MULTIMODAL APPROACH

Effective pain management before, during, and after a dental procedure can significantly improve the comfort of your patients.
Multimodal Analgesia for Periodontal Therapy

As the gateway to the body, the mouth is constantly invaded by bacteria, parasites, and viruses. Perhaps, then, it should be no surprise that 91% of dogs and 85% of cats aged 3 years and older are diagnosed with some form of dental disease.¹ In fact, according to the World Small Animal Veterinary Association, dental and oral disease is the most common medical issue in small animal medicine.²

One common and serious form of dental disease, periodontal disease, increases in prevalence as dogs and cats age and as their body weight decreases (BOX 1).³,⁴ Thus, many older patients have advanced periodontal disease in addition to systemic disease.⁵ However, periodontal disease is “silent,” progressing without obvious clinical signs. Owners may note oral malodor (“bad breath”) without recognizing it as a sign of disease. Likewise, they may attribute behavior changes associated with periodontal pain to other causes, such as age.³ Some common signs of oral pain are listed in BOX 2. If owners mention seeing these signs, an oral examination and full mouth radiographs under anesthesia should be recommended.

Without treatment, pain from periodontal disease increases, leading to oral dysfunction and, eventually, tooth loss. Untreated pain also has other systemic

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The severity of periodontal disease is positively correlated with histopathologic alterations in the kidneys, myocardium, and liver. Treatment of periodontal disease in all patients is therefore prudent, and the use of analgesia, including general anesthesia, is essential to the comprehensive treatment plan. However, many owners fear subjecting their pets—particularly older pets—to general anesthesia, especially for a disease they cannot “see.” Veterinary nurses play an important role in not only mitigating the risks of anesthesia for patients but also educating owners about the clinic’s protocols to help keep their pet safe.

EDUCATING CLIENTS TO CONSENT TO TREATMENT

Most clients have a strong bond with their pets and consider them members of the family. As a result, clients are protective of their pets’ wellbeing and concerned by any potential risks to their safety. Discussing anesthesia with owners often produces or heightens feelings of anxiety; however, taking a few extra minutes to answer questions and educate clients on how their pet will be assessed to identify potential risks, how the anesthesia protocol will be tailored accordingly, and what safety precautions the clinic follows can help assure them that their family member will be well cared for.

Veterinary nurses should avoid the mindset that “dentals” can be added on to other surgical appointments to avoid the need for multiple anesthetic procedures. Offering this suggestion may reinforce the idea that general anesthesia is something to be avoided, rather than accepted as a necessary part of professional dental care. Instead, the discussion should center around points such as those in the American Veterinary Dental College’s (AVDC) position statement on dental scaling without anesthesia: “Modern anesthetic and patient evaluation techniques used in veterinary hospitals minimize the risks, and millions of dental scaling procedures are safely performed each year in veterinary hospitals.”

Clients should also be made aware of the seriousness of periodontal disease and the benefits of periodontal therapy. Periodontal therapy entails treatment of affected teeth and any supporting structures with evidence of periodontal disease. In addition to a full dental cleaning—tooth scaling (removal of plaque), and the severity of periodontal disease itself has been positively correlated with histopathologic alterations in the kidneys, myocardium, and liver.

Periodontal disease refers to gingivitis and periodontitis, which are conditions that affect the health of the periodontium, the tissues that surround and support the tooth. They are caused by bacteria in the biofilm that naturally and constantly form on oral surfaces. Left undisturbed, this biofilm, known commonly as dental plaque, accumulates along the gingival margin, stimulating inflammation in adjacent gingival tissues. This first stage of periodontal disease, gingivitis, is reversible with appropriate treatment, including thorough plaque removal.

If supragingival plaque is not controlled or removed, gingivitis progresses in severity and induces local changes that allow bacterial colonization of subgingival sites. In attempting to fight this infection, the patient’s immune response may also damage local tissues through cytokines released from inflammatory cells. This stage, periodontitis, requires advanced therapy and meticulous plaque control to prevent further progression of the disease and tooth loss.

