ASK A SPECIALIST

Anesthetic Strategies for the Dental Patient

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Pain interventions should be aligned with the degree of pain stimulus experienced by the animal.[1] Ideal pain management would consist of a preventive, multimodal approach, intervening in the pain pathway at multiple points and attempting to avoid any perception of pain by the patient.[1-3] To achieve this goal, a combination of oral, intravenous, locoregional, and nonpharmaceutical agents can be used to create a full complement of strategies to mitigate pain.

What are the commonly used analgesics in dental patients?

Analgesia has been proven to be more effective when administered preemptively (before the procedure) than postoperatively.[4-6] Oral preemptive analgesia and sedation are often achieved with premedication designed to be administered by the client before bringing the patient to the hospital.[7] Agents generally consist of gabapentin and trazodone, which have wide safety ranges. Pregabalin has also been investigated for preemptive use.[8] Although generally aimed at reducing anxiety and allowing for ease of obtaining intravenous access, gabapentinoids can also be administered before the procedure. Although NSAIDs are also powerful analgesics, they are reserved for postprocedure administration due to their potential to lead to renal insult if hypotension has been difficult to mitigate under general anesthesia. Acetaminophen (dogs only) is also being increasingly added to the armamentarium of perioperative oral pain control options.[1,9,10]

Abstract

Dental care for small animal veterinary patients requires high-quality anesthesia and pain management. Dental patients often have significant comorbidities along with their need for dental care, continuing into the geriatric period. With appropriate preanesthetic preparation and perianesthetic management, these patients can still receive quality dental care to support them throughout their life. Robust pain management and techniques that decrease inhalant anesthetic minimum alveolar concentrations can help manage common comorbidities such as mitral valve disease and chronic kidney disease. However, complex patient status or advanced dental disease may present a challenge to the provider. For such patients, anesthesia-free dentistry is not recommended; instead, referral to a specialist team will reduce surgery and anesthesia time and enable use of advanced monitoring techniques.

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Take-Home Points

- Pain control intervenes in the pain pathway at multiple points, and a multimodal, preemptive approach supports a continuum of analgesia throughout the patient experience.
- Locoregional anesthesia offers numerous benefits for pain management and techniques for reducing intraoperative inhalant anesthetic minimum alveolar concentrations.
- Periodontal disease can increase the risk for development of new renal or cardiac comorbidities and can exacerbate preexisting disease; although dental work should be encouraged for patients with these conditions, patients must be properly prepared and their conditions managed.
- Anesthesia-free dentistry is not a viable treatment option.
- A specialist dentistry and anesthesia team can help improve patient outcomes, especially for patients with complex status or advanced dental disease.

NSAIDs provide excellent pain control for oral surgery, typically for 24 hours, and can be given intraoperatively or postoperatively (especially advantageous in the initial postoperative period when a patient may resent oral manipulation). NSAIDs should be used with aligned standards in feline patients (robenacoxib or low-dose meloxicam only) and in all patients with metabolic disease, especially renal impairment.[11] Preoperative testing (including CBC, serum chemistry, and urinalysis) and close intraoperative blood pressure monitoring are critical for minimizing any anesthetic complications. Opioids are the mainstay analgesic for acute pain, and their safety index is favorable.[12] Full µ agonists (e.g., methadone, fentanyl, hydromorphone, morphine) are commonly used during surgery. For postoperative pain control, buprenorphine provides a step-down partial µ agonist effect, but it can be a useful option to send home with patients or administer in a sustained-release formulation. Butorphanol is generally *not* adequate for pain control because its effect size is limited.[13]

Additional constant-rate infusions (CRIs) have been investigated to complement opioids. Dexmedetomidine (an α_2 agonist) has been shown to be as effective as morphine for postoperative pain control in dogs undergoing invasive surgery.[3] Ketamine, an NMDA (*N*-methyl-D-aspartate) receptor antagonist, has been shown to effectively reduce scores indicating acute pain but also to prevent conversion to or treatment of chronic pain for oncologic palliative care.[3]

Which locoregional techniques are commonly used in dental practice?

