



Extraction of the First Premolar Teeth*

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Abstract: In most cases, the small, functionless first premolar teeth (wolf teeth) of horses cause no harm. However, in some riding horses, these teeth may be a source of discomfort. As a result, wolf teeth are often extracted by veterinarians. For success, the extraction procedure described in this article requires the veterinarian to be prepared with proper instrumentation and to proceed patiently; the patient must be adequately sedated and restrained and a local anesthetic administered before initiation of the extraction procedure. The use of a dental speculum during wolf tooth extraction can substantially improve visualization during the procedure.

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In most horses, the first premolar teeth (wolf teeth) are located just rostral to the first cheek teeth and commonly erupt in the first year of life. The number of wolf teeth in a horse can vary from none to four. The upper arcade is the most common location for eruption of these teeth, but they may be seen on the lower arcade as well. In most cases, these teeth are small and functionless and do not cause problems. However, wolf teeth may cause discomfort to some horses as a result of a bit placing pressure on a wolf tooth and the surrounding sensitive mucosal tissue. Unerupted wolf teeth (“blind” or “impacted” wolf teeth) may cause discomfort when the mucosa is compressed against the tooth by a bit. Wolf teeth in the lower arcade, whether erupted or unerupted, have been associated with biting problems in horses. In addition, the presence of wolf teeth can make it difficult for veterinarians to adequately float and smooth the rostral part of the second premolar tooth (i.e., create a “bit seat”). For these reasons, wolf teeth are often extracted from young riding horses to prevent performance problems related to oral

discomfort. Older horses with a history of attitude change or unusual head action should also be examined for the presence of wolf teeth or remnants from a previous extraction.

Extraction Procedures

Wolf teeth can be extracted during most routine dental procedures, such as a dental examination or flotation. Several different instruments are available for these purposes, and techniques for extraction of wolf teeth have been described.¹⁻⁸ Excessive chewing movements, vigorous tongue movement,¹ and “rooting” behavior by the horse can be very frustrating for the veterinarian during attempts to extract wolf teeth. In addition, the size of the crown of a wolf tooth may be misleading as to the degree of difficulty that may be encountered during removal.⁴ Consequently, adequate restraint, sedation, and analgesia; good visualization; and proper instrumentation are key considerations to maximize the safety of the veterinarian and horse and to minimize the risk of complications associated with dental procedures.

*A companion article titled “The First Premolar Teeth” appeared in the March 2009 issue.

Sedation and Local Anesthesia

After the initial examination, the horse should be administered either detomidine (0.01 to 0.02 mg/kg IV) or xylazine (0.25 to 0.50 mg/kg IV) to provide sedation. After 5 minutes, the mouth should be rinsed with water and the head supported at an appropriate height using either a dental halter or a head stand. A full-mouth dental speculum can be applied to provide optimal visualization during the procedure. A variety of speculums, including McPherson, Conrad, and Stubbs designs, can be used during extraction of wolf teeth.

Local anesthesia is recommended before extraction of wolf teeth in order to provide an additional level of comfort for the horse and to reduce the amount of struggling, head tossing, chewing, and tongue movement during the procedure.^{1,7,8} With the mouth held open by the speculum, a needle is directed through the palatine mucosa toward the crease between the gingiva and palatine mucosa on the palatal side of the wolf tooth^{7,8} (FIGURE 1). Approximately 1.5 to 2 mL of mepivacaine hydrochloride solution (2%; Carbocaine-V, Pfizer Animal Health) is injected submucosally in this area, and the solution is allowed to diffuse into the gingiva around the tooth. Although the submucosa of the hard palate is shallow and fibrous, the anesthetic solution can be injected with firm pressure. A mucosal bleb will appear if the injection is performed properly. If necessary, an additional 1 to 2 mL of local anesthetic solution may be injected submucosally on the buccal side of the wolf tooth at the junction of the gingiva and cheek mucosa. For blind upper wolf teeth, mepivacaine solution is injected submucosally in the tissues overlying the buried crown. For mandibular wolf teeth, 1.5 to 2 mL of mepivacaine is injected through the loose fold of mucosa just rostral to the wolf tooth.