Bacterial plaque is the most important substrate in the development of periodontal disease, and effective supragingival plaque control is the best preventive therapy.

**Signs of Oral Pain**

- Changes in eating habits
- Reluctance to groom
- Reduction in socialization
- Signs of “depression”
- Decreased appetite
- Lethargy
- Drooling
- Pawing at the face
- Aggressive behaviors or sensitivity when head or muzzle is touched
supragingival and subgingival plaque and calculus) with power or hand instrumentation, tooth polishing, and oral examination—periodontal therapy includes one or more of the following procedures: gingival curettage for removal of plaque, calculus, and debris in gingival pockets; root planing; periodontal flaps; regenerative surgery; gingivectomy–gingivoplasty; and local application of antimicrobials. This therapy is performed by a trained veterinary healthcare team member with the patient under general anesthesia. Although this therapy may seem quite invasive to owners, they should be assured that the result will be a healthier, pain-free pet.

PREPARING THE ANESTHETIC TREATMENT PLAN

Individual planning and case management are required for patients preparing for periodontal therapy. A complete head to tail physical examination must be performed, and a full hematology and biochemistry panel is recommended. This is especially true for geriatric patients (i.e., those that have completed 75% to 80% of their anticipated life span), as the potential for systemic disease or chronic oral infection is increased and may not be recognized by the owner.

The veterinary dental team members should read the patient’s anesthesia records in advance to identify any sources of concern in the preoperative blood work and cardiac status and to plan for support if needed. Details of how to assess these parameters are available elsewhere. Common considerations include:

- **Cardiac murmur.** If a murmur was heard during the examination, was a cardiac workup recommended? If so, was it completed, and does the team have the report?
- **Renal disease.** Does this patient have increased renal values, and is there a plan to preload with fluids before anesthesia?

On the day of the procedure, everything should be carefully planned and provided. Senior patients, in particular, may benefit from an electrocardiogram.

**BOX 3**

**Effects of Untreated Pain**

Untreated pain may have several undesirable consequences, such as:

- **Muscle wasting.** Pain creates a catabolic state, and patients with oral pain may already be prone to improper or decreased nutrient intake.
- **Suppressed immune response.** This predisposes the patient to infection or spread of the existing oral infection. The result is increased hospitalization time and cost.
- **Promotion of inflammation** and subsequent poor wound healing.
- **Increased anesthetic risk.** The more pain the patient has, the higher the doses of anesthetic drugs needed to maintain a stable plane of anesthesia.
- **Patient suffering,** which adds to stress on the owner and the veterinary team.

**BOX 4**

**Patient Safety and the Veterinary Nurse**

It is the veterinary team’s responsibility to provide the safest anesthetic experience for every patient. Many options exist for safe patient monitoring under anesthesia; however, no machine can take the place of a skilled veterinary nurse with hands and eyes on the patient during anesthesia. One way clinics can provide a safer experience for patients undergoing dentistry anesthesia is to have one veterinary professional dedicated to the cleaning, charting, and radiographing of the patient, and another to monitoring vital signs during anesthesia.
ECG) before anesthesia induction to identify issues not evident during auscultation, such as ventricular premature contractions, heart block, or other arrhythmias. A baseline ECG is valuable in choosing the right drugs or deciding whether rescheduling to allow for a cardiac consult is prudent. For senior patients with renal and cardiac disease, a baseline blood pressure is also helpful.

It is imperative to make sure all anesthesia and dental equipment is working properly before inducing any patient. The anesthesia machine must be pressure tested before any anesthetic events each day.

SOURCES AND TRANSMISSION OF PAIN
Most pain managed in veterinary patients falls into two types: somatic and visceral. Somatic pain, which is often sharp, comes from areas such as the skin, muscles, and soft tissues and can be caused by inflammation or trauma, including tissue damage during surgery. Dental pain is usually somatic pain. Visceral pain, which is described as diffuse and dull, generally comes from internal organs. All dental procedures, from routine cleaning to extractions to surgery to remove an oral mass, cause varying degrees of pain.

