

EQUINE ODONTOCLASTIC TOOTH RESORPTION AND HYPERCEMENTOSIS: TECHNIQUES FOR EXTRACTION OF CANINE AND INCISOR TEETH

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Key Points:

- Equine odontoclastic tooth resorption and hypercementosis (EORTH) is a very painful condition for the horse once lesions become infected and/or supragingival.
- EORTH most commonly affects the incisors but canine teeth can be severely involved; therefore, intraoral radiographic exam of incisor and canine teeth is warranted upon initial exam.
- Extraction is currently the only viable treatment option when teeth become moderately to severely affected by EORTH.
- All dental material should be removed during extraction to provide the best response to extraction therapy.
- Extractions can be challenging on EORTH teeth due to weakened dental structure, ankylosis of the periodontal ligament, and severe inflammation and infection of surrounding alveolar bone.
- Horses with no incisor teeth have a high quality of life, and dietary recommendations post-extraction rely on appropriate pelleted feed and hay products with reduced fiber length (e.g. hay stretchers, dengi, chopped hay). Most horses maintain the ability to graze on new growth in pasture.

Equine Odontoclastic Tooth Resorption and Hypercementosis

EORTH is a newly recognized pathology affecting both the incisors and canine teeth of the horses typically greater than 15 years of age.ⁱ There are a few antidotal reports of resorption of the second and third premolars. EORTH is characterized by internal and external resorption of dental structure sometimes associated with excessive production of cementum on the exterior of the tooth. As the disease progresses, the pulp, periodontal ligament, and alveolar bone become inflamed and infected leading to reduced structural support for the teeth, degradation of gingiva, increased incisor angle, fistula formation, tooth fracture, and pain. It has been reported that periodontal inflammation might be an initiating trigger for tooth resorption.ⁱ Resorption is sustained by chronic stimulation of osteoclastic activity; an inflammatory factor that plays a primary role in stimulation of osteoclasts during periodontal disease is PGE₂. A reparative reaction involving fibroblasts and cementoblasts invades between the osteoclasts producing a cementum-like tissue to fill the dental defects. Depending on the animal and individual tooth reaction, the balance between resorption and deposition can vary resulting in the variety of stages seen sometimes in one mouth.ⁱⁱ Though a singular etiological theory has not been proven for EORTH, it is clear that chronic inflammation is involved.

EORTH in general is a painful disease. The most common initial sign of incisor pain reported by owners is a reduced ability in grasping apples and carrots. Many horses over time will eventually become completely disinterested in accepting these treats. Other signs of pain associated with EORTH include sensitivity to biting, head shaking, ptyalism, resistance to turning during work, shyness about the head, periodic inappetance, weight loss, and decreased use of incisors for grasping and grazing. Some horses become incredibly adept at grasping feed with the lips, sliding it past the incisors and moving it into the mouth through the “bar” region.

Watching how an EORTH horse eats hay prior to an oral exam is a good way to gauge the animal's discomfort and stage of disease. Some highly trained horses or horses in earlier stages of the disease can show no apparent signs of discomfort, and patients with primarily hypercementosis and very little to no resorption also seem to remain comfortable. Oral exam can be quite challenging because patients are resistant to manipulation of the lips and pressure on affected teeth. Placement and opening of an oral speculum can elicit alert and possibly dangerous behavior even under heavy sedation. Oral exam findings can include enlarged mandibular lymph nodes, decreased incisor angle not appropriate for age, prominent juga, loss of dental papillae, gingival and mucogingival fistulas, severe regional inflammation, purulent drainage, calculus and feed accumulation, missing teeth, hyperplastic gingiva, gingival recession, bulbous enlargement of dental structures, tooth mobility, and supragingival regions of dental resorption. Resorptive lesions in older horses can be found under excessive tartar deposition on the mandibular (more common) and maxillary canine teeth. Exposing these lesions after removal of tartar will cause discomfort for the horse and the practitioner should be prepared to address the problem either through extraction under primary care or referral to a dental or surgical specialist.

EOTRH necessitates intraoral radiographs of both the incisors and canines to properly formulate a treatment plan. Radiographic findings typically include loss of the periodontal ligament space, disruption of alveolar and regional cancellous bone, osteomyelitis, and tooth fracture. Cases involving only hypercementosis can usually be monitored via annual oral exam and radiographs as these horses usually remain comfortable for a long period of time. Patients with mild subgingival resorption and no regional osteitis or alveolitis can be monitored with oral exam and radiographs as the pace of disease progression varies between teeth and individuals. It is not uncommon to see on radiographs a variety of disease stages ranging from normal to severe throughout the incisors and canines. Once supragingival lesions, alveolitis, osteomyelitis, tooth fractures, and extensive resorption of the reserve crown and root are detectable on radiographs extraction is recommended. Moderate to severe cases of EOTRH require staged or complete extraction of the affected incisor and canine teeth to alleviate infection and pain caused by this disease. Incisor extraction can be accomplished in two ways depending on the nature and severity of the pathology associated with the tooth/teeth. Singular incisor extraction can be accomplished simply in mild to moderately affected teeth by elevation and avulsion.ⁱⁱⁱ In cases of multiple incisor and canine tooth extraction with severe EOTRH, a surgical approach is necessary to allow for complete removal of dental material, visualization of tooth and diseased structures, debridement, and closure. In addition, a surgical approach increases the surgeon's ability to deal with complicated extractions where reserve crowns and roots have fractured due to initial trauma and resorption.