Extraction of Erupted Wolf Teeth

The steps for extracting an erupted wolf tooth include elevating the gingival tissue and periodontal attachments from the crown and root, removing the loosened tooth with forceps, and inspecting the alveolar margin for sharp or loose fragments. Several instruments may be used to complete each step (FIGURE 2). A few principles should be considered when deciding which instruments to use for a particular horse. An instrument with a circular tip

(Burgess instrument) is very useful for initially cutting the gingiva around the circumference of the tooth. The ring of incised gingiva that is created around the tooth by the Burgess instrument serves as a useful outline when a periodontal elevator is used. Burgess instruments can be designed to accommodate various-sized wolf teeth, and handle extension bars are also available (FIGURE 2). Instruments with these extension bars are needed when a speculum is in place during the extraction procedure. A gap of at least 2 to 3 mm must exist between the wolf tooth and the second premolar to properly place the Burgess instrument over the crown without dramatically increasing the risk of breaking the wolf tooth root when force is applied to the instrument. When a speculum is used, the Burgess instrument and periodontal elevator should be directed in the vertical axis over the tooth. This requires the veterinarian to pass the shaft of the Burgess instrument between the inner side of the cheek bars of the speculum and the horse's face (FIGURES 3 AND 4).

After cutting the gingiva, it is advisable not to further loosen the periodontal attachments with the Burgess instrument. With the gingival cut margin as a guide, the tip of a periodontal elevator is used to elevate the gingival tissue to a depth of several millimeters around the periphery of the tooth to loosen the soft

CriticalPoint

Adequate restraint, sedation, and analgesia; good visualization; and proper instrumentation are key considerations during extraction of wolf teeth.

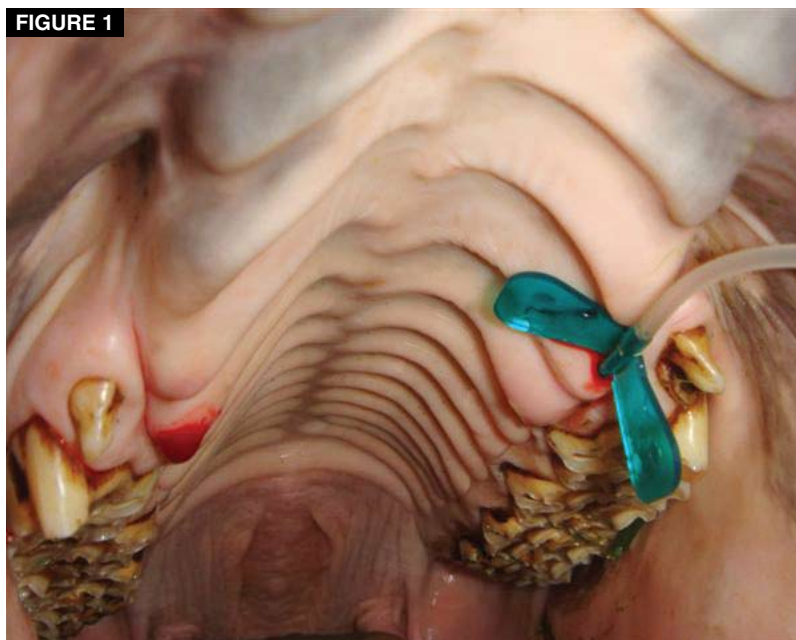


FIGURE 1

Deposition of local anesthetic into the palatine submucosa and gingiva adjacent to the wolf tooth (Triadan 205).

tissue attachments. After sufficiently elevating the gingiva on the rostral, buccal, and palatal sides of the tooth, the tip of the elevator can usually be placed between the wolf tooth and the first cheek tooth to further elevate the wolf tooth (FIGURE 5). With the tip of the elevator in place, the shaft of the elevator may be slowly twisted or rocked slightly and held

for several seconds to apply pressure against the periodontal attachments of the wolf tooth root. These maneuvers should be done with patience because they slowly disrupt the soft tissue attachments to the root; the premature use of excessive force usually results in breakage of the tooth. Caution should be exercised not to damage the second premolar by applying excessive pressure with the elevator. With sufficient elevation of periodontal tissues and subsequent bleeding within the alveolus, the root usually becomes loose and the tooth can be grasped and removed with a wolf tooth forceps.