Locoregional techniques are excellent for blocking transduction and transmission of the pain stimulus, beginning before any surgical stimulus is created until long into the postoperative period if long-term techniques are used.[14] Locoregional anesthesia reduces overall systemic drug consumption, recovery times, and inhalation anesthetic minimum alveolar concentrations (MACs).[15]

Commonly used locoregional techniques include infraorbital, mental, and caudal mandibular blocks, which are best learned in a hands-on laboratory and are taught in most extraction courses. For a list from the lead author, including a virtual option, see **vdspets.com**.

Infraorbital block (FIGURES 1 AND 2): If properly performed, the infraorbital block affects the ipsilateral maxilla teeth, as well as associated soft tissues.[16,17] The infraorbital canal runs rostrally just above the apices of the maxillary fourth premolar and exits the maxilla over the distal root of the third premolar. To approximate the dorsoventral location, imagine the fourth premolar being approximately the same size mesiodistally as corona-apically. Measure the width of the tooth and then that same distance dorsally from the cusp tip. The infraorbital canal is just apical to this point. Starting approximately over the second premolar parallel to the maxilla, advance the needle caudally, close to the maxillary bone. The depth is controversial; some veterinary dentists barely enter the needle into the canal, and others place the needle all the way caudally to the level of the second molar. These authors generally recommend insertion to the level of the medial canthus of the eye in mesocephalic and dolichocephalic dogs.[16] Correct placement can be confirmed by gentle lateral movement of the needle, allowing it to engage the canal wall.

In brachycephalic dogs and in cats, the infraorbital canal is very short, which may easily allow for orbital penetration.[16] The block will diffuse distally to the molars if a finger is placed over the foramen for 30 to 60 seconds after injection.[17]

Mental block (FIGURES 3 AND 4): The mental block affects the inferior alveolar nerve and anesthetizes the ipsilateral canine tooth to the central incisor, including the surrounding bone and associated soft tissue.[16,17] For the block to be effective, the needle must be placed slightly within the canal.

In dogs, the middle mental foramen is located rostrocaudally apical to the mesial root of the second premolar; in cats, it is midway in the diastema between the canine tooth and the third premolar.[16,18]

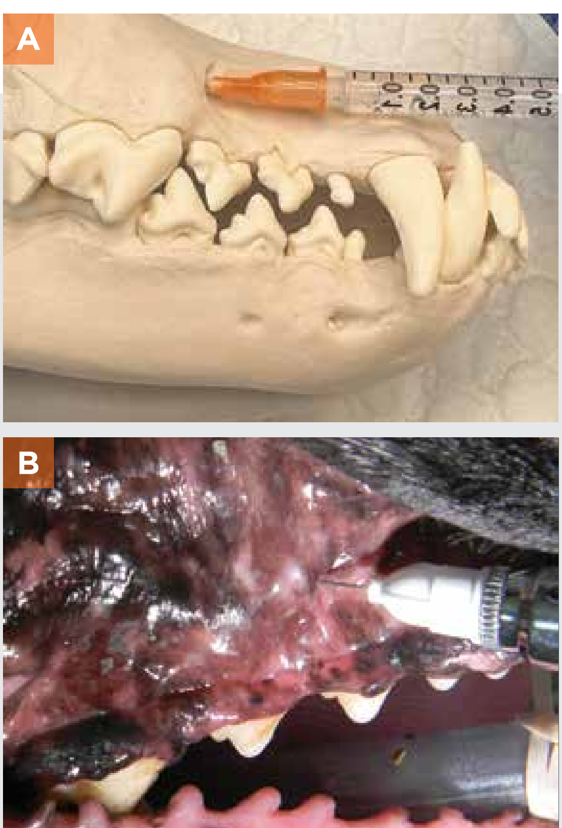

FIGURE 1. Infraorbital block demonstrated on **(A)** a canine skull and **(B)** a specimen.