When tissue is damaged, whether by surgery or injury, the central nervous system recognizes the painful stimulus through a process known as nociception. Nociception consists of 4 steps: transduction, transmission, modulation, and perception.

1. **Transduction**: The painful stimulus is transformed into a traveling nerve impulse. Drug classes that are effective at inhibiting transduction are opioids, local anesthetics, and NSAIDs.

2. **Transmission**: The nerve impulse travels to the dorsal horn of the spinal cord; then from the spinal cord to the brainstem; then along sensory tracts to the brain. The drugs most effective in inhibiting this step are local anesthetics.

3. **Modulation**: Certain processes can interrupt, inhibit, or intensify the transmission impulses within the spinal cord, thereby changing the perception of pain in the brain.

4. **Perception**: The brain recognizes the impulse as painful. The somatosensory cortex is responsible for the higher processing and awareness of pain. Perception is inhibited by many drug classes, such as alpha-2 agonists, inhalant anesthetics, and opioids.

EFFECTIVE PAIN MANAGEMENT IN DENTISTRY PATIENTS
Because the different steps of nociception are inhibited by different classes of drugs, the anesthetic and analgesic pain management plan should use multiple drug classes to effectively control the transmission and perception of pain. This is known as multimodal analgesia. Patients managed with multimodal analgesia experience fewer side effects overall and have more specific analgesia.

Multimodal analgesic techniques also help prevent the phenomenon known as wind-up. Wind-up happens when pain signals constantly bombard the spinal cord, increasing the excitability of spinal cord neurons and eventually leading to more serious conditions such as allodynia and hyperalgesia. These signals may be from
untreated disease or from inappropriately managed pain resulting from treatment procedures.

Opioids and local analgesic agents have been shown to decrease the development of wind-up; however, they are not as effective when given after injury (e.g., surgery). Therefore, pain should be prevented rather than treated as much as possible. In this way, postoperative pain can be decidedly decreased.

Preemptive Analgesia

Preemptive analgesia is the administration of analgesics preoperatively with the intent to reduce postoperative pain. Although preemptive analgesia may prevent sensitization, it does not eliminate postoperative pain; therefore, postoperative analgesics are also required to ensure a comfortable recovery.

Appropriate premedication with analgesics and sedatives has the following benefits in dentistry patients (and all surgical patients): 16

- Reduction of patient stress during IV catheterization
- Reduction of doses of other drugs, such as inhalant anesthetics
- Provision of preemptive analgesia
- Provision of the best chance of a smooth recovery period

In animals experiencing oral pain from periodontal disease, appropriate premedication includes the use of an opioid to reduce sympathetic stimulation, heart rate, myocardial oxygen demand, and risk of arrhythmia, as well as block central sensitization. 16 Nonsteroidal anti-inflammatory drugs (NSAIDs) reduce the severity of the peripheral inflammatory response. Consequently, the combination of an opioid and an NSAID has been determined to be more effective than using either drug alone. 14

General Anesthesia

General anesthesia is essential to perform all oral procedures, including periodontal therapy. General anesthesia can be maintained using inhalation or injectable agents. However, if an injectable technique is used, the airway should always be secured with an endotracheal tube to prevent aspiration of saliva, debris, and irrigation fluids. A full discussion of general anesthesia is beyond the scope of this article.

Local Anesthesia

Local anesthesia provides intra- and postoperative analgesia while the patient is under general anesthesia. If local anesthesia is given before the start of a procedure, the requirement for general anesthesia drugs during surgery may be reduced, which can help preserve blood pressure. In addition, if administered at the end of a procedure, before recovery, postoperative analgesia is provided. Local anesthetic drugs also help block central sensitization by blocking all sensory input from the affected area, thereby providing complete pain relief.