Mandibular wolf teeth are removed in a similar manner. The close proximity of a lower wolf tooth to the second premolar usually prohibits the use of a Burgess instrument to cut the gingiva. A small, half-moon-shaped elevator is usually sufficient to elevate the gingival and periodontal tissues to allow extraction of lower wolf teeth.

If an upper blind wolf tooth is identified, a Burgess instrument can be used to cut a circular area of gingiva overlying the crown; alternatively, a curved scalpel blade may be used to incise the mucosa over the length of the crown.^{7,8} A half-moon-shaped elevator or a periosteal elevator is then used to elevate the gingiva. The instrument is directed between the horizontally situated wolf tooth and the maxillary bone. Alternatively, a Burgess instrument may be slid over the crown of the tooth to continue elevating the tissues away from the tooth. In either case, firm, controlled efforts are used to wiggle and pry the soft tissue attachments away from the tooth root so that the tooth can be removed.

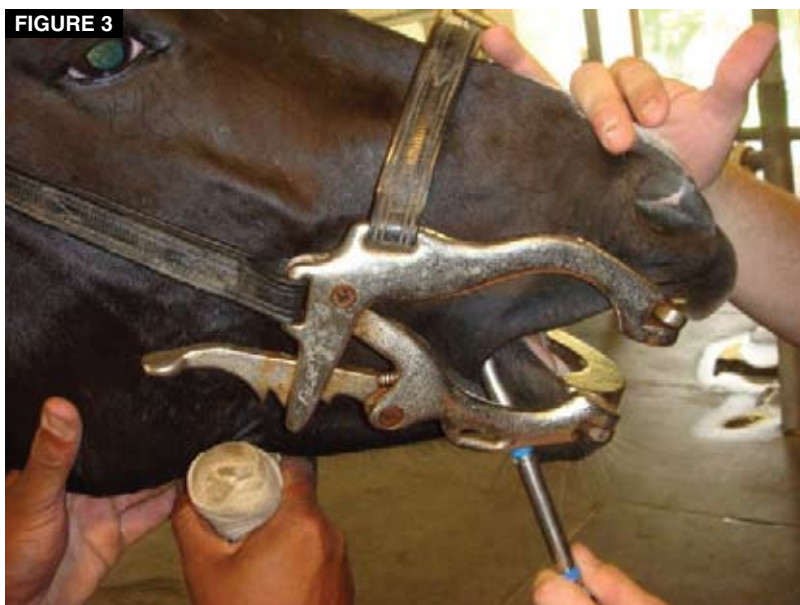
Each tooth should be thoroughly inspected after removal. On occasion, the root of the tooth will fracture near its junction with the crown (FIGURE 6). If a pulp chamber is visible in the extracted tooth, Stelzer⁵ has advocated removal of the retained root tip with a root forceps. However, if the fractured root remnant is anchored well and does not protrude over the rim of the alveolus, the additional surgical trauma required for removal of the remnant is unnecessary.^{3,6,8} In my experience, leaving the remnant has not been associated with lasting harmful effects. Instead, the owner should be made aware of possible complications of a root tip fracture (e.g., irritation, redness, pain,

