Equine Intraoral Cheek Tooth Extraction

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1. Introduction
Exodontia (removal of a tooth) should not be performed unless it has been determined beyond a doubt which tooth or teeth are problematic and that all methods of medical, periodontic, and/or endodontic therapy have been exhausted to arrest the disease process and preserve the tooth. Throughout the 20th century, exodontia has classically been the backbone of equine oral surgery.1 There are a wide range of indications for tooth removal, most of which depend upon which tooth or teeth in the arcade are causing a problem. Some common indications for tooth removal are associated with one of the following:
(1) Interceptive orthodontics secondary to retained deciduous teeth.
(2) Periodontal disease secondary to diastema, dental maleruptions, and displacements, supernumerary teeth, or malocclusion.
(3) Endodontic (pulp) disease or apical infection usually associated with secondary osteomyelitis.
(4) Paranasal sinus disease secondary to oral or dental disease.
(5) Developmental dental disorders.
(6) Surgical consideration in oral or skull bone fractures.
(7) Fracture or disease of the dental crown or root.
(8) Occlusal trauma.
(9) Neoplasia.
(10) Bitting discomfort.

Most indications are associated with nonfunctional or infected teeth. Tooth removal is indicated to relieve pain, preserve adjacent teeth, or prevent the spread of infection systemically or to the proximal tissues.

Exodontia can be simple or very time-consuming. It can also be frustrating and fraught with operative and postoperative complications.2–7 The specific tooth involved, dental disease process, age of the animal, and number of teeth to be removed dictate the surgical technique and instruments used.8–12 Thorough treatment planning before beginning an extraction procedure will minimize complications and produce realistic owner expectations. Some questions that should be posed prior to surgery include the following:
(1) Which tooth (teeth) is the problem, and is it suitable for intraoral extraction?
(2) What is the overall health and temperament of the patient?
(3) Has the owner been thoroughly informed about the procedure and the possibility of another surgery, complications, and costs involved?
(4) Does the surgeon have the proper equipment, instrumentation, and training to complete the procedure?
(5) Is there a backup plan if the extraction fails?
(6) At what point, should I use a different technique?

(7) Is the surgeon prepared to treat a possible associated bone or sinus infection?

(8) Who will provide aftercare and follow-up on the horse?

The earliest known method to remove diseased cheek teeth in the horse was via the oral route.13 Oral extraction has been practiced by veterinary surgeons for centuries on severely diseased or loose teeth. Molar extraction forceps have been available for well over 100 years and until very recently have changed little in design. In the mid-20th century, with the advent of equine general inhalation anesthesia, which makes working in the mouth around a mask or endotracheal tube difficult, oral extraction lost popularity.

Most 20th century veterinary literature limited intraoral tooth extraction to teeth that were loose or presented in older horses with short dental crowns.14

For over 50 years, most equine teeth were removed surgically by trephination and retrograde repulsion. In more recent years, modern sedative analgesic combinations and regional dental anesthesia have allowed veterinarians to safely access the standing horse’s mouth. This has led to the development of better oral extraction techniques and the manufacture of a wide variety of high-quality dental instruments.

Oral tooth extraction should be the primary method of tooth removal used by the veterinarian. Even though a retrograde approach to the sinus or periradicular area may be necessary to reach an existing secondary disease condition, oral extraction should be attempted first. Proper extraction technique based on sound dental surgical principles minimizes postoperative discomfort and encourages rapid healing of associated soft tissues.

The basic principles of tooth removal in humans and small animals involve obtaining adequate access to the periodontium for loosening, creating an unimpeded pathway for removal of the tooth, and using controlled force to elevate the tooth without damaging adjacent structures.16 The interdigitating contours of the long reserve crown and presence of multiple roots on each tooth can make loosening and elevation of the hypsodont tooth very challenging in horses. Equine tooth removal also requires deformation of the dental sockets to open the eruption pathway of the tooth for elevation.

Oral extraction can be performed on any tooth, but several dental disease processes require special consideration when planning surgery. Teeth with gross pulp horn or infundibular caries have crowns that may disintegrate during extraction. Diseased caudal maxillary teeth often are associated with secondary sinusitis, and surgical drainage of the sinuses is required in this situation. The more caudally situated teeth are more challenging because of limited space in the back of the mouth. Dental wedging between the adjacent teeth may block the eruption pathway of the tooth and complicate extraction. Intraoral extraction may be complicated by teeth with divergent roots; root dilacerations; increased number of roots; hypercementosis or bulbous roots; long, thin roots; and/or horizontally fractured roots. Teeth that are ankylosed to the socket are also complicated to remove.