Local dental nerve blocks are a great addition to the multimodal plan in veterinary dentistry. They are relatively quick for veterinary nurses to administer and require very little investment in materials and equipment (BOX 6). Their use also encourages the patient’s quick return to normal eating and drinking, which owners appreciate. Although commonly used for patients requiring extractions, local anesthetic techniques are equally valuable in patients suffering from severe periodontal disease or a malocclusion resulting in palatal trauma.

Incorporation of regional nerve blocks into dental protocols is necessary in providing the best patient care. Regional dental blocks use an injected local anesthetic to block the transmission step of nociception, leading to a temporary and complete loss of sensation in the affected area, usually an entire quadrant in the oral

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**BOX 6**

**Equipment for Dental Blocks**

The safest way to administer local anesthetic for dental specific nerve blocks is to use specific equipment designed for dentistry, such as a specialized dental syringe. These are autoclavable devices that can be fitted with a single-use 27- or 30-gauge needle and a carpule prefilled with local anesthetic. Needles are available in a variety of lengths; different breeds (brachycephalic versus dolichocephalic) require different lengths. These dental-specific syringes have a thumb ring at the end of the plunger to enable one-handed aspiration and injection.

If the clinic does not have dental syringes, a 1-mL syringe with a 25-gauge, 3/4-inch needle is an alternative. 17
The most commonly used regional nerve blocks for dental procedures are the infraorbital block, the inferior alveolar block, the mandibular block, and the caudal maxillary block. However, this loss of sensation leads to the potential for self-inflicted injury to soft tissues postoperatively; therefore, veterinary nurses should be aware of this risk during the recovery period.

Choosing Local Anesthetics
Many local anesthetics are available; however in veterinary medicine, lidocaine and bupivacaine are the most widely used. TABLE 1 provides dosing information for commonly used local anesthetics. It is important to note that if gingival tissue is extremely inflamed, the lower pH of the inflamed tissue will make local anesthetics less effective.

<table>
<thead>
<tr>
<th>ANESTHETIC AGENT</th>
<th>DOSE PER SITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>Dogs: 0.5–1.0 mL; maximum dose, 8 mg/kg or 0.4 mL/kg</td>
</tr>
<tr>
<td></td>
<td>Cats: 0.2–0.3 mL; maximum dose, 5 mg/kg</td>
</tr>
<tr>
<td>Bupivacaine (0.5%)</td>
<td>Dogs: 0.5–1.0 mL; maximum total dose, 2.0 mg/kg</td>
</tr>
<tr>
<td></td>
<td>Cats: 0.2–0.3 mL; maximum total dose, 1 mg/kg</td>
</tr>
<tr>
<td>Buprenorphine</td>
<td>Add 2–3 mcg/kg to the syringe with local anesthetic agent</td>
</tr>
<tr>
<td>Dexmedetomidine</td>
<td>Add 0.5–1 mcg/kg to the syringe with local anesthetic agent</td>
</tr>
</tbody>
</table>

Lidocaine
Lidocaine is a short-acting medication with a rapid (<5 minutes) onset of action. It is a good choice if the veterinarian is seeking intraoperative pain relief only. Additionally, if the veterinarian would like the local anesthetic to be metabolized by the time the patient is awake, lidocaine would be the most appropriate choice for regional anesthesia.

When lidocaine is used, the veterinary healthcare team must remember that cats are considerably more sensitive to its effects than dogs and that its total dosage is additive. The veterinary nurse must also watch for central nervous system excitation. This potential side effect of lidocaine administration may result in convulsions.

Bupivacaine
Bupivacaine is a longer-acting medication with a longer onset of effect (ranging from 15 to 20 minutes). Reportedly, the effect lasts from 3 to 6 hours, depending on placement.

Cats are highly sensitive to bupivacaine. Additionally, the toxic dose of bupivacaine is >2 mg/kg total dose. Due to its highly cardiotoxic nature, bupivacaine should not be used in constant rate infusions. The total dosage for local blocks is additive. When bupivacaine is used, veterinary nurses must watch for neurotoxic and cardiotoxic complications (e.g., tremors, seizures, cardiac depression, ventricular fibrillation, asystole).