FIGURE 2



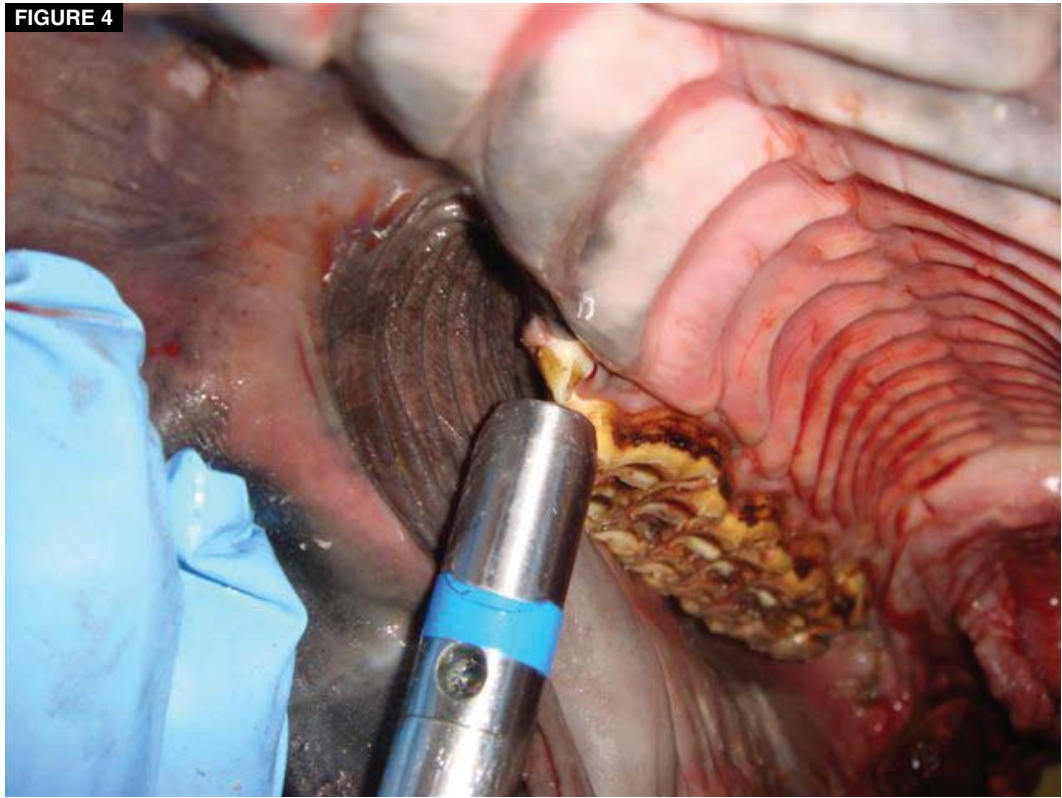
Instruments that can be used to assist with wolf tooth extraction include periodontal elevators of various sizes and lengths, a Burgess instrument with handle extensions and cutting cones (blue tape), a curette, a forceps, and a rubber mallet.

FIGURE 3



Passing the instrument on the axial side of the lower cheek bar of the speculum allows a more vertical orientation within the patient's mouth for extraction of upper wolf teeth.

