Plan B: When Oral Extraction Fails

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1. Introduction
Equine oral cheek tooth extraction technique involves using molar spreaders and molar forceps to slowly break down the periodontal ligament, so the tooth may be elevated out of the alveolus. Oral extraction techniques do not always succeed completely. Frequent causes of an intraoral extraction failure are (1) fractured clinical crown, (2) decayed clinical crown, (3) retained root tips, (4) cemental enlargement of the reserve crown and root tip, (5) sagittal fracture of the clinical and reserve crown, (6) dilacerated root tip(s), (7) maleruption, (8) tooth resorption, and (9) alveolar ankylosis. Extraction patients have a high rate of complication and a varied clinical presentation, so it is important to have a well-thought-out treatment plan with several alternatives before oral extraction.

2. Materials and Methods
With the use of constant rate infusion with alpha-2 agonists and opioids and regional nerve blocks, most dental procedures can be performed with the horse standing. The benefits of a standing procedure include (1) improved visualization of the surgical site, (2) more working space within the oral cavity, (3) easier access for intraoral and extraoral radiographs, and (4) better hemorrhage control when dealing with sinus and alveolar disease.

Equipment needs may be categorized into the following: (1) motorized, (2) extraction, (3) alveolar bone debridement, and (4) imaging equipment. Imaging equipment has been covered extensively elsewhere.

Motorized equipment includes (1) standard dental unit with a high speed handpiece, (2) 100,000 rpm high-speed surgical handpiece, (3) 45,000 high torque electrical handpiece, and (4) a large-volume suction unit.

Extraction equipment includes (1) right-angled dental elevators, (2) long-bladed and offset dental elevators, (3) periosteal elevators, (4) trephines, (5) dental punches, and (6) long-handled retractors.

Alveolar bone debridement equipment includes (1) bone curettes and (2) bone rongeurs.

3. Results
Right-Angled Elevators
Right-angled elevators (root tip elevators) may be used in attempts to retrieve retained root tips and occasionally fractured reserve crowns. Typically, partial periodontal ligament breakdown is required so that the tip of the elevator has an edge to engage leverage. The right-angled elevators are designed to be used by exerting constant, slow, and gentle pressure from all aspects of the dental fragment (mesial, distal, buccal, and palatal/lingual).
When a maxillary cheek tooth is presented with a chronic sagittal fracture, the root tips may fracture during the extraction process. An intraoral dorsal-ventral radiograph is helpful in the diagnosis of a retained root tip and the confirmation of a complete extraction. With patience, proper instrument placement and elevation force, many retained root tips can be extracted with right-angled elevators.

Direct Coronal Elevation

Long-handled and long-bladed elevators (Fig. 2) may be used through a transbuccal approach as a method of applying a direct line of pressure on the tooth fragment and/or retained root tip. In addition, a surgical mallet may be used with soft blows to try to elevate the fragments from the alveolus. This technique works well with chronically decayed fragments that are partially embedded and/or ankylosed within the alveolus. Bisecting-angle intraoral radiographs are useful during the extraction procedure to evaluate the placement of the elevator and as a postoperative confirmation of a complete extraction.

Direct Coronal and Apical Elevation

A transbuccal and apical approach may be used in combination as a method to apply elevation pressure simultaneously from both aspects of the dental fragment. This technique works well with maxillary cheek teeth that are severely decayed with sagittally fractured fragments and long-standing concomitant sinusitis. The remaining fractured fragments that have adhered tightly to the alveolar wall due to chronic inflammation can be elevated from both a direct transbuccal coronal approach and an apical approach through a sinusotomy (or buccal bone removal if the second and third premolars are involved). The long-handed and long-bladed elevators work well when elevating from both the coronal and apical aspect. As described with the direct coronal elevation technique, “light tapping” with a surgical mallet may be used and elevator placement is guided with intraoral radiography.

Modified Repulsion Technique

If greater force is needed for repulsion, a modified repulsion technique may be used. This technique typically works well for maxillary cheek-teeth. Radiography is necessary for accurate location of the root tips. The trephine hole is enlarged with a dental handpiece to access and visualize the root tips. The mesial and distal buccal root tips are isolated and sectioned. The remaining buccal root tips are gently elevated and the surrounding bone is lightly reduced. After careful extraction of both buccal roots, the broad palatal root is isolated and sectioned. After appropriate bone removal, the remaining palatal root tip is gently elevated. Care should be taken to section the entire palatal root tip because it is very wide relative to the buccal root tips. The remaining outline of the periodontal ligament is used as a guide to carefully resect/remove and level/flatten the apical aspect of the reserve crown. Moderate repulsion force is applied to remove the remaining reserve crown.