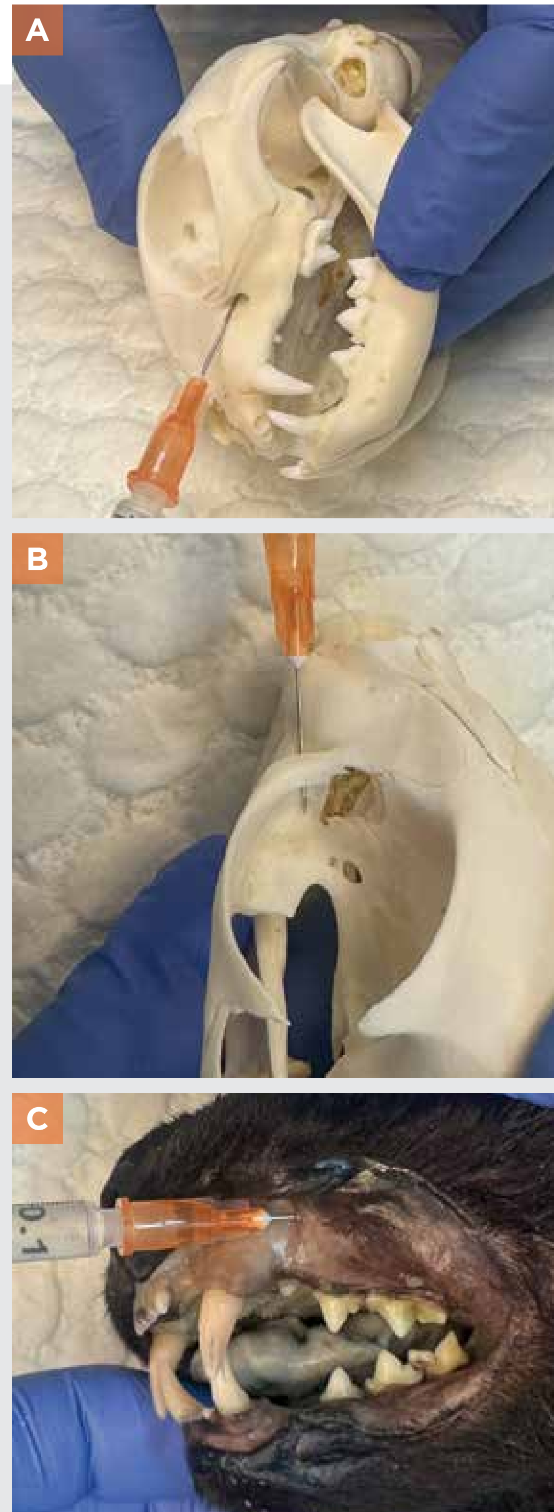

FIGURE 2. Infraorbital block demonstrated on **(A)** a feline skull, **(B)** showing the short infraorbital canal, and **(C)** a specimen.

Dorsoventrally, the middle mental foramen is approximately two-thirds of the distance down from the dorsal border of the mandible.

To perform a mental block, retract the mandibular labial frenulum ventrally and insert the needle at the rostral aspect of the frenulum and advance it at an approximately 45° angle along the mandibular bone until it just enters the canal. Confirm placement by moving the syringe laterally to encounter the lateral aspect of the canal.

Caudal mandibular block (**FIGURES 5 AND 6**)**:** The inferior alveolar nerve enters the mandibular foramen on the lingual aspect of the caudal mandible.[16,17] The caudal mandibular block is performed by infiltrating the nerve at this level before its entry into the canal.

To perform the intraoral approach, place the patient in dorsal recumbency with the mouth open. Approximate the width of the last molar tooth (M3 in dogs and M1 in cats), and insert the needle starting at 1 width of the tooth caudally from the caudal edge of the last molar. The needle is inserted into the mucosa on the lingual aspect of the mandible and advanced right along (ideally touching) the mandible. Insert the needle at a 45° angle caudally, advancing it along the bone approximately halfway ventrally from the dorsal aspect of the mandible. If this insertion is correctly performed, all mandibular teeth, bone, and soft tissue on the treated side are affected by this block.[18]

Is there a use for anesthesia-free dentistry, especially given the prevalence of patients with comorbidities such as advanced cardiac disease?