FIGURE 4

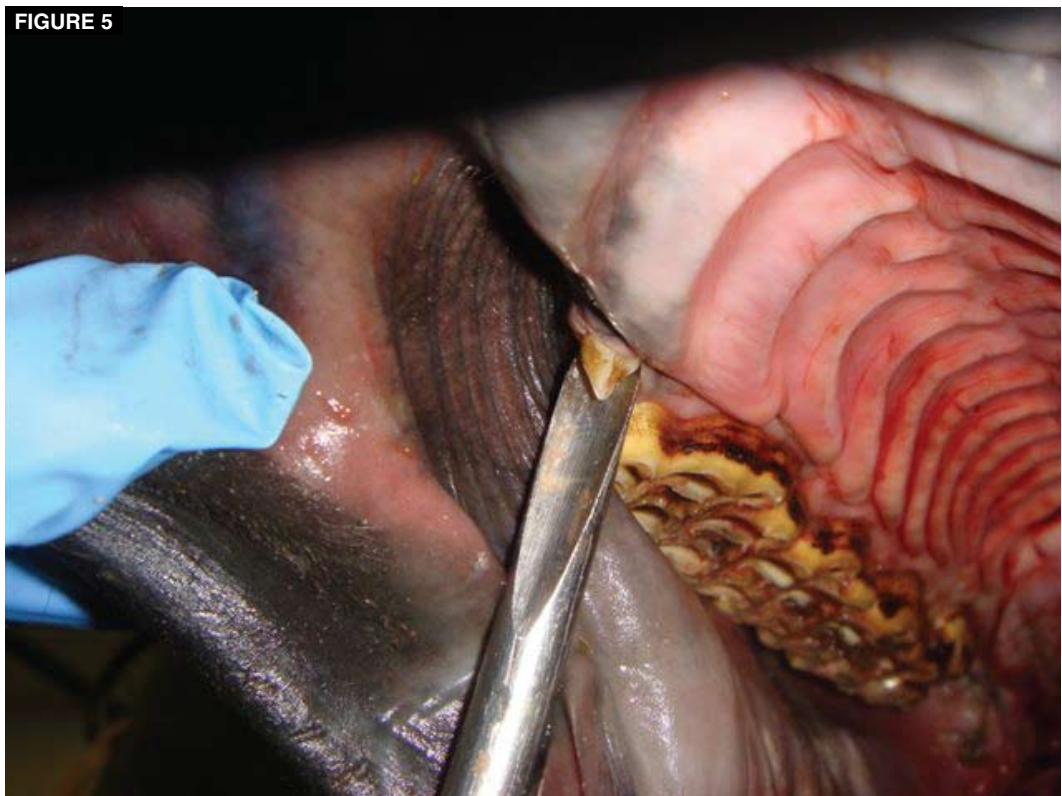


A circular-tip cutting instrument is placed over the wolf tooth (Triadan 105) to cut the gingiva around the periphery of the tooth. (Cadaver specimen.)

CriticalPoint

The steps for extracting a wolf tooth include elevating the gingival tissue and periodontal attachments from the crown and root, removing the loosened tooth with forceps, and inspecting the alveolar margin for sharp or loose fragments.

FIGURE 5



Using the cut margin around the tooth as a guide, the clinician uses an elevator to loosen the attachments of the wolf tooth (Triadan 105). (Cadaver specimen.)

bitting problems, or a draining tract of the overlying gingival tissue due to migration of the fractured root tip). If any of these complications develop, radiography of the affected area is warranted, and any tooth remnants should be removed (using sedation and local anesthesia as previously described).

After removal of a wolf tooth, a gloved fingertip should be used to palpate the extraction site for the presence of loose tooth fragments or sharp areas of bone on the rim of the alveolus. Loose root fragments may be removed with an elevator or a forceps, and any bony spicules and sharp areas created during the extraction should be smoothed with a curette or rongeur.⁶

Some wolf teeth can be very difficult to loosen, requiring the use of a slightly angled, flat-ended elevator to elevate the tissue on the rostral side of the tooth.³ A rubber mallet is used to tap the handle of the elevator several times, and then the elevator is repositioned on the caudal side of the tooth; this process is repeated until the tooth is loosened sufficiently to be extracted. This technique elevates the gingiva and disrupts periodontal tissue around the wolf tooth.⁸ There are two important concerns when using this technique. First, it should not be used on the palatal side of the tooth because of the close proximity of the palatine artery. Second, gingival tissue on the buccal side of the tooth can easily be damaged with this technique; this tissue can usually be elevated sufficiently without the use of a mallet. In my experience, this technique has facilitated removal of a number of diffi-

cult wolf teeth without complication, but it is always used judiciously. The occasional use of a mallet and elevator to assist removal of large wolf teeth in Draft breeds has been described previously,² and general anesthesia has been reported to be necessary in some instances to assist in removing molarized wolf teeth.⁷

