width as the root. Extend the alveolar bone removal to expose the periodontal ligament space on either side of the tooth root. A very small round bur in a high-speed handpiece held perpendicular to the tooth root may be used to outline the periodontal ligament space. Clear visualization of the periodontal ligament space allows the surgeon to properly place the dental elevator or luxator. If elevation of a particular tooth root is difficult, consider removing more buccal bone.

7. Section multirooted teeth. To facilitate extraction, section multirooted teeth into single-rooted segments. To allow straight-line access into the periodontal ligament space with the dental elevator

or luxator, use a round bur or cross-cut bur to section the tooth into the single-rooted segments.

■ **Sectioning 2-rooted premolars (FIGURE 9):**

Identify the furcation of the tooth and make 2 diagonal cuts. Remove the diamond portion of the crown to allow straight-line access when placing the dental elevator or luxator into the periodontal ligament space of the tooth roots.

■ **Sectioning the mandibular molar (FIGURES 10 AND 11):**

To allow straight-line access to the distal root, identify the furcation and make the first cut in line with the mesial side of the distal root. Make an additional horizontal cut in the distal crown and remove the rectangular piece of tooth crown. This additional cut decreases



FIGURE 8. Alveolectomy, right maxillary canine tooth.

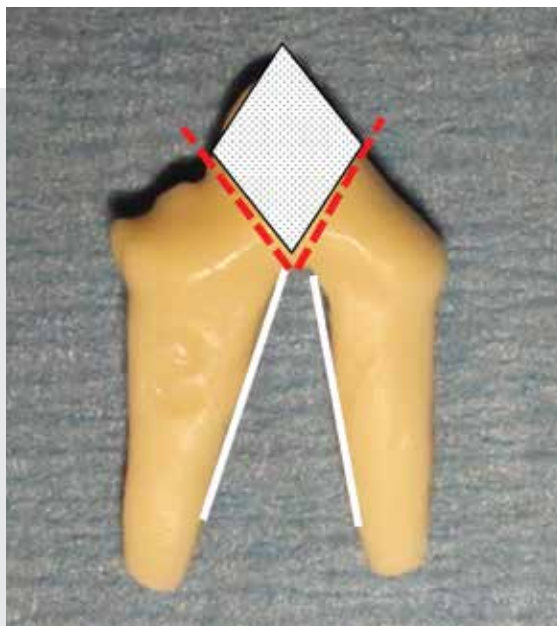


FIGURE 9. Sectioning plan for 2-rooted premolars.

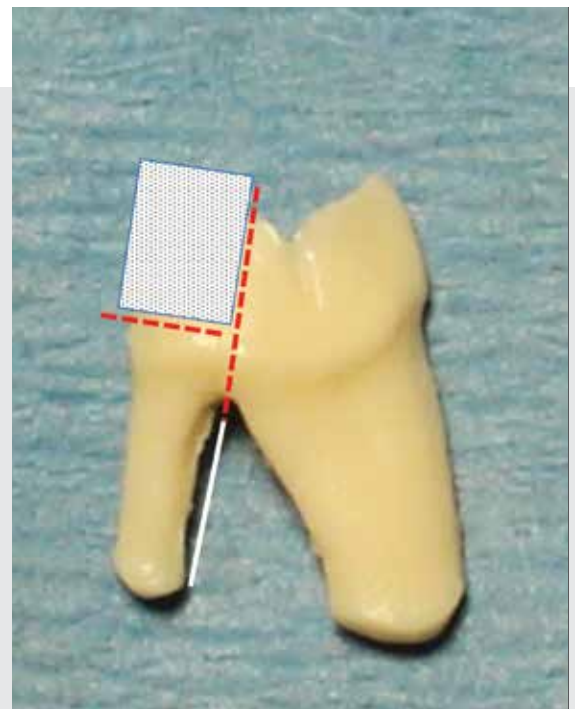


FIGURE 10. Sectioning plan for mandibular molar.



FIGURE 11. Sectioned right mandibular premolars and molar.

the incidence of breaking the distal root during elevation and extraction because it eliminates the long “lever arm” of the distal crown and allows for easier access to the mesial portion of the distal root. Extract the distal root first, thereby providing clear access to the distal portion of the mesial root.

