Regional Anesthesia for Veterinary Dentistry
Benita Altier LVT, VTS (Dentistry)
Pawsitive Dental Education
Prosser, WA

Pathophysiology
Pain, by definition, is a localized suffering associated with bodily disorder, a basic perceived sensation induced by a noxious stimulus, received by naked nerve endings, characterized by physical discomfort and typically leading to evasive action. Pain can facilitate self-preservation and is a deep-seated natural defense mechanism to prevent bodily harm. This kind of response by the body to a potentially harmful sensation such as burning, pressure or a forceful jolt allows us time to respond quickly and move away from the danger of a harmful object causing the above sensation. This type of pain can be referred to as physiologic pain, and is the result of A-delta (fast) and unmyelinated C fibers which transmit a slower, less intense pain sensation being stimulated through nociceptors, or bare nerve endings at the site of potential injury on the body.3

Somatic pain, a type of peripheral pain involving the joints, muscles or periosteum, can best describe our veterinary patient’s oral pain due to the localized sensation of pain in the mouth and skull structures.3 It can be further described as a sudden sharp jolt, pulsating discomfort or a dull constant pain. When these raw nerve endings or nociceptors are continually activated due to the ongoing insult to the oral tissues through periodontal treatment, root canal therapy, extractions, excision or incision of oral masses, gingivectomy, fracture repair and other invasive dental procedures, clinical pain will be perceived as a result.3 This stimulation causes a response called “wind up” which can produce alterations in the way that the patient responds to even the gentlest touch during recovery from a procedure eliciting this over-stimulation of the Central Nervous System (CNS).4 This response is termed allodynia and is something that we can and should prevent in our patients through the use of a multimodal approach to anesthesia/analgesia.5 This article does not go into a full discussion of multimodal drug protocols used in pre-anesthetic pain relief and prevention plans, these should be referred to in other texts.

The prudent use of local or infiltrative anesthetic drugs and regional, or area specific, nociceptive obtunding techniques should be used to prevent transduction or the conversion of unpleasant stimuli at the site of insult into impulses in the trigeminal afferent nerves, transmission or conveyance of these electrical impulses towards the CNS, modulation which in the case of oral stimulation happens between the neurons from the A-delta and C fibers synapsing with specific neurons in the nucleus caudalis within the medulla of the brain.5 Finally the perception of pain takes place in the cerebral cortex of the brain, and is the true manifestation of conscious pain perception in our patients.3 If this perceived pain is not treated or prevented then hyperalgesia ensues and the pain response increases even into nearby uninjured tissues resulting in further central sensitization or the “wind-up” phenomenon of pain.5

Why Use Regional Anesthesia for Dentistry?

The use of regional anesthetics in dental patients has many advantages. These include:

- Extensive analgesia to the targeted tissues thus reducing the quantity of inhalant anesthetic required and the elimination of the “roller coaster” up and down effect if the anesthetized patient perceives painful stimuli.2
- Reduction in the amount of inhaled anesthetic by the patient will lower the incidence of adverse events due to low blood pressure and bradycardia.5
- Prevention of pain can also reduce the time of convalescence through a decrease in the harmful catabolic process, which can hasten tissue healing and prevent a depressed immune response, which decreases the likelihood of infection overall improving patient recovery.5

Drugs used in regional anesthesia such as bupivacaine hydrochloride 0.5% and lidocaine hydrochloride 2% act to affect all three areas of the nociceptive pathway: transduction, transmission and modulation.3 Due to its length of action (3-10 hours) bupivacaine hydrochloride 0.5%, with or without epinephrine, is the most routinely used regional dental anesthetics today in veterinary dentistry.2

Disadvantages of regional anesthesia include:

- Potential nerve damage
- Accidental intravenous injection, which can cause cardio- toxicity or arrhythmias with the use of bupivacaine 0.5%. Or as in the case of lidocaine hydrochloride 2% which can be given IV, excessive doses given intravenously can cause CNS or cardiac toxicity.6
- Feline patients have a much lower threshold for drug toxicities. Lidocaine hydrochloride should be only used very cautiously in cats.