Extraction procedures range from minor to major surgical procedures, and practitioners should critically evaluate their ability (training, experience, instrumentation, etc) before performing an exodontic procedure. In aged animals with short reserved crowns or in the case of advanced periodontal disease that has resulted in loosening of the tooth, extraction may be carried out digitally. In young horses with apically diseased teeth and long reserved crowns firmly attached in the alveolus, extraction will require more effort and expertise. It may be necessary in some juvenile horses to remove permanent dentition before eruption, which may complicate an oral approach. Young animals with long reserved crowns may present an insurmountable challenge to oral extraction. However, clinical studies show a success rate of 70% to 90% for tooth removal via standing oral extraction.14

Several conditions must be present to have success utilizing intraoral extraction:

1. An appropriate area for surgery that is quiet and clean with adequate work space.
2. An assistant(s) to steady the head and help with instrumentation and equipment use.
3. Proper restraint with a stocks, sedation/analgesia (nonsteroidal anti-inflammatory drugs, tranquilizers, continuous rate infusion (CRI), regional nerve blocks), and a head support or stand.
4. A complete set of oral examination equipment (speculum, light sources, mirrors, and/or endoscope).
5. Intra-operative radiography or fluoroscopy.
6. A set of dental extraction instruments.
7. The time and patience to allow proper extraction technique.

Advantages of standing intraoral extraction over other methods of tooth removal are listed below:

1. Shortened postoperative socket healing time.
2. Fewer surgical and postsurgical complications.
3. Standing surgery reduces the time pressure on the surgeon and anesthetist and the recovery risk to the patient.
4. There is minimal risk of damage to adjacent structures (facial nerve, parotid duct, infraorbital nerve, greater palatine artery, etc).
5. Extraction leaves an intact alveolus in most cases, reducing the risk of postoperative fistula formation.

Disadvantages of standing intraoral extraction:

1. May be very time-consuming.
2. Special restraint is needed to access the mouth.
3. Special, costly instruments are required.
4. An intact exposed crown is needed for loosening and extraction.
(5) Tooth reserve crown and root conformation and position can impede elevation from the alveolus.

(6) A compliant patient is necessary for standing surgery.

When oral extraction is not successful, the veterinarian should have a backup plan for surgical extraction. Such a surgical plan should consist of the following:

1. Minimally invasive transbuccal surgery to remove upper cheek teeth or lower 06–08 teeth.
2. Buccotomy and dental elevation through the lateral alveolar plate.
3. Retrograde repulsion with pin or punch.
4. Division of the tooth orally with extraction in fragments.17–23

Surgical extraction is not reserved only for extreme situations when oral extraction has failed. When used appropriately on selected cases, surgical extraction may be more conservative and cause less morbidity than intraoral extraction. Excessive force might be required to extract a tooth orally, and this could lead to fracture of roots, adjacent bone, or both. Surgical extractions often allow for more controlled removal of bone and elevation of the tooth, leading to a more predictable outcome.

Intraoral Extraction Procedure

Careful preoperative examination of the patient is important, and all aspects of the approach to therapy should be planned thoroughly before surgery. Radiographic and endoscopic examinations should be carried out before and after surgery to support the clinical findings. When available, additional imaging techniques such as digital radiology, fluoroscopy, scintigraphy, computed tomography, and MRI may be indicated.

A basic set of dental extraction instruments includes the following:

1. Dental spreaders or separators with the proper size blade and angle of handle to fit between the mesial and distal margins of the tooth to be removed.
2. Various molar extraction forceps to fit the crown of the tooth being removed.
3. Three- or four-pronged forceps for tooth elevation.
4. Dental fulcrum set.
5. Extirpation or turning (offset head) forceps.
7. Quick-release C-clamp or elastic band.
8. Steel or hardwood leverage bar.
9. General orthopedic instruments.
10. Material to pack or cover the dental socket (iodoform gauze, acrylic, base plate wax or polyvinyl siloxane impression material, Plaster of Paris, honey sugar) (Appendix A).

Intraoral tooth extraction is best performed on the standing horse, although general anesthesia may be necessary in a nervous or fractious animal. Sedative analgesics are administered, and the horse's head is restrained in a steel frame, dental halter, or head stand. Regional anesthesia is helpful in gaining patient cooperation. Pain management standards of care require regional or local infiltration anesthesia for extraction of permanent teeth. A full-mouth speculum is needed to gain adequate access for working in the oral cavity. A headlight or speculum light is essential for good visualization. Oral photographs taken before and after surgery are often helpful in documenting the surgery and explaining the procedure to the owner and referring veterinarian.

