REGIONAL NERVE BLOCKS FOR DENTAL EXTRACTION
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Key Points
- Regional nerve blocks make it possible to perform most extractions under standing sedation.
- Appropriate use of the extraperiorbital fat body insertion technique for the maxillary nerve block is effective with small volumes of anesthetic and can be performed in a manner that minimizes risk to the surrounding anatomy.
- Using a nerve stimulator to locate the inferior alveolar nerve at the mandibular foramen may help reduce risk of lingual maceration.
- Tuohy needles are a safer alternative to spinal needles for regional blocks though they are more expensive.

Providing adequate pain control for equine patients in the perioperative and postoperative period should be part of any practitioner’s surgical plan involving dental extraction and/or sinus surgery. The vast majority of extraction techniques in common use today can be performed standing with good perioperative analgesia/anesthesia via intravenous sedation and regional nerve block. This greatly reduces the risk to the horse from general anesthesia, bleeding during surgery and recovery time. Many same day surgeries can be performed stall side or with only a 24 to 48 hour stay at an equine hospital.

There are many ways to provide analgesia and anesthesia for the horse intravenously or intramuscularly. These topics have been thoroughly covered in the 2010 Vet Clinics of North America: Equine Practice – Pain Therapy in Horses. In the words of Dr. Goodrich, “Pain that is controlled results in a nondepressed horse that maintains a good appetite and has a normal functioning immune system, which results in normal tissue healing.” The author highly recommends reading this issue of Vet Clinics to catch-up on the most recently reported literature on pre-, intra-, and postoperative pain control strategies using a multimodal approach to achieve maximal results.

One facet of a good multimodal pain control plan is regional nerve block. Nerve blocks are the key to being able to perform dental extractions in the standing horse under a constant rate intravenous infusion of an anesthetic agent. Prior to the common use of regional nerve blocks for standing extractions, the surgeon’s success relied more on the nature of the horse, very high doses of intravenous anesthetics, and uncomplicated or nonsurgical extraction procedures. With the use of nerve blocks now most horses can have productive noninvasive and invasive dental procedures standing. General anesthesia is still necessary for intractable patients, surgeries requiring computed tomography, and extractions or maxillofacial surgeries requiring precise, delicate surgical technique. When placing a nerve block achieving effectiveness while reducing risk is paramount. The following descriptions give systematic directions to perform the major nerve blocks associated with extractions.

Local Anesthetic:
- Major Procedures: Bupivacaine 5% solution
  - onset of action 10-20 minutes
  - duration of action 180-480 minutes
Minor Procedures: Lidocaine 2% solution
- onset of action 1-3 minutes
- duration of action 60-120 minutes
Give all regional anesthetics slowly over a minimum of 1-2 minutes and chose volume to match the injection site to reduce any possible nerve damage. Avoid placing too much volume in a restricted space.

Equipment Needed:
- Clippers
- Betadine and saline soaked gauze for prep tray
- Sterile gloves
- Tuohy Epidural Needles (spinal needles used historically)
  - 2.0” length; 22 gauge
  - 3.5” length; 22 gauge
  - 6.0” length; 20 gauge
- Extension set 6” luer lock
- Syringe
  - 12cc luer lock
- Loss of Resistance Syringe
- Peripheral nerve stimulator
  - Insulated peripheral nerve block needle 6” length and 20 gauge
  - Conducting gel

General Preparation:
- Heavily SEDATE the horse!
- Locate injection site.
- Surgically prepare the injection site.
- Fill syringes with local anesthetic and flood extension lines if used.
- Don sterile gloves and work in sterile manner for injection.

Inferior Alveolar Nerve Block (Mandibular Nerve Block)
The inferior alveolar nerve block anesthetizes the inferior alveolar nerve as it branches away from the mandibular nerve and travels into the mandibular foramen and the mandibular canal. This block will provide analgesia to the ipsilateral mandible and mandibular teeth in addition to all soft tissue structures innervated by the mental nerves (see below). The mandibular foramen is located rostrally on the medial aspect of the coronoid process at the level of the ipsilateral mandibular occlusal surface. Drs. Rawlinson and Campoy at Cornell University have introduced the use of a nerve stimulator to assist with localization of the inferior alveolar nerve to reduce the risk of desensitizing the lingual nerve.
- Locate the mandibular foramen at the intersection of the following two lines:
  - Lay a straight edge along the occlusal surface of the mandibular cheek teeth. The most caudal portion of the commissure of the lips usually corresponds to this surface and is parallel to the facial crest. Mark with a Sharpie the portion of this plane over the masseter muscle.
  - Lay the straight edge from the lateral canthus of the ipsilateral eye to the most ventral aspect of the mandibular ramus and mark with a Sharpie the plane over the
masseter at the intersection point with the preceding plane. This marks the location of the inferior alveolar foramen on the medial aspect of the coronoid process.