■ **Sectioning the maxillary fourth premolar (FIGURES 12 AND 13):** To separate the distal

root from the 2 mesial roots, identify the furcation and make the first cut in line with the mesial side of the distal root (FIGURE 12A). To separate the mesiobuccal and palatal roots, position the bur nearly parallel to the long axis of the tooth and perpendicular to the palate (FIGURE 12B). Do not begin elevating roots until all 3 roots are distinct and separate. Elevate the distal root first, followed by the mesiobuccal root and finally the palatal root. Removing bone on the buccal side of the palatal root may improve visualization of the palatal root and facilitate extraction.

8. Elevate each tooth root segment (FIGURE 14). When using the dental elevator or luxator, gently cradle the patient’s head in your opposite hand so you can deliver controlled force and neutralize the pressure applied during tooth extraction. Work with

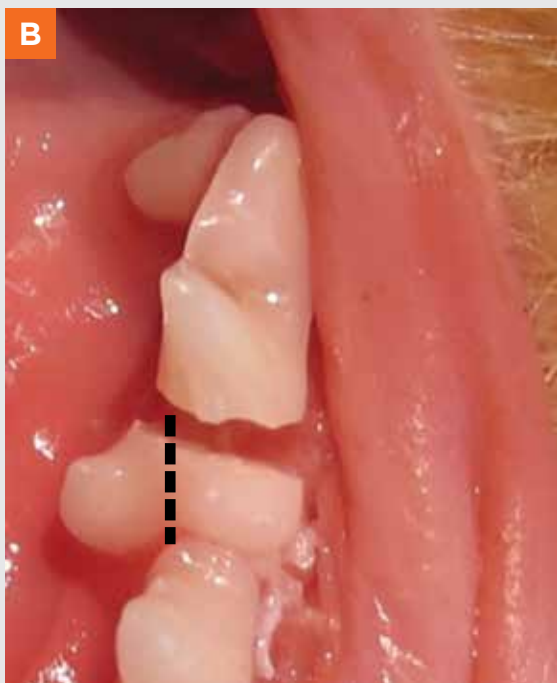
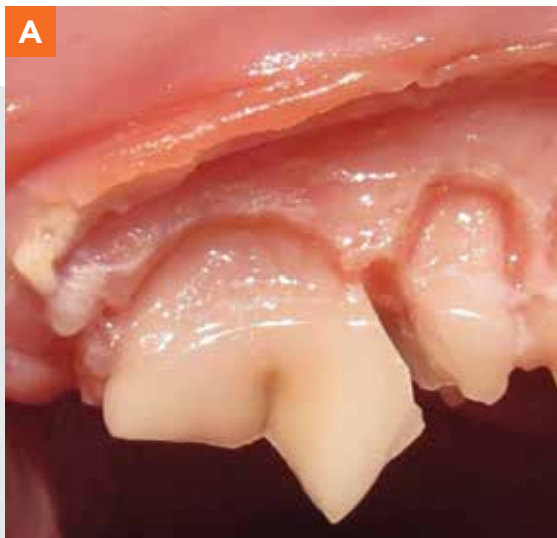


FIGURE 12. Sectioned right maxillary fourth premolar. (A) Section between the distal root and the 2 mesial roots (patient in lateral recumbency); (B) section between the mesiobuccal root and the palatal root (patient in dorsal recumbency) (black dashed line).



FIGURE 13. Sectioned right maxillary premolars.



FIGURE 14. Placing the elevator into the periodontal ligament space of the mesial root of the left mandibular fourth premolar of a cat in right lateral recumbency. Working with the apex of the tooth away from you, introduce the dental elevator or luxator into the periodontal ligament space while using a short finger stop.

the apex of the tooth away from you so the periosteal elevator, dental elevator, or luxator is directed away from you.¹ Grasp the handle of the dental elevator or luxator in the palm of your hand and extend your index finger down the shaft of the instrument to within a few millimeters of its tip. Use a short finger stop to prevent inadvertent penetration of the sublingual space, orbital region, or nasal cavity if the elevator slips. Introduce the dental elevator into the space between the tooth and alveolar bone that is occupied by the periodontal ligament. To facilitate stretching and tearing the periodontal ligament, rotate the elevator and hold steady pressure for 15 to 30 seconds. As space allows, place the elevator further apically and repeat the elevation. Continue elevating circumferentially around the tooth until the tooth is loose. Alternatively, a dental luxator may initially be placed in the periodontal ligament space and moved side to side to create a cutting action at the luxator tip. The luxator is then pressed apically to sever the periodontal ligament, creating a wedging force.⁶ Note that luxators are made of softer metal and should not be rotated because the thin tip of the instrument will bend and break.¹