A tooth with a healthy crown is loosened by placing a thin blade spreader between the mesial and distal interdental spaces of the involved tooth (Fig. 1). Special care must be taken to avoid loosening the 06 or 11 tooth when extracting a 07 or 10 tooth (spread first on the side with the most support: between 07 and 08 or between 09 and 10). The spreader blades are carefully placed between the teeth at the gingival margin and the handles closed, bringing the blades partially together. Just enough force should be placed on the spreader to slightly move the tooth. The blades are held in this position, placing pressure on the periodontal ligaments, stretching them beyond the elastic limit over a 5- to 10-minute period. The spreader is removed and replaced on the opposite interdental space and the handles again are closed, prying the teeth apart. This process is repeated until the thin blade spreaders are easily closed both mesial and distal to the affected tooth. Teeth with split or damaged crowns may not be suitable for spreading and can often be loosened with an equine dental elevator and forceps.
Next, the gingival mucosa is separated from the buccal and lingual edges of the tooth crown with a sharp gingival elevator or osteotome (Fig. 2). This will expose enough tooth surface area to allow forceps to be placed on the crown. It may be advantageous to remove a collar of alveolar plate on the buccal and/or lingual edge of the tooth crown with a sharp right angle osteotome or periotome to allow the forceps to be placed more securely. When using the dental forceps or elevator on the palatal side of the upper teeth, care should be taken not to damage the palatine artery.

The properly sized extraction forceps is placed on the tooth crown (Fig. 3). The forceps can be secured with a quick-release C-clamp or length of rubber elastic wrapped around the handles (Fig. 4). Maximizing the purchase between the head of the forceps to the crown of the tooth is the most important aspect of instrument selection. Sagittally fractured cheek teeth may have food material stuck in the fragment fissure: all such material should be flushed/removed to allow the fragments to come back together and permit better placement/purchase of the extraction forceps on the clinical crown. The forceps are then rocked from side to side in a lateral-to-axial oscillating movement. This motion causes the tooth to rotate on its long axis in the socket. The forceps handle should be moved over a very short range of motion to ensure that the head of the forceps stays engaged on the tooth crown. Slipping of the forceps requires immediate reexamination with possible repurchasing of the crown. This will help avoid abrading or breaking the tooth. Torsion can be placed on the tooth with a steel or wooden leverage bar, using a rotating movement of the forceps handles (Fig. 4). This allows the tooth to move from side to side in the socket. Undue haste or excess force must be avoided. Care must also be taken to prevent crown damage from sudden movement of the horse’s head. Application of the thick blade spreaders at this point can be helpful, along with repeat forceps motion to encourage further loosening of the tooth. When the tooth begins to become mobile, a sucking sound can be heard and frothing blood can be seen around the margins of the tooth. Progress can be checked by removing the forceps and checking for further loosening.

Fig. 2. A set of equine gingival elevators and right-angle osteotomes. The blade angle and length can be used to a mechanical advantage when working in the deep recesses of the oral cavity.

Fig. 3. Several sizes and head configurations of box-head equine dental forceps. The size and shape of the head of the extraction forceps must be sized to fit tightly on the margins of the tooth crown. Most of these forceps are made with parallel jaws when properly seated on the tooth. The process of sizing a forceps for a particular tooth is similar to a mechanic choosing the right size socket wrench.

Fig. 4. Adjustable quick-release C-clamp and rubber tubing used to secure the spreader or extraction forceps handles. The 18-inch long, 1.5-inch diameter bar of locust wood can be used as a leverage bar to place torque on the extraction forceps handles. Using this tool and technique, the tooth can be rocked sideways in the dental socket during loosening.
forceps and digitally palpating the crown for mobility. Keep in mind that the tooth is like a post in a hole. A great deal of movement must be placed on the portion of the post above ground to be reflected in a small amount of movement at the bottom of the post. In a young animal with a short ratio of exposed crown to reserved crown and root, more movement of the exposed crown is needed to result in movement at the apex in the alveolus. Conversely, in an old horse with almost the entire crown exposed, even a slight movement in the crown puts great pressure on the roots. The tooth is locked in place because the irregular shape of the reserve crown and roots mirrors the shape of the alveolus. The thin alveolar plate is relatively easy to deform into the spongy surrounding bone of a normal jaw. Diseased teeth may be surrounded by sclerotic bone, making tooth-loosening difficult. The combined process of disrupting the periodontal ligament and deforming the contour of the alveolus is essential to completely loosen the tooth and open a path for extraction.