In the opinion of the authors (as well as numerous veterinary dentists and veterinary dental associations), the short answer is no; anesthesia-free dentistry (also called nonanesthetic dentistry) serves no medical purpose whatsoever. It is well established that it is not possible to fully diagnose oral and dental pathology without a thorough anesthetized oral examination (including periodontal probing and imaging) of an anesthetized patient.[19-25] Furthermore, a professional dental cleaning includes supragingival and subgingival

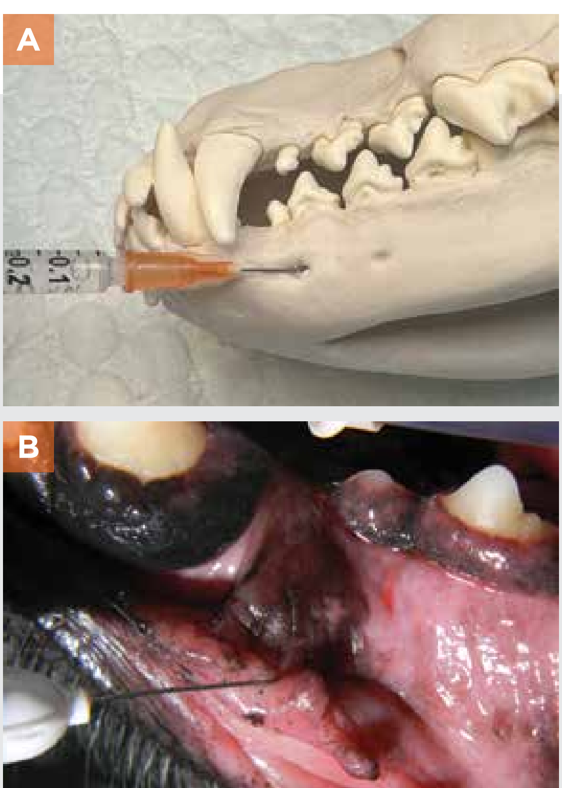

FIGURE 3. Mental block demonstrated on **(A)** a canine skull and **(B)** a specimen.

FIGURE 4. Mental block demonstrated on **(A)** a feline skull and **(B)** a specimen.

scaling as well as polishing of the teeth with power and/or hand instrumentation performed by a trained veterinary healthcare provider while the patient is under general anesthesia.[23,26]

One study showed that anesthesia-free dentistry may result in periodontal health that is worse than it was before the procedure.[27] In addition, there are concerns about the emotional stress and potential physical injury that animals may endure during the procedure,[26] which