Complications

Excessive Hemorrhage

The major palatine artery, originating from a branch of the maxillary artery, runs cranially along the palatine groove from the major palatine foramen (located near the caudal border of the hard palate) and is accompanied by a vein and nerve. The palatine groove is parallel to, and within about one finger-width of, the upper cheek teeth.⁵ Along its course, the major palatine artery provides branches supplying the hard palate and the mucosa of the floor of the ventral nasal meatus. Near the corner incisors (Triadan 103 and Triadan 203), the artery curves medially to unite with the artery from the opposite side and passes through the incisive foramen^{9,10} (FIGURE 7). The artery may be inadvertently cut during elevation of wolf teeth, resulting in sudden, copious hemorrhage originating from the surgical wound in the mucosa of the hard palate. If this occurs, the horse's head should be elevated (to about the level of the withers) and direct pressure applied to the hemorrhaging vessel using a stack of 4 × 4-inch gauze sponges. The gauze compress is then temporarily secured in the roof of the mouth with elastic tape around the muzzle. The compress is left in place until hemorrhage is controlled—normally within 15 minutes. It is advisable to delay any remaining dental procedures to allow adequate healing of the affected tissues. The horse should be observed periodically for at least 1 to 2 days for evidence of further hemorrhage.

Soft Tissue Trauma and Infection

Soft tissue infections, sepsis, and tetanus have reportedly occurred after wolf tooth extraction.^{3,11,12} Therefore, it is wise to assess the patient's vaccination history and administer tetanus prophylaxis, if indicated.¹² During wolf tooth extraction, the gingiva, palatine mucosa, and oral mucosa may be accidentally torn or lacerated, and these tissues may become infected with organisms from the oral cavity.

CriticalPoint

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³Scrutchfield WL. Personal communication, College Station, Texas, May 2007.

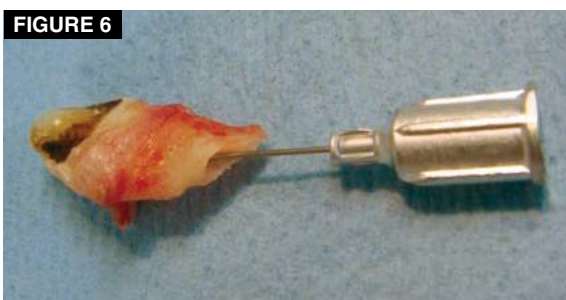


FIGURE 6
A wolf tooth that fractured during extraction from a 2-year-old Quarter horse stallion. A 25-gauge, $\frac{5}{8}$ -inch needle has been inserted into the apical end of the pulp chamber.



FIGURE 7 The maxilla and hard palate region of a juvenile horse skull. Near the lateral border of the hard palate on each side, the greater palatine artery runs forward from the palatine foramen (yellow arrows) near the cheek teeth within the palatine groove (red arrows). Continuing rostrally along the bone, the vessels curve axially near the corner incisors (Triadan 103 and Triadan 203) and enter the incisive foramen (blue arrow). A single wolf tooth is present in this specimen (green arrow; Triadan 205).

CriticalPoint

Complications of the extraction procedure include excessive hemorrhage due to iatrogenic trauma to the major palatine vessels.

If accidental laceration or tearing of mucosa occurs, the owner should be instructed to irrigate the injured tissue with water, saline, or dilute chlorhexidine solution to cleanse the defect until healing is complete.

Incomplete Removal of the Tooth

If an equine patient exhibits biting problems after removal of wolf teeth, the extraction sites should be visualized and palpated to detect the presence of pain, draining tracts, or sharp tooth remnants. If a fractured wolf tooth remnant projects past the rim of the alveolus, the patient may experience pain when ridden with a bit.^{8,11} In these cases, the fractured root remnant should be elevated and removed. Sharp bony enlargements associated with the extraction site should be smoothed with a curette or rongeur in any equine patient experiencing biting problems after wolf tooth removal.

Aftercare

The vast majority of equine patients do not

experience complications after wolf tooth extraction, and aftercare tends to be minimal in most practices (FIGURE 8). One report advocates that horses should not be fed hay or bedded on straw for 12 hours after extraction. This report also recommends that any grain concentrate should be fed as a mash for the first 12 hours after surgery.⁵

If lower wolf teeth have been extracted, the extraction sites may become packed with feed material or infected, possibly delaying healing. Therefore, it is important to instruct the owner to irrigate these sites twice daily after surgery until the wounds have epithelialized. To minimize the development of alveolar osteitis, lower wolf teeth extraction sites may be packed with gel foam or gauze after surgery.^{1,6}