Once the tooth is loose, the forceps should be repositioned to get a firm grip on the crown. Use of a 3- or 4-prong forceps allows the surgeon to get a firm grip on the dental crown, lessening incidence of slippage from the crown of the tooth as it is elevated (Fig. 5). A properly sized and shaped fulcrum or block is placed near the head of the forceps (Fig. 6). A reverse fulcrum forceps may be helpful to elevate a 06 or 07 from the alveolus (Fig. 7). Gradual, firm traction will readily bring the loosened tooth from its socket. The tooth must be extracted along its path of eruption to gain the best mechanical advantage. Teeth of young horses that have long reserve crowns and are located in the caudal recess of the oral cavity may require sectioning with a molar cutter or Gigli wire saw to allow delivery into the oral cavity. A turning forceps may facilitate delivery of these long teeth into the oral cavity without sectioning (Fig. 8).

The extracted tooth should be examined to make sure it has been removed in its entirety and that no root fragments or slivers of crown have been left in the socket. The alveolus should be examined digitally and with an endoscope or dental mirror, and any bone or tooth fragments must be removed. Operative radiographs will confirm that the correct

Fig. 5. A set of three- and four-pronged extraction forceps. These forceps provide a firm, nonslipping grip on the tooth and aid in elevating the tooth from the socket. The three-pronged forceps come in a right- and left-side design and are available in wide (upper) or narrow (lower) widths.

Fig. 6. A set of fulcrums in a wide range of sizes is helpful in elevating the tooth from the socket. A soft metal such as aluminum and a design that distributes the compression force applied to the forceps over a wide area of the dental arcade reduces the chance of iatrogenically damaging a tooth.

Fig. 7. A duck-billed and a four-prong reverse fulcrum forceps. These forceps allow for a fulcrum to be placed caudal to the tooth being extracted. This allows better leverage in elevating the 06 from the socket. The prong forceps has an adjustable screw in fulcrum attached to the extended end of the forceps.

Fig. 8. Extirpation or turning forceps with an off-set head. This forceps is often confused with the smaller incisor extraction forceps. This forceps is used to grasp and rotate or turn a partially elevated caudal cheek tooth into the mouth so that it can be removed without sectioning the tooth.
tooth has been removed and that the alveolus is free of tooth and bone fragments.

Dental fragments and pieces of lose bone can often be elevated from the socket with angled picks, elevators, and curettes (Fig. 9). In human dentistry, attempts at blind retrieval of small root tip fractures may prove excessively traumatic, and the risk of removal of small root fragments embedded in the bone often outweighs the benefit. As a rule, root tips can be left in place if they are under 5 mm in length, if there is no evidence of periapical pathology, or if the removal process might damage adjacent structures, open the maxillary sinus, or cause uncontrollable hemorrhage. The same criteria apply in most cases encountered in equine dentistry.

After surgery, lower cheek tooth sockets that are chronically infected or contaminated with oral debris may need to be drained ventrally. This can be done using a quarter-inch Steinmann pin or a half-inch trephine to create a hole in the ventral lateral aspect of the mandible below the affected alveolus. The open alveolus is protected by the placement of several 4 x 4 gauze sponges tied in the center to a length of quarter-inch umbilical tape. The tape ends are passed into the empty alveolus through the oral cavity and out the drainage hole. The gauze roll is wedged firmly into the space between the opposing teeth and secured in the socket with umbilical tape tied around another roll of gauze on the outside of the skin incision. The gauze should be changed every few days and the wound irrigated until the periphery of the dental socket is covered with healthy granulation tissue (5 to 10 days).

The alveolus should be protected for several weeks from oral contamination with a patch or plug of dental acrylic, dental base plate wax, polyvinyl siloxane (PVS), or polymethylmethacrylate (PMMA). The entire plug should be about one-fourth the length of the reserve crown of the removed tooth to allow room for the formation of a blood clot and development of granulation tissue in the dental socket. When using dental acrylic, dental base plate wax, or PMMA, the plug should extend only slightly above the top of the gingiva so that it is not involved in chewing. After the plug is in place, its surface is molded carefully with a finger to build a slight flange over the gingival line, sealing the alveolus. When using PVS, this rubbery material should be molded slightly below the gingiva to prevent it from prematurely coming out of the socket. Bone cement (PMMA) can be combined with radiopaque contrast media or antibiotics if needed.

If a hard setting material such as PMMA or dental acrylic is used, the plug will need to be removed 6 to 8 weeks after extraction. Removal may require a four-pronged extraction forceps. Older horses with shallow intact dental sockets do better with no dental packing or plug, leaving the sockets to fill with grass or soft, leafy hay.

The objective of exodontia should be to carefully plan and execute the extraction and protect the dental socket, thereby minimizing complications. Detailed descriptions for avoiding and managing surgical and postsurgical complications can be found in the literature.

Appendix A: Equine Dental Extraction Instrument Suppliers

Pegasus Instruments, Manfred Stoll, 65329 Hohenstein, Germany. www.pferderpraxis-stoll.de.


References