Mixing lidocaine and bupivacaine has been shown to not provide any benefit in terms of analgesia, but the mixture does have a duration of action between that of lidocaine alone and bupivacaine alone. This is not to say that the mixture is not efficacious; however, it is this author’s (TM) opinion, based on practical evidence in the dentistry clinic setting, that plain bupivacaine is used for dental regional nerve blocks.

Additional Agents
Addition of opioids to a local block may improve postoperative analgesia long after the effects of the local agent wear off. In a study comparing use of bupivacaine alone with bupivacaine plus buprenorphine (15 mcg) in 8 dogs, 3 dogs demonstrated analgesia 72 hours after administration, while 2 dogs experienced analgesia for 5 days following administration.
Some local anesthetics work more effectively with the addition of vasoconstrictors (epinephrine or dexmedetomidine), which help keep the drug at the site longer by inhibiting the absorption of the anesthetic agent into local blood vessels.26 Dexmedetomidine is not only an analgesic but also a sedative that is often used in premedication. In addition, it causes vasoconstriction of peripheral blood vessels, including those in the gingiva.26 When combined with local anesthetics, dexmedetomidine has been shown to enhance anesthetic effects and prolong the duration of action of drugs like lidocaine.26

**Regional Nerve Blocks**

Accurate administration of regional nerve blocks requires understanding the nerve and vessel anatomy of the head. The trigeminal nerve and ganglion carry pain signals from the tissue and bones of the head to the brain. The trigeminal nerve has three branches: ophthalmic, maxillary, and mandibular. Most dental nerve blocks are placed around these branches as they enter or exit small bony foramina (openings). A vein and an artery lie alongside each nerve, raising the potential for intravascular injection;17 therefore, it is imperative to first aspirate the syringe before proceeding with the injection. The authors have never experienced adverse side effects or complications when careful technique is used and recommended dosages are followed.

Veterinary nurses and clinicians alike should practice local blocks on cadavers before administering them in practice. In addition to intravascular injection, possible complications of improperly placed dental local blocks include injection of the nerve sheath, causing trauma to the nerve and resulting in long-term nerve dysfunction, and, rarely, retrobulbar hemorrhage. These blocks can be mastered by veterinary nurses and placed to help save the clinician time and effort. Hands-on training is available through a variety of avenues, such as workshops at national conferences and the annual Veterinary Dental Forum.

The most commonly used regional nerve blocks for dental procedures are the infraorbital block, the inferior alveolar block, the mandibular block, and the caudal maxillary block.27 When performing these blocks, it is recommended to place the tip of the needle at the opening of or barely into the foramen. Once the local anesthetic has been delivered, digital pressure can be applied to force the agent to flow deeper into the foramen, driving the anesthetic action distal to the foramen.17

Before placing needle and hands into the oral cavity to perform any local block, the administrator should ensure the patient is at a stable plane of anesthesia.

**Infraorbital Block**

The infraorbital foramen is palpated as a depression above the distal root of the third premolar, and the needle is inserted just before the opening of the canal or just into the canal (**FIGURE 1**). This block desensitizes the premolar, canine and incisor teeth on the same side, as well as the bone and soft tissue buccal to the teeth.17 The veterinary nurse should be careful when performing this block in brachycephalic patients due to the foramen’s proximity to the globe of the eye, the optic nerve, and the optic nerve’s blood supply. Improper needle placement can penetrate the globe or cause retrobulbar bleeding leading to severe complications such as proptosis.27

**Inferior Alveolar Block**

The inferior alveolar nerve is located within the mandibular canal, adjacent to the mandibular tooth roots (**FIGURE 2**). The foramen can be found by first locating the ramus of the mandible and then feeling for the foramen on the medial side. This block can be performed with an intraoral or extraoral approach.17 It...
is the author’s (TM) opinion that the extraoral approach is easier to perform when the patient is at an appropriate plane of anesthesia.\(^ {28}\)