- Once the site is prepped, hold the 6-inch needle to be used above the skin in the pre-marked vertical plane to measure the distance on the needle from the ventral aspect of the ramus to the mandibular foramen.

- Perform block with or without the assistance of a nerve stimulator.
- If no nerve stimulation guidance is chosen, use the 6 inch 20 gauge Touhy needle to perform the block. Use of an extension set is recommended for ease. Positioning of the needle and delivery of local anesthetic is the same for stimulation-guided and non-guided blocks.

- For use with a nerve stimulator:
  - Connect 6 inch 20 gauge insulated nerve block needle to unit and second contact to horse.
  - Initially set unit at 1mA and 1 Hz. This is well tolerated by sedated horses.
  - The needle is introduced ~2cm lateral from the midline of the intermandibular space at the most ventral aspect of the ramus.
  - The needle is directed towards the medial aspect of the coronoid process at a 30 to 45 degree angle.
  - When the needle contacts bone, redirect the needle to a parallel plane with the coronoid process and try to keep the needle constantly in contact with the bone while sliding dorsally.
  - As you get close to the mandibular foramen, twitching of the mylohyoid muscle and the digastricus muscle may be evident.
  - Once you reach the premeasured length of the needle, a chomping of the teeth (masticatory reflex) in rhythm with the stimulation will indicate proximity of the inferior alveolar nerve. Turn the unit to 0.5mA to more precisely locate the nerve.
  - The syringe is aspirated to ensure no direct placement in a vessel. Inject 10-15cc of local anesthetic slowly.
  - If no chomping reflex is elicited, carefully redirect or advance the needle until the reflex is stimulated. Avoid making wide excursions with the needle, so if necessary, completely remove the needle and attempt a slightly different angle/placement of approach.

The use of the nerve stimulator gives the clinician confirmation of appropriate deposition of local anesthetic while minimally affecting adjacent nerves like the lingual nerve.

Mental Nerve Block

The mental nerve block anesthetizes the rostral portion of the inferior alveolar nerve as it branches into the mental nerve at the level of the mental foramen. If the block is delivered to the rostral inferior alveolar nerve, then the ipsilateral canine and incisor teeth will be anesthetized in addition the skin and lip rostral to the mental foramen. Only the mental nerve (skin and lip) will be anesthetized if the local anesthetic is not delivered through the mental foramen into the mandibular canal. The mental foramen is located on the lateral aspect of the mandible in the interalveolar space (the “bar”) at the level of the commissure of the lips halfway between the most dorsal and ventral aspect of the mandible. Dorsal elevation of the tendon of the depressor labii inferioris, which lies over the foramen, will assist with palpation.\textsuperscript{3,5,61}
Locate the position of the mental foramen.
- Clip, clean, and prep site.
- Use a 2-inch 22-gauge Tuohy needle for this block.
- Palpate the foramen. Introduce the needle roughly 1 cm rostral to the foramen at a 30 to 40 degree angle to the bone.
- The needle is passed into the foramen roughly 1 cm and digital pressure is applied to the mental foramen to stabilize the needle and prevent outflow of local anesthetic.
- The syringe is aspirated to ensure no direct placement in a vessel.
- Slowly deposit 5 mls of local anesthetic. If in the mandibular canal, avoid placing too much fluid (>10 mls) in the canal as this may result in nerve damage due to high pressure within the canal.
- Slowly remove the needle and apply pressure to the site for roughly 1 minute.

This block is NOT well tolerated by the horse due to the almost unavoidable direct needle contact with the nerve. A trick to obtaining proper placement of the needle is to inject Lidocaine as the needle is advanced SLOWLY towards the mental foramen. Let the Lidocaine take effect at each injection site (roughly 1 ml) before advancing further.

Maxillary Nerve Block (Extraperiorbital Fat Body Insertion (EFBI) Technique)\textsuperscript{viii}

The maxillary nerve block anesthetizes the infraorbital nerve as it branches from the maxillary nerve in the region of the pterygopalatine fossa. This nerve block will provide analgesia to all ipsilateral maxillary teeth and gingiva. The EFBI technique aims to infuse anesthetic into the extraperiorbital fat body, which allows for diffusion of material into the region of the caudal infraorbital canal, maxillary foramen, pterygopalatine fossa housing the infraorbital nerve, and the maxillary nerve. By using this technique, the practitioner avoids close contact of the needle tip with significant regional vessels and nerves.