9. Extract each tooth root segment (FIGURE 15). After the tooth is very mobile, use extraction forceps and grasp the tooth near the cementoenamel junction as close to the root as possible. Gently rotate the extraction forceps along the long axis of the tooth root while pulling the tooth root segment coronally. Pushing the tooth toward the apex with the extraction forceps may help break down the periodontal ligament fibers. Applying excessive



FIGURE 15. Extraction forceps positioned at the cementoenamel junction of the left mandibular canine tooth.

force with the extraction forceps may lead to root fracture. After tooth removal, always inspect the extracted root to be sure the apex is smooth and round. A rough or jagged root edge indicates that a root remnant probably remains in the alveolus.²

10. Perform alveoplasty (bone recontouring). To remove any diseased bone and to smooth rough alveolar bone edges, use a medium-grit football diamond bur in a high-speed handpiece with water coolant. Palpate the extraction site to confirm that no sharp bony projections remain.

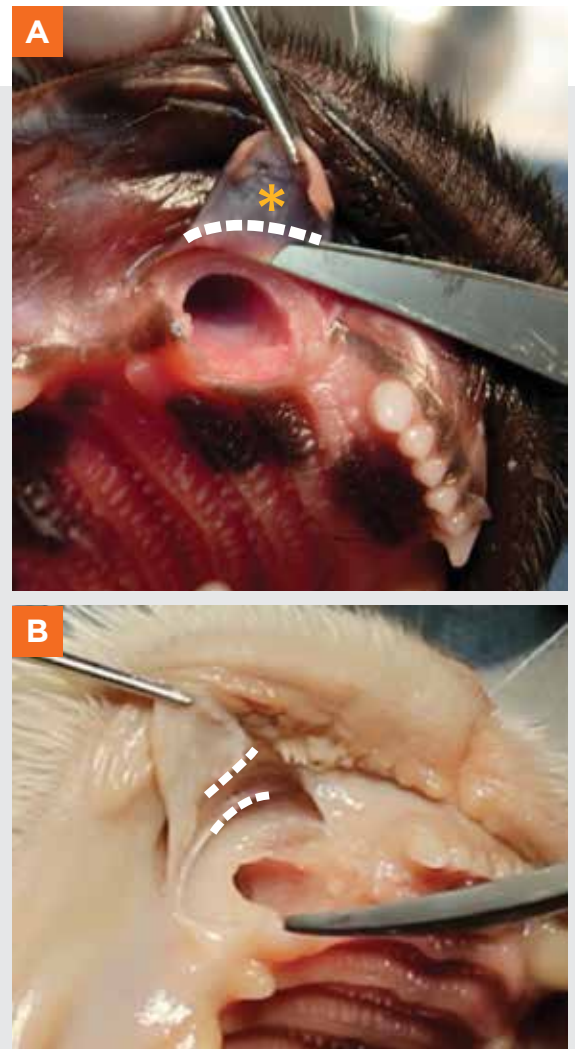


FIGURE 16. Releasing the periosteum. (A) Undermine the tissue plane between the alveolar mucosal tissue and the periosteum. These tissues are apical to the mucogingival line (white dashed line). The attached gingival tissue is coronal to the mucogingival line (yellow asterisk). (B) Periosteum partially released on the right side of the flap (white dashed lines).