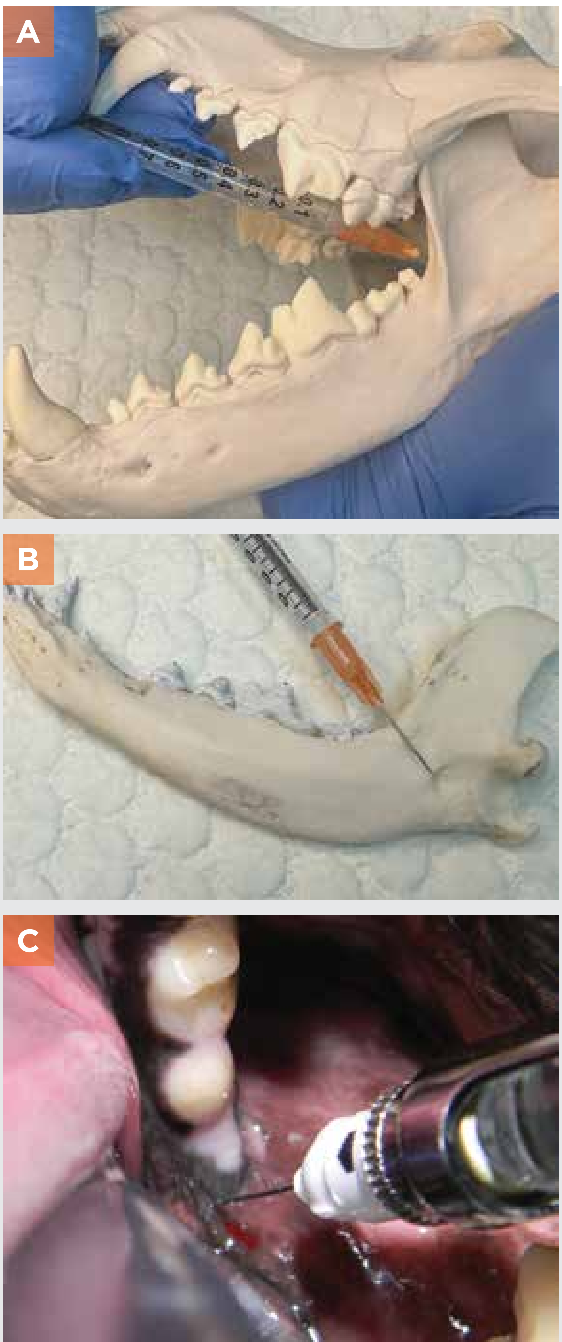

FIGURE 5. Mandibular block demonstrated on **(A)** a canine skull, **(B)** mandible from the lingual aspect showing the foramina, and **(C)** a specimen.

FIGURE 6. Mandibular block demonstrated on **(A)** a feline skull, **(B)** mandible from the lingual aspect showing the foramina, and **(C)** a specimen.

may be particularly applicable for patients with comorbidities for which sympathetic tone increase can have a significant negative effect. Last, when heart murmurs are properly diagnosed and optimized for anesthesia, morbidity has not been shown to be increased for those patients.[28]

What are the anesthetic strategies for dogs with cardiac disease?

In dental practice, one of the most common conditions among dogs is mitral valve disease. If not previously diagnosed, patients should be screened for heart disease by physical examination, history, murmur auscultation, NT-proBNP (N-terminal pro–B-type natriuretic peptide) testing, and/or electrocardiography.[29] In specialty dental practice, cardiology consultation and echocardiography are recommended and often pursued by the client, which provides the anesthetist the most robust database to formulate a risk-management plan.

Protocol design can be guided by echocardiography findings (e.g., left atrium to aortic root ratio, systolic function, degree of regurgitation, presence of arrhythmias).[29] Staging of heart disease will help determine if the dental procedure should be rescheduled to a later date to allow time for further stabilization. For instance, dental procedures for dogs with newly diagnosed stage B2 heart disease should be delayed to allow for commencement of medical therapy (e.g., pimobendan), and dogs with stage C heart disease should be confirmed free of any acute signs of heart failure before being admitted for dental procedures. The increased risk associated with anesthesia should be discussed with the client, including options for specialty dentistry and anesthesiology referral.

Before the patient is anesthetized, pimobendan and diuretics should be continued and a minimum database obtained (including volume and electrolyte status) to help guide intraoperative fluid therapy. To avoid refractory intraoperative hypotension, anesthesiologists often request that angiotensin-converting enzyme inhibitors and angiotensin receptor blockers be discontinued for at least 24 hours before arrival at the hospital.[30] Patient handling should involve minimal stress as endogenous catecholamine surge can worsen cardiac regurgitation and precipitate disease exacerbation or an acute heart failure event. If intravenous access can be obtained, premedication with an opioid is ideal, followed by 3 to 5 minutes of diligent preoxygenation and, if possible, placement of preanesthesia monitoring (e.g., electrocardiography, noninvasive blood pressure measurement, blood oxygen saturation) to ensure vital signs are stable before induction. Induction can be achieved with carefully titrated alfaxalone or propofol, often with benzodiazepine coinduction. Partial intravenous anesthesia techniques (e.g., fentanyl CRI) can reduce the vasodilation and negative contractility effects of inhalant anesthetics.

Anesthetic management strategies focus on maintaining high-normal heart rates, avoiding afterload increases, and supporting contractility; patients with advanced disease may benefit from receiving care at a facility with advanced monitoring capabilities.[31] Dobutamine (pure β agonist) is a preferred agent for treating hypotension.[28] Fluid volume delivery (including any CRI) should not exceed 2.5 to 3 mL/kg/hour.

During anesthesia and continuing into the postoperative period, the anesthetist should monitor for signs of fluid overload and congestive heart failure. Desaturation and decreased chest compliance are signs that the patient may benefit from furosemide. During recovery, the patient should receive oxygen and flow-by oxygen should be available. Before discharge, respiratory rate and effort and clear respiratory auscultation should be documented.