Expediting the use of the appropriate regional anesthetic technique will allow adequate time for the onset of drug action prior to any noxious stimulation.

A thorough knowledge of cranial anatomy and foramina used in these techniques is required. The use of a canine and a feline skull can be very helpful as an example to visualize and palpate the target areas on the anesthetized patient.

Regional Anesthetic Drugs and Dosages

The maximum toxic dose should be calculated every time, for each patient.
For Bupivicaine the maximum dose should be calculated at 2mg/kg of patient body weight. Each regional block to be performed should have its own pre-determined quantity of drug not to exceed the total maximum volume of anesthetic. Common quantities used are 0.10mL per 10 pounds of body weight. Not to exceed the maximum quantity calculated. Bupivicaine has a delayed onset of action of at least 6-10 minutes and some authorities report even up to 30 minutes, once given in a foramen, but it has duration of 3-10 hours. Regional anesthetics cause vasodilatation, which hastens the reversal of the pain preventative effects due to the added blood supply to the area injected, aiding in the removal of the drug. The addition of epinephrine to bupivacaine will cause vasoconstriction and increases the drugs’ duration of action.

- Products containing epinephrine should not be used in patients with hyperthyroidism or cardiac disease or in conjunction with the use of halothane as and inhalant anesthetic.

Glossary

**Allodynia**- When a normally non-painful stimulus causes a painful response.

**Analgesia**- Absence of a pain perception.

**Buccal Mucosa**- Lines the oral cavity facing the cheeks.

**Central Sensitization**- Hyper-excitability of pain perception. Also referred to as “wind up”.

**Clinical Pain**- A painful response that is noted by the clinician after ongoing nociceptors stimulation has changed the way the afferent nerve system responds to stimuli from injury.

**Hyperalgesia**- An increase in pain response caused by local inflammation as a result of noxious stimulation to the area.

**Mandible**- Lower jawbones separated into a right and left mandible joined by a symphysis.

**Maxilla**- The bones of the upper jaw structure.

**Multimodal analgesia**- The use of analgesic drugs from different classes that act in synergism to promote a more complete pain prevention protocol.

**Nociceptors**- Nerve endings that can be activated by noxious stimuli to transmit electrochemical impulses through the afferent nerve pathways for perception of pain in the brain.

**Regional Anesthesia**- The use of an anesthetic solution injected into an area at or near a foramen containing a major nerve branch to effectively “block” the pain pathway to a specific region of the mouth.

Table 1

**Infraorbital Regional Nerve Block**

This block affects the bone and soft tissues of the anterior maxilla in that quadrant.

The bony margin of the foramen is palpated just dorsal to the distal root of the maxillary third pre-molar. The needle is then inserted just into the opening using caution to aspirate the syringe in 4 different planes to confirm that a blood vessel has not been punctured, only then should the anesthetic be injected very slowly into the space. Digital pressure over the injected area for 30-60 seconds will further allow the agent to disperse into the canal.
Table II  
Maxillary Regional Nerve Block  
This blocking technique affects the bone, palatal aspects, soft tissue and all maxillary teeth of the dental quadrant injected.

Site for Maxillary nerve block in a dog.

The injection site is located dorsal to the last molar at the ventral junction of the zygomatic bone on the maxilla, by injecting the anesthetic agent slowly into this area after careful aspiration to avoid any accidental injection into a vessel you will effectively block pain sensation to all of the maxillary teeth in this quadrant. Great care should be taken not to advance the needle past the intended area due to the location of large vessels and the ocular globe in this area.

Table IV  
Inferior Alveolar (Mandibular) Regional Nerve Block  
The tongue, mandibular teeth and soft tissue are affected on the infiltrated quadrant to the symphysis.
The mandibular foramen is easily palpated intra-orally in the dog. It is located just rostral and dorsal to the prominent angular process on the lingual side of the mandible. Careful intra-oral palpation along with extra-oral injection technique to place the tip of the needle over the foramen will accurately deposit the anesthetic agent to effectively block all ipsilateral mandibular teeth and adjacent soft tissues and tongue.

References