Extraction of Incisors and Canine Teeth

Extraction of the equine incisor and canine teeth requires knowledge of regional and dental anatomy. Incisors are radicular, hypsodont teeth with long reserve crowns that erupt continually throughout the life of the horse. Therefore, as a horse ages incisor extraction should theoretically become easier. The interproximal bone between the incisors on the maxilla and mandible is relatively thin. This is significant when considering extraction, as the interproximal bone should deform allowing for instrument placement around incisors. The structure of the equine canine tooth is less complex than the incisors and cheek teeth, and in outward appearance may seem to be more brachyodont in nature. When looked at more closely though the crown is

superficially covered with peripheral cementum and coronal enamel extends deep into the alveolus suggesting a tooth more hypsodont in nature. The average length of a canine tooth from crown tip to apex is 5-7 cm, and only a 1/4 to 1/3 of this is clinical crown. Canine teeth do not continually erupt like the incisors and cheek teeth, so the length of the tooth within the alveolus changes minimally. Therefore, extraction of the equine canine tooth, even in the older horse, can be a significant undertaking requiring a surgical approach if pathology has not already caused significant degradation of the periodontium.

Prior to starting any extraction, the patient needs to be properly restrained and sedated. A complete oral exam and all necessary occlusal adjustments should be performed before extraction so the oral speculum will not need to be placed on the surgical site post-operatively. Regional and local anesthesia of the extraction site is necessary to alleviate pain and ensure a successful procedure. EORTH is exquisitely painful for the horse, and without regional and local anesthesia, a standing procedure utilizing a constant rate infusion of a sedative will not be possible. Preoperative radiographs of incisors and canine teeth to determine the condition of reserve crown, root, alveolar bone, and periodontal ligament are highly recommended to accurately diagnose the condition and appropriately prepare for extraction. Flushing of the extraction site and surrounding tissue with antimicrobial rinse to remove major debris and decrease bacterial populations prior to extraction produces a cleaner working site with decreased chance for serious contamination. Owners should be warned that full incisor extraction may lead to a slight protrusion of the tongue especially when animals are at rest. Horses without incisor teeth have a high quality of life and most maintain their ability to graze on soft, fresh pasture. It should be emphasized to the owner though that a balanced, pelleted ration should be the main stay of the patient's diet to ensure adequate nutrition.

Equipment list:

Basic surgery tray (scalpel, forceps, metzenbaum and mayo scissors, needle driver, etc)

Dental elevators^a

Lane's bone holding forceps^b

Wolf tooth extraction forceps^c

Periosteal elevator^d

High-speed dental unit (or pneumatic surgical drill)^e

Round carbide bur^f

Round diamond bur^g

Antimicrobial flush (0.12% chlorhexidine solution)

2-0 suture material on a cutting needle^h

Incisor Extraction

Simple extraction of incisor teeth can be accomplished by using dental elevators to slowly break down the periodontal ligament. The dental elevator is slipped into the periodontal ligament space, and slow, constant rotational force is applied to fatigue the ligament. Once the tooth is moderately mobile, extraction forceps (wolf tooth or small animal) can be used to elevate the tooth. The Lane's bone holding forceps can be particularly useful for grasping onto the triangular shaped incisor. These forceps tightly grasp the tooth to allow the practitioner to exert a rotational and avulsion force simultaneously. Constant application of a controlled force is superior to "wiggling" the tooth. Once the tooth is extracted, the site is debrided and flushed. Some practitioners may elect to pack the open alveolus with gauze, but with daily flushing by the

owner incisor extraction sites usually heal quickly without packing. Impression material packing is not routinely used, as it will fall from the alveolus readily due to its shape and depth.

A surgical approach to incisor extraction involves the creation of a mucogingival flap to reveal underlying tooth and bone. Bone removal with a high-speed or pneumatic drill with a cutting bur decreases supporting structures and allows for cleaner and quicker extraction of the tooth/teeth. Elevation and extraction are performed following bone removal, and the area is debrided, flushed and smoothed. The mucogingival flap can be partially or completely closed depending on the nature of the extraction and pathology. Closure can be in either a simple continuous pattern or a simple interrupted pattern. Due to the high rate of dehiscence of these sites (see note below), simple interrupted allows for more regional removal of suture. Monocryl is the suture of choice.