I generally recommend that affected patients not be ridden or bitted for 24 hours after wolf tooth extraction, after which normal training may commence. Some veterinarians advocate that the patient's mouth should not be bitted for a longer period after wolf tooth extraction in

FIGURE 8



A 2-year-old Quarter horse stallion with a small amount of bleeding from the gingival and alveolar tissues, which can be expected during and immediately after wolf tooth removal.

order to allow epithelialization of the extraction sites.^{5,7} Postoperative administration of analgesics (e.g., phenylbutazone [2.2 mg/kg PO q12h for several days]) may be indicated in some cases, such as those that require lengthy, difficult extraction procedures.

Conclusion

Veterinarians are frequently asked by owners and trainers to examine riding horses of all ages for suspected dental problems and for behavioral problems that may be associated with oral pain. The patient may demonstrate oral discomfort in several ways, including head tossing and head shaking. (A basic knowledge of the types of bits and bridles used for riding horses and how these instruments function can be very helpful in evaluating and treating affected patients.) Wolf teeth may cause discomfort due to bit pressure forcing the cheek mucosa against the sharp point of the tooth or due to bit contact against the mucosa overlying an unerupted wolf tooth. Therefore, veterinarians often remove wolf teeth from horses. The extraction procedures described in this article are straightforward and yield successful outcomes if the veterinarian is adequately prepared with the proper instrumentation and proceeds with patience on an adequately sedated and restrained horse that has been administered a local anesthetic before initiation of the extraction procedure. 🐾

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3 CE
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1. Erupted wolf teeth

- a. are more common on the upper arcade.
- b. may be present on the lower arcade.
- c. may cause discomfort in some horses due to movement of the bit during riding.
- d. all of the above

2. Which statement(s) regarding wolf teeth in horses is/are correct?

- a. A wolf tooth may erupt during the first year of life.
- b. A wolf tooth may be present in each of the four dental arcades.
- c. Wolf teeth are considered to be functionless.
- d. all of the above

3. Blind wolf teeth are also known as

- a. canine teeth.
- b. impacted wolf teeth.
- c. unerupted wolf teeth.
- d. b and c

4. Which of the following may be used before wolf tooth extraction in order to improve the patient's comfort?

- a. placement of the patient in a stanchion
- b. administration of local anesthetic to desensitize the extraction site

- c. administration of a sedative or analgesic (e.g., xylazine)
- d. b and c

5. Which statement(s) regarding the removal of erupted upper wolf teeth is/are correct?

- a. An elevator may be used to carefully pry and loosen the tissue around a wolf tooth.
- b. A Burgess instrument may be used to cut the gingiva around a wolf tooth.
- c. Proper use of a mallet can help loosen wolf teeth that are difficult to remove.
- d. all of the above

6. If the wolf tooth fractures during extraction,

- a. loose fragments of bone or tooth should not be disturbed.
- b. fractured root remnants protruding past the rim of the alveolus should not be disturbed.
- c. it is unnecessary to inspect the extraction site and alveolus if the tooth was fractured.
- d. none of the above

7. Which of the following may result from tooth extraction in horses?

- a. excessive hemorrhage due to laceration of the major palatine vessels

- b. soft tissue infection
- c. mandibular alveolar osteitis
- d. all of the above

8. If a patient exhibits abnormal biting behavior after wolf tooth removal,

- a. the extraction site should be visualized and digitally palpated.
- b. removal of the permanent second premolar is indicated.
- c. a thorough oral examination is not necessary.
- d. none of the above

9. If lower wolf teeth are removed,

- a. the extraction sites should be rinsed of debris twice daily until the wound is healed.
- b. the canine teeth should also be extracted.
- c. postoperative infection and poor healing of the extraction sites could occur.
- d. a and c

10. If a fractured wolf tooth remnant projects past the rim of the alveolus,

- a. the remnant should not be disturbed.
- b. the remnant should be removed.
- c. the gingiva should be sutured over the remnant for padding.
- d. a and c