- Locate the entry point for a 3.5” 22 gauge Tuohy needle
  - Follow facial crest to most caudal aspect where crest starts to deviate dorsally to become part of the zygomatic arch. This point is usually located in the region of the middle third to caudal third of the eyeball, but different facial conformation and various size horses make the use of eyeball positioning less reliable.
  - Roughly, 10mm caudal to the point of dorsal deviation of the facial crest and parallel to the plane of the body of the facial crest marks the point of entry for the needle.
- Clip, clean, and prep the site.
- A small bleb of lidocaine can be placed subcutaneously at the point of entry of the Tuohy needle.
- Holding the Tuohy needle perpendicular to the skin the needle is advanced into the masseter muscle. As the needle passes through the multiple bodies of the masseter muscle small changes in needle resistance will be felt.
- If at 10-20mm of depth a bony structure is encountered, withdraw the needle and reposition the entry another 5mm caudal. The bony structure is the dorsal portion of the maxillary tuber.
- At roughly 50-60mm depth a definitive “pop” will be encountered with the needle and the resistance to advancement of the needle will be much less after the “pop”. The increased resistance accounting for the ‘pop” is the thick fascial plane dividing the masseter muscle from the extraperiorbital fat body.
A loss of resistance syringe filled will air can be used to help differentiate between muscle tissue and fat tissue if the practitioner has doubts about the location of the dividing fascial plane. Air will pass easier into fat than into muscle; therefore, a small amount of air can be used to determine resistance within the masseter and loss of resistance within the fat body.

Once the needle has passed through this fascial plane, it is advanced an additional 3-mm into the extraperiorbital fat body.

When the needle is appropriately positioned, 10-20mls of anesthetic material can be slowly injected into the site. Remember to aspirate prior to injection.

Remove the needle and apply pressure to the entry point for 15-30 seconds.

The choice of local anesthetic agent depends mostly on the duration of action the practitioner hopes to achieve. As the use of narcotics is less desirable in the horse due to decreased gastric motility and the risk of colic, it is desirable to use a local anesthetic that will work for as long as possible to help provide postoperative analgesia. Nerve blocks should be performed prior to performing surgery or extracting teeth, and depending on the length of surgery, providing a second block prior to recovery can be beneficial postoperatively. Bupivacaine has proven to be an excellent anesthetic for maxillofacial and dental procedures. Research is also starting to reveal the benefit of combining an alpha-2 agonist with local anesthetics to increase the duration of the block. Combining dexmedetomidine with the local anesthetic could potentially double its duration of action though no clinical trials in horses have been performed yet to prove the theory.

The risk of complications that can arise during nerve blocks is significant. Needle on nerve contact as in the case of the mental nerve block can result in an explosive response from the horse no matter how sedate. Practitioners should be prepared to deal with this type of response and keep themselves, their staff, and laymen in safe positions. Neurovascular damage is a major complication that can occur with the use of regional nerve blocks. This is particularly important when entering tight canals or regions packed with major vessels and nerves. Conventionally used spinal or hypodermic needles cut through these structures. Using needles specifically designed for nerve blocks and decreasing needle size helps reduce this risk. The smallest possible gauge needle should always be used to minimize nerve and vessel laceration. The tip of Tuohy needles, recommended above, have a rounded bevel with cutting edges off to the side; therefore, these needles are more likely to push the vasculature and nerves away from the needle tip. The more blunt end of the Tuohy needle also provides increased tactile feedback. This becomes a major advantage when placing the maxillary nerve block as it helps identify the distinct “pop” associated with the medial fascial plane of the masseter muscle.

a Marcaine, Hospira, Lake Forest, IL.
bLidocaine hydrochloride 2%, Hospira, Lake Forest, IL.
cTuohy Epidural Needle, GPC Medical Limited, New Delhi, India.
dLoss-of-Resistance Syringe, BBraun, Bethlehem, PA.
eStimplex DIG RC, BBraun, Bethlehem, PA.
fStimuplex A insulated needles with 30 degree bevel 20 Ga x 6 in, BBraun, Bethlehem, PA.
gDexmedetomidine 100 mcg/ml, Macleods Pharma, India.