11. Debride, curette, and flush the alveolus. Debride the soft tissue edges of the extraction site. Introduce a curette into the alveolus to remove granulation tissue, debris, necrotic bone, and bone fragments from the alveolus. Flush the empty alveolus with saline to remove any persistent debris.
12. Release the periosteum (**FIGURE 16**). To eliminate tension on the mucoperiosteal flap before closure, incise the periosteum along the entire width of the flap. Use a blade or scissors to incise the periosteum on the alveolar side of the mucoperiosteal flap just apical to the mucogingival line. The tissue coronal to the mucogingival line is the attached gingiva and is 1 layer thick. If you try to cut the attached gingival tissue, you will cut a portion of your flap off. Place the scissors between the mucosa (away from you in **FIGURE 16A**) and periosteum (toward you in **FIGURE 16A**), and undermine to separate the

2 layers. Place 1 blade of your scissors into the “tunnel” that you created with undermining and then cut the periosteum. When the periosteum is properly released, the mucoperiosteal flap will cover the empty alveolus without tension. To allow for easier placement of the suture needle and to minimize tearing of the tissues when suturing, elevate the lingual or palatal mucosa and 2 mm of the attached gingival tissue on the mesial and distal sides of the extraction site. Periosteum release can be completed when elevating the flap or after tooth extraction.

13. Obtain a postoperative radiograph. Always document complete extraction of the entire tooth root without unnecessary damage to the surrounding bone.
14. Suture the mucoperiosteal flap. If an envelope flap was used, place sutures to appose the gingival tissue