Buccal Alveolar Bone Removal and Surgical Extraction

The technique for buccal alveolar bone removal and surgical extraction of mandibular cheek teeth has recently been described. A 100,000-rpm surgical drill and long surgical bur can be used for this technique (Figs. 3 and 4). By removing the buccal alveolar bone plate, the underlying crown, reserve
crown, and root is isolated, sectioned, and gently elevated from the alveolus. This technique has currently been best adapted for the extraction of mandibular cheek teeth. Aggressive repulsion techniques involving mandibular cheek teeth may lead to sequestra, fistulae, collateral damage, and even mandible fracture. The initial incision differs, depending on whether a premolar or molar is extracted. If a premolar is extracted, the incision is located directly over the affected tooth midway between the vestibule (junction of the alveolar and buccal mucosa) and the apical roots. The incision can be a straight horizontal or a curvilinear incision. When extracting molars, the initial incision is made in a vertical direction slightly tipped in the rostral-dorsal to caudal-ventral plane so that the incision aligns with the angle of the mandibular molar. The dorsal extent of the incision is placed below the vestibule and the ventral extent is at the level of the apical aspect of the tooth. Critical radiographic evaluation with markers (such as skin staples) will help with initial placement of the incision.

Once the initial skin incision is placed, careful dissection through the facial anatomy is needed to avoid major structures such as the facial artery and vein, the buccal branch of the mandibular nerve, the dorsal and ventral branches of the buccal facial nerve, the parotid duct, and a venous plexus of sinus veins (transverse facial sinus vein, profunda—deep facial sinus vein, and the buccal sinus vein). Once the overlying alveolar bone is reached, the periosteum is incised and elevated. The gingival margin is then gently elevated off of the bone and tooth so that there is access to the oral cavity. The gingival opening is extended so that the mesial and distal margins of the clinical crown are visualized. These two margins identify the initial location of the buccal bone removal. As the buccal bone is removed, the mesial and distal extent of the periodontal ligament is used as a guide for the margins. When bone removal approaches the apical extent of the tooth, special care is given to identify the mandibular canal (and artery). Typically, buccal bone is removed to the level of the reserve crown and root junction. Additional bone removal over the roots may be indicated if the roots are dilacerated or involved with reactive cementum.

Once the buccal bone is removed, the tooth is sectioned in a coronal-to-apical direction so that the tooth is divided into a mesial and distal segment. If gentle elevation does not yield extraction of the two segments, an additional horizontal sectioning at midway (between the crown and apex) of the tooth in a mesial to distal direction can be performed. This creates four sections of tooth. The coronal half (mesial and distal segment) of the tooth should elevate easily at this point. If the remaining reserve crown and root segments cannot be extracted with gentle elevation, careful removal of additional bone may be indicated. Once the tooth is elevated and removed, the alveolus is curetted and debrided. Vinyl polysiloxane is placed into the alveolus and the incision is closed.

Clinical and Reserve Crown Sectioning
An oral approach with a right-angled, high-speed handpiece may be used in certain situations to section the clinical/reserve crown of a cheek tooth. This technique works well in teeth that have a shallow clinical and reserve crown (<22 mm) but are difficult to extract because of resorptive and/or ankylosing root tips. After the crown is sectioned, each portion is elevated and extracted with the corresponding root. Repetitively overreduced premolars can lead to chronic pulp exposure and prematurely expired and sensitive teeth. Even with standard nerve blocks, this type of tooth can be very painful when extracting. By sectioning the tooth in half before right-angle elevation and extraction, the process is tolerated better by the horse and the total extraction time is reduced.

4. Discussion
The goal of using different extraction methods is to minimize trauma to the alveolus and surrounding bone. Excessive/misguided rotational and extraction forces may lead to large bone sequestra, damaged palatal bone, mandible fracture, sinus infections, incomplete extractions, fistulas, and so forth. All available options should be considered when evaluating an extraction case. With complete assessment and treatment planning, the incidence of extraction complications can be minimized.

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References and Footnotes

AAEP PROCEEDINGS / Vol. 58 / 2012 287


*IM3 Elite LED dental unit. IM3 Vancouver, WA 98682.

Hall surgical high-speed handpiece. Hall Powered Instruments, Largo, FL 33773.

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Root tip elevators, Equine Dental Picks Potts Style, Medco Instruments, Hickory Hills, IL 60457.

T-Handled 4-positions elevator. Equine Specialties, Georgetown, TX 78626.

Extended molar fragment elevator set. Harlton's Equine Specialties, Elmwood, WI 54740.


Extended wolf tooth elevators. Harlton's Equine Specialties, Elmwood, WI 54740.

Periosteal elevators. Synthes, Paoli, PA 19301.

Trephines. Harlton's Equine Specialties, Elmwood, WI 54740.

Dental punches. Harlton's Equine Specialties, Elmwood, WI 54740.

Hohmann retractors. Synthes, Paoli, PA 19301.

BRUN curette size #1 to #5. Medco Instruments, Hickory Hills, IL 60457.

Bone rongeurs. Medco Instruments, Hickory Hills, IL 60457.

Oval carbide bur (bur 4 mm diameter × 8 mm long, shaft 3/32-inch diameter × 48 mm long), Brassler USA, Savannah, GA 31419.

Orthopedic mallet. Synthes, Paoli, PA 19301.

Aquasil EasyMix Putty, Dentsply Caulk. Benco Dental, Pittston, PA 18640.