This block desensitizes all mandibular teeth and bone on the same side as the block, as well as the soft tissue lingual to the mandible. To avoid blocking the lingual nerve, the person performing the injection should keep the needle close to the mandible and foramen. If the lingual nerve is blocked, the patient could bite and traumatize its tongue on recovery.\(^ {17}\)

**Mandibular Block**

The mandibular block is also referred to as a middle mental nerve block. The caudal, middle, and rostral mental nerves branch from the inferior alveolar nerve within the body of the mandible and emerge from their respective mental foramina, located on the lateral aspect of the rostral mandible. In dogs, the middle mental foramen is located just under the first or second mandibular premolar (FIGURE 3). In cats, it is located midway between the mandibular canine tooth and the third premolar tooth (cats have no first or second mandibular premolar teeth) at the midpoint of the mandible. In very small animals, it is nearly impossible to feel the foramen, so the needle should enter the mucosa just before the mandibular frenulum and be advanced to just before the opening of the foramen. The calculated volume of local anesthetic is deposited and digital pressure can be used to “drive” the local anesthetic to the opening of the foramen where the nerves are exiting. This block anesthetizes the buccal mucosa and lip forward of the foramen to the midline.\(^ {17}\)

Caution should be taken when performing a mental block, as blocking the mental nerve branches results in desensitization of the lower lip and teeth rostral to the mental foramina. Additionally, the middle mental foramen may not be palpable and/or may be too small a diameter to successfully insert even a fine needle, especially in cats and small-breed dogs.\(^ {14}\)

**FIGURE 2.** Opening of foramen near ramus of mandible (arrow).

**FIGURE 3.** (A) Opening of the middle mental foramen (arrow). (B) Mandibular block.
Caudal Maxillary Block
This block affects all branches of the maxillary nerve—the infraorbital nerve, the pterygopalatine nerve, and the major and minor palatine nerves. It is especially useful to block the majority of the upper jaw, including the bones, teeth, and gingiva. This block also desensitizes the soft and hard palatal mucosa on the corresponding side. To perform this block, the needle is advanced in a dorsal direction perpendicular to the plane of the palate (i.e., at a 90° angle), penetrating the mucosa directly behind the roots of the maxillary second molar tooth (FIGURE 4). The needle does not need to be advanced very far (3–5 mm). Extra caution should be used in small, brachycephalic, or feline patients. Inadvertent placement into the ocular cavity can occur.

Assessing Effectiveness
In human dentistry, efficacy of local blockade is tested by asking patients if they have desensitization in the target tissues. Because veterinary patients lack the same direct communication skills, veterinary teams must rely on other markers. One of the most reliable ways of confirming a local block has worked is a stable, smooth respiration rate. When regional nerve blocks are effective, pain signals are not conducted and therefore do not reach the brain to cause a sympathetic response (increased respiration rate, increased heart rate). This allows use of a lower percentage of inhalant anesthetic and subsequently reduces the side effects of inhaled anesthetic drugs.

As the clinician is starting the dental procedure, the veterinary nurse should monitor the patient’s blood pressure, heart rate, and respiration rate. If these increase with surgical manipulation, the block was not correctly placed or has not had adequate time for onset. If enough time has elapsed based on the local anesthetic agent used and the veterinarian thinks the time for onset is not an issue, the block may be repeated if the maximum total dose is not exceeded.

POSTOPERATIVE ANALGESIA
Typically, the effects of the regional nerve block last throughout recovery and discharge of the patient to home. If an injectable NSAID was prescribed by the veterinarian and administered during the dental procedure, it may also continue to provide analgesia for up to 24 hours. Owners appreciate when their pet eats when returning home and are comfortable throughout the evening, so this level of postoperative analgesia can also help to increase compliance with the follow-up professional care essential to successful management of periodontal disease.