Even if the patient's dental disease is not severe, referral may be warranted for anesthesia management capability. When heart disease is properly screened for and managed, morbidity among affected dogs that were anesthetized by trained personnel and monitored diligently during routine dental procedures was no higher than that among dogs with lower American Society of Anesthesiologists status.[32]

What are the anesthetic strategies for cats with chronic renal disease?

Among geriatric cats, chronic kidney disease (CKD) is highly prevalent (up to 80%).[33] In addition, periodontal disease has been implicated as a risk factor for CKD.[33,34] Geriatric cats should be screened for CKD and, if present, their renal perfusion should be optimized and clients should be counseled as to potential exacerbation of CKD. The disease process is not expected to resolve, but the progression varies based on many risk factors and the control thereof.[35] Therefore, the risk-to-rewards balance of pursuing dental treatment should be weighed, considering the staging of the CKD, management and stability of the condition, risks from the dental disease, and overall prognosis for survival from the primary disease process, all of which may involve multiple specialties (e.g., dentistry, internal medicine, anesthesia). For example, patients with CKD at International Renal Interest Society (IRIS) stage I and with moderate to severe dental disease may be candidates for pursuing dental treatment, whereas patients at IRIS stage IV with mild dental disease may not be.

Helpful diagnostics to screen for CKD in new patients include physical examination, CBC and chemistry, SDMA (symmetric dimethylarginine), and blood pressure.[36] Common abnormalities include azotemia, anemia, electrolyte imbalances, acidemia, and hypertension. Previously undiagnosed CKD patients should be referred for CKD staging and management before general anesthesia is pursued for dental care. Comorbidities (especially concurrent heart disease) add to the difficulty as the management strategies for heart and kidney disease may directly oppose each other.

As with cardiac disease, low-stress handling avoids the increased renal vascular resistance and decreased renal perfusion that result from sympathetic stimulation.[36] Oral pretreatment can be helpful; however, if intramuscular premedication is required for catheterization, as is often the case for cats, low-dose dexmedetomidine or alfaxalone can avoid major shifts in hemodynamics. Benzodiazepines or opioids are also appropriate, but these agents alone will not confer adequate sedation if temperament is difficult; often they are used adjunctively with the former 2 options. Alfaxalone and propofol are equivalently adequate choices for induction as long as care is taken to prevent hypotension. Ketamine is more extensively renally excreted in cats and therefore is not a good choice for patients with advanced CKD.[36]

To protect against further renal insult, techniques that reduce inhalant MACs (e.g., fentanyl CRI, locoregional blocks) and aggressive blood pressure management with adrenergic agonists help prevent hypotension. Target mean arterial pressure should be 70 to 80 mm Hg, unless the cat has been chronically hypertensive, in which case 20% of baseline should be achieved. Invasive pressure monitoring is a helpful advanced monitoring technique to tightly regulate blood pressure.[36,37] In addition, electrolyte imbalances or metabolic acidosis are common among patients with CKD; therefore, these values should be monitored and ventilation should be controlled. An arterial catheter also facilitates serial bloodwork as needed.

Discretion should be used regarding whether to continue fluid therapy during the postoperative period until discharge; additionally, NSAID therapy, if elected, should be administered with extreme caution. New literature is redefining when NSAIDs may be appropriate for patients with underlying kidney disease, but the findings are new and broad applications are not yet clear. However, if the degree of inflammatory dental pain warrants it, it may be worth the risk for CKD exacerbation to cautiously administer NSAIDs.[29]

SUMMARY

Anesthesia and dentistry are specialties that have long existed in concert with each other. General practice encompasses both anesthesia and dentistry skill sets on a continuum from basic to advanced care, and it is up to the discretion of the practitioner to determine when a case exceeds the expertise of their clinical practice and should be referred. With anesthesia consultation, remote guidance, or in-person referral, patients with intricate comorbidities can still be provided dental care and returned to oral health, either by their primary veterinarian or through referral to a specialty practice. TVP

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