Canine Tooth Extraction

Due to the length of the reserve crown and root situated within a curved alveolus, basic principles of surgical dental extraction will need to be utilized for canine tooth removal.^{iv} In general, a mucogingival flap will need to be raised to expose the underlying labial bone. Depending on the tooth and the pathology affecting the tooth, 60-80% of the labial bone plate will need to be removed with a high-speed dental drill to allow for elevation. Once the reserve crown and root are uncovered, a dental elevator is used to fatigue the periodontal ligament and the tooth is removed with extraction forceps. All bone margins should be smoothed with a round diamond bur and the site should be debrided and flushed clean. The flap will need to be closed in a tension free manner; therefore, the periosteum underlying the mucosa will need to be cut to allow for free movement of the flap. The flap is sutured closed in a simple interrupted pattern.

Post-operative radiographs are recommended for every extraction procedure to ensure no dental fragments have been left behind and to provide documentation of the procedure and lack of adjacent hard tissue damage. Post-operative pain medication and antibiotics are indicated in surgical extraction procedures. Owners should be instructed to keep horses on a pelleted mash for the first 24 hours. After this time, soft soaked hay, dengi, or soaked hay stretchers can be introduced with dry pelleted feed. The surgical sites should be rinsed with warm water or a warm antimicrobial rinse (0.12% chlorhexidine or very dilute betadine) twice a day until the sutures fall-out or are removed. Long term dietary planning needs to be considered on an individual basis, as horses will differ in feed preference.

Surgical extraction of teeth may sound simple, but experience demonstrates how challenging this procedure can be especially when first learning all the steps involved. Extensive incisor extractions and canine tooth extraction can be complicated and frustrating for experienced dental surgeons, and a practitioner should evaluate his ability to perform this procedure (training, experience, instrumentation, etc) before attempting it. Case referral may be in the best interest of the patient and all parties involved. In the past, canine teeth have been extracted by surgical and nonsurgical procedures with various outcomes. The goal of the surgical procedure outlined above is to maximize success while minimizing uncontrolled collateral damage, frustration, and time. Extraction of a canine tooth in a nonsurgical manner is not recommended unless the tooth already displays significant mobility and the reserve crown and root are intact. The high-speed or pneumatic drill dramatically increases the practitioner's ability to precisely remove bone and deal with more complicated extractions (fractured reserve crown/root, resorbed teeth, and ankylotic periodontal ligament) in an exacting manner.

It should be noted that mucogingival flaps in horses are notorious for dehiscence especially on the mandible. The reason behind this is not exactly known, but time devoted to mastication, disruption of circulation during surgery, labial and frenulum attachments, gravity and tongue action have all been thought to contribute to dehiscence. In the author's experience, dehiscence if present usually occurs between days 5 – 10, when granulation tissue, partial primary closure, and wound contraction have already started to occur at the surgical margin. Sutures involved with the dehiscence are removed, and the owner is instructed to flush the wound twice daily with an antimicrobial rinse until complete healing has occurred by second intention (usually 2-5 weeks).

Sometimes severely resorbed teeth make complete extraction particularly challenging, and there has been discussion within the dental community as to whether clinical crown amputation is acceptable for these teeth. There is no study documenting the long-term success of this procedure in horses; however, in cats with severe tooth resorption, crown amputation is acceptable and successful if no periodontal ligament or regional pathology is visible on radiographs. Whether horses are similar to cats in this manner is unknown. The author suspects that the degree of regional/dental necrosis, bulbous hypercementosis, infection, and inflammatory tissue reported by Staszuk in 2008 would lead to continual post-operative regional inflammation and infection if portions of an incompletely resorbed tooth were purposefully left in the alveolus.¹ The practitioner and the owner should carefully weigh the pros and cons of this approach if resorption is severe enough for this procedure to be considered.

In conclusion, extraction of equine incisor and canine teeth can be rewarding for both the patient and practitioner when performed in a well thought-out surgical manner.

^aWinged dental elevators size 5mm to 8mm, Miltex Inc., York, PA.

^bLane bone holding forceps with ratchet 13 inch, Or homed Inc, Portland Oregon.

^cWolf tooth forceps, Harlton's Equine Specialties, Elmwood, WI.

^dSeldin periosteal elevator, I.R.H Surgical Co., Sialkot, Pakistan.

^eiM3 GS Dental Unit, iM3, Vancouver, Washington.

^fSize 8 round carbide cutting bur, Henry Schein, Melville, NY.

^gSize 023 round diamond finishing bur, Henry Schein, Melville, NY.

^hMonocryl 2-0 cutting needle, Medex Supply, Santa Monica, CA.

ⁱ Staszuk C, Bienert A, Simhofer H, et. al.: Equine odontoclastic tooth resorption and hypercementosis. *Vet J*178:372-79, 2008

ⁱⁱ Schatzle M, Tanner SD, Bosshardt DD, et al. Progressive, generalized, apical idiopathic root resorption and hypercementosis. *J Periodontology*76:2002-2011, 2005

ⁱⁱⁱ Tremaine W, Schumacher J: Exodontia, in Easley J, Dixon P, Schumacher J (eds): *Equine dentistry* 3rd ed. London: Saunders Elsevier, 2011, pp 321-322

^{iv} Wiggs R, Lobprise H: *Veterinary dentistry: principles and practice*. Philadelphia: Lippincott-Raven, 1997