It is recommended that management of pain continue in the days following the dental procedure. Available
options for postoperative analgesics depend on the needs of the patient and the abilities of the pet owner and include chewable tablets, oral liquids, and transdermal patches.\(^{30}\) If warranted, an opiate can be given in combination with an NSAID to provide a greater analgesic effect for the patient.

**CONCLUSION**

In 2010, a veterinary usage study showed that when asked as part of a focus group, many pet owners simply thought that regular vaccination was appropriate wellness veterinary care.\(^{30}\) They did not as readily understand the need for routine examinations (including oral examinations) and preventive care.\(^{30}\) Veterinary nurses can play a critical role in recommending professional dental care and educating clients about their pet’s oral health. By being advocates, veterinary nurses can help their patients avoid oral infection and pain and may even help them live longer.

**TVN**

**References**


**GLOSSARY**

**Alldynia:** Central pain sensitization (increased response of neurons) following normally nonpainful, often repetitive, stimulation

**Biofilm:** Buildup of bacteria on a surface; on teeth, also known as dental plaque

**General anesthesia:** Procedure performed after administration of a medication(s) that results in analgesia, paralysis, and unconsciousness: it begins with the preanesthetic evaluation and is not complete until anesthetic recovery is reached

**Hyperalgesia:** Increased pain from a stimulus that usually provokes pain
CONTINUING EDUCATION

Multimodal Analgesia for Periodontal Therapy

LEARNING OBJECTIVES
Upon completion of this article, readers should be able to identify signs of nociception that arise from periodontal disease and the pain caused by subsequent treatment such as tooth extraction and deep cleaning of gingiva. Readers will also be able to identify the appropriate local anesthesia technique for specific extraction sites and the importance of regional analgesia in controlling pain as part of a multimodal analgesic protocol.

TOPIC OVERVIEW
This article demonstrates that effective pain management before, during, and after a dental procedure can significantly improve care and raise the bar for dentistry services provided in veterinary practices. Veterinary nurses can help their patients avoid oral infection and pain and may even help them live longer.

1. If a cardiac murmur is heard during the preoperative physical examination, which of the following diagnostic options may be useful?
   a. Complete blood count
   b. Glucose curve
   c. Echocardiogram
   d. Preoxygenation

2. _____ of dogs and _____ of cats aged 3 years and older are diagnosed with some form of dental disease.
   a. 55% and 60%
   b. 81% and 95%
   c. 85% and 91%
   d. 91% and 85%

3. An analgesic plan that involves combining different drug classes acting on different pain pathways is known as
   a. Multimodal analgesia
   b. Constant-rate infusion
   c. Soaker catheter
   d. Take-home medication

4. How do local anesthetic drugs function?
   a. By reducing inflammation
   b. By blocking impulse conduction in nerve fibers
   c. By facilitating the breakdown of arachidonic acid
   d. By acting as an antipyretic

5. The 3 branches of the trigeminal nerve are:
   a. Ophthalmic, maxillary, and mental
   b. Ophthalmic, maxillary, and mandibular
   c. Ophthalmic, metatarsal, and mandibular
   d. Infraorbital, middle, and maxillary

6. Which of the following is a consequence of untreated pain?
   a. Muscle wasting
   b. Patient suffering
   c. Increased anesthetic risk
   d. All of the above

7. Which regional dental block would be preferred to desensitize the area for treatment of an upper canine tooth?
   a. Middle mental
   b. Inferior alveolar
   c. Sacrococcygeal
   d. Infraorbital

8. Based on duration of action, ________ would be an appropriate local anesthetic for a longer dental procedure (e.g., multiple extractions).
   a. Lidocaine
   b. Tetracaine
   c. Bupivacaine
   d. EMLA cream

9. True or false: Cats have no first or second mandibular premolar teeth.

10. What physiologic parameter(s) should be monitored to ensure the effectiveness of a local block?
    a. Respiration rate
    b. Blood pressure
    c. Heart rate
    d. All of the above