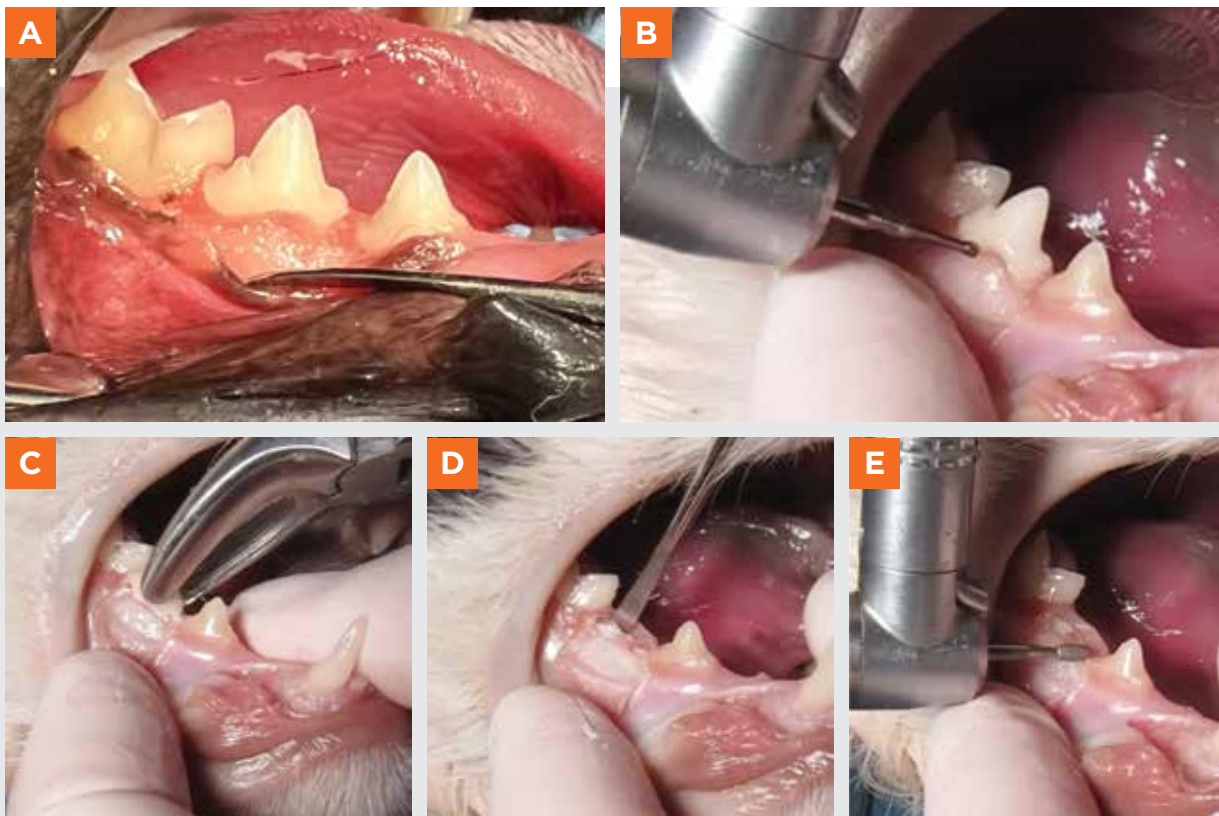


FIGURE 17. Coronectomy of the right mandibular fourth premolar tooth in a cadaver specimen. Note that the tooth did not have a tooth resorption lesion and was used for demonstration purposes only. **(A)** Create a small envelope flap. The gingiva is minimally reflected to expose the tooth and marginal alveolar bone. If more exposure is needed, a triangular or pedicle flap may be used. **(B)** Amputate the tooth at or slightly below the alveolar bone margin. Retract the gingiva and use a No. 2 round bur in a high-speed handpiece with water coolant to amputate the affected tooth at or slightly below the alveolar crest. Remove all visible tooth structure. Cut almost all the way through the tooth, but avoid cutting all the way through the tooth to avoid inadvertent damage to the lingual or palatal mucosal tissue. **(C)** Use extraction forceps to “break” the crown off. **(D)** Elevate the lingual or palatal mucosa from the bone with a periosteal elevator. **(E)** Use a medium-grit diamond bur to remove the remaining tooth structure and smooth sharp bony projections.

BOX 2 Steps for Coronectomy

1. Create a flap (**FIGURE 17A**).
2. Amputate the tooth at or slightly below the alveolar bone margin (**FIGURE 17B**).
3. Remove the tooth crown (**FIGURE 17C**).
4. Elevate the lingual or palatal mucosal tissue (**FIGURE 17D**).
5. Perform alveoplasty (**FIGURE 17E**).
6. Take a postoperative radiograph.
7. Suture the flap.

only in the interdental papilla. If a triangular or broad-based flap was used, the suture line should be supported by intact healthy bone. With the flap in normal position, the mucoperiosteal flap is apposed to the palatal or lingual mucosal tissue by using 5-0 absorbable sutures and a reverse cutting or tapered needle in the surgeon's choice of pattern. Closing oral surgery sites allows for primary intention healing, which lessens the amount of re-epithelialization, collagen deposition, contraction, and remodeling needed for healing.⁷

CORONECTOMY (MODIFIED EXTRACTION)

A coronectomy, or modified extraction technique (**FIGURE 17 AND BOX 2**), has been described as a treatment for root replacement resorption, commonly referred to as type 2 tooth resorption, in cats.⁸ Using

this technique requires preoperative dental radiographs to confirm type 2 resorption. If radiographs confirm type 1 tooth resorption, proceed with surgical extraction as described above. If the radiographs confirm type 2 tooth resorption, the periodontal ligament space is not visible, the root structure is not clearly defined, and the root structure is similar in density to the surrounding alveolar bone, then a coronectomy may be completed. Teeth with concurrent endodontic or periodontal pathology or teeth in a patient with feline chronic gingivostomatitis cannot be treated with coronectomy.

POSTOPERATIVE CARE

Discharge patients with postoperative analgesics that are customized for each patient. Instruct clients to feed the cat a soft diet (either softened kibble or canned food) for 7 to 14 days and to not allow the cat access to treats or toys that may affect the sutures during the postoperative period. A 2-week complimentary recheck examination allows the surgeon to recheck the oral surgery sites and provides the staff an opportunity to review the patient's preventive oral healthcare plan with the client.¹

CONCLUSION

To minimize extraction complications and decrease surgeon stress, be aware of anatomy and the relationship of the tooth roots to other structures of the head, formulate a plan, use intraoral radiographs, use proper instrumentation and technique, apply controlled forces, and be patient. Completing extractions in a consistent, orderly manner will decrease the incidence of complications.²

The best way to gain confidence and improve your oral surgery skills and knowledge is to participate in a wet lab for tooth extraction in cats. If a particular case or circumstance is beyond your ability, referral to a board-certified veterinary dentist is in the best interest of the patient.² **TVP**

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Dr. Charlier brings to dentistry continuing education more than 35 years of small animal practice, specialty practice, and ownership experience. She has received the Peter Emily Outstanding Candidate Award and the Fellow of the Year award. In 2004, she created VDENT (Veterinary Dental Education, Networking and Training) to educate the entire veterinary healthcare team about the value of oral health and its effects on all of our patients. In 2017, she was named the NAVC Small Animal Speaker of the Year.



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