DEVELOPMENTS AND OPTIONS IN EQUINE CHEEK TEETH EXTRACTION

Author: THOMAS WITTE

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THOMAS WITTE describes the factors to be considered when choosing an extraction method in horses, the latest techniques and equipment needed.

Summary

Diseases of the cheek teeth are a major cause of morbidity in horses and, in severe cases, can result in euthanasia due to progression of the original disease process or iatrogenic exacerbation. In the absence of techniques with proven long-term efficacy for dental preservation, extraction remains the treatment of choice for most apically infected, fractured or displaced teeth or those with severe wear abnormalities.

While repulsion under general anaesthesia via large trephines or even sinus flap osteotomies was the mainstay extraction technique for many years (Dixon, 2000; Schumacher, 1993), standing extraction techniques have superseded these approaches in most cases due to advances in sedation protocols, regional anaesthetic techniques and enhanced equipment (Dixon, 2005; Townsend, 2008). Today we have a range of techniques available to us, which we can tailor to the individual circumstances of each tooth to achieve an optimum outcome with regard to morbidity, function, cosmesis and cost. These include oral extraction, minimally invasive buccotomy with screw extraction, intraoral tooth segmentation and minimally invasive trephination and Steinmann pin repulsion. Full osteotomy or traditional buccotomy is only required in rare cases.

Key words

horse, exodontia, molar, instruments, techniques
CHEEK teeth diseases in horses are a major cause of morbidity and, in severe cases, can result in euthanasia due to progression of the original disease process or iatrogenic exacerbation.

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Indications for extraction (Figure 1) include apical infection (blood-borne or ascending due to infundibular or pulpar disease), fracture (due to external trauma, severe pulpitis or infundibular decay), periodontal disease (young horses with developmental valve diastemata or older horses with generalised periodontal disease) and developmental disorders (displaced or abnormal teeth, including polydontia).

The first goal in evaluation of a horse with dental pathology is to definitively identify the implicated tooth, and to confirm the necessity for intervention.

This is easier said than done in many cases, particularly when using two-dimensional imaging. Clinical signs will persist after extraction if the wrong tooth is removed, or if dental disease is not the primary cause. That said, one must not be too cautious in the presence of subtle apical changes since the financial costs of conservative management can be considerable and disease progression can complicate later surgical treatment, making an early and accurate diagnosis and timely intervention desirable.

Standing CT is cost effective, safe and readily available across the UK and it should be considered in all cases of suspected apical disease, even in the absence of obvious occlusal surface changes. CT can greatly enhance surgical planning, even where the need for dental extraction may be obvious, since it provides information on the shape of tooth roots, configuration of fractures and can predict other impending difficulties with extraction or problems in other teeth.

In cases of diastemata and displaced teeth, CT can help predict the likely success of conservative treatment.
Choice of extraction technique

The technique of choice for exodontia will be determined by a number of factors. Irrelevant of the chosen technique, the surgeon must keep in mind (and have available) a plan B, plan C and even a plan D. Considerations for initial choice include the animal’s age and temperament, the morphology of the tooth (angled/divergent roots or wedging) and pathological changes of the crown and root.

Clients must be appropriately informed and their consent obtained after careful discussion of the risks and potential complications of the proposed technique. In the presence of a residual clinical crown, the author always begins with oral extraction techniques, which may be followed by minimally invasive buccotomy (combined with screw extraction or intraoral segmentation) or minimally invasive trephine and repulsion, as necessary.

Based on a preoperative CT, clients can be made aware of the likely necessity for the more invasive techniques and are, therefore, not surprised at increasing costs or duration of hospitalisation.

Although oral examination can add a great deal of value to the decision of the technique of first choice, the presence or absence of occlusal surface abnormalities must be interpreted with care. Obvious fractures of the clinical crown need not always necessitate full extraction, while absent occlusal surface pathology may mislead in cases with more subtle, though no less clinically significant, apical disease.

Equipment requirements

While a critical mass of sometimes costly equipment is required for many of the extraction techniques discussed in this article, appropriate equipment not only improves success rates, it also improves patient compliance and reduces surgeon fatigue.

An appropriately quiet room with sufficient space and, ideally, a set of stocks or other method of restraint is essential. Oral extraction can succeed or fail on the quality of assistance available and the experience and efficiency of assistants can be almost as important as those of the operator.

Essential equipment for any standing extraction technique includes head support, ideally a dental halter suspended from above or at least a head stand; speculum/gag; bright headlight; dental endoscopy (mirrors are often not adequate for optimum outcomes in the more advanced techniques); and intraoperative radiography.

Sedation and regional anaesthetic techniques
Sedation for all standing techniques is best achieved using a combination of alpha-2 agonists and opiates. At the RVC this means detomidine and butorphanol. An initial loading dose at the upper end of the dose range may be topped up intermittently as required at key times of the procedure or a constant rate infusion may be used. Diazepam can also be added to achieve increased relaxation, although the duration of effect is short.

Regional anaesthesia can be achieved using maxillary or mandibular nerve blocks (10ml to 15ml mepivicaine and/or bupivicaine). The rostral cheek teeth can sometimes be anaesthetised by advancing a narrow gauge spinal needle retrograde up the infraorbital or mental canals.

**Oral extraction**

Oral extraction offers the potential for reduced collateral damage and less morbidity compared to other techniques, resulting in shorter convalescence times and faster return to function, and is, therefore, the technique of choice on the majority of horses.

Although there is a substantial learning curve associated with this approach, it can be performed in the standing horse, resulting in less time pressure. The avoidance of general anaesthesia is clearly a considerable advantage in equine patients. Disadvantages are that the process can be time consuming (average total times for routine extraction are one to one-and-a-half hours) and it requires specialist equipment.

Specific additional equipment for oral extraction includes molar spreaders of at least two different widths, extraction forceps (the author prefers four-prong forceps in two sizes to accommodate ponies and smaller teeth or fragments), gingival elevators in a variety of lengths and angles, fulcrums of various thicknesses, and instruments for fragment retrieval (Figure 2).

The first step in oral extraction is always careful separation of the gingival attachments to the tooth. The author routinely detaches all soft tissues on the palatal or lingual aspects of the target tooth to the level of the alveolar rim. The buccal side is most often left intact. However, these attachments can rarely be detached fully without collateral damage and leaving them attached does not appear to hinder extraction.

Next, the periodontal ligaments must be loosened, and this relies on two techniques: mesial-distal spreading with wedged spreaders, avoiding the mesial aspect of 07s and distal aspect of 10s; and subsequent loosening with molar extraction forceps through rotation and tilting. When the tooth is sufficiently loose within the alveolus, it may be extracted vertically using a fulcrum beneath the handles of the extraction forceps.

After extraction, the tooth should be carefully examined for signs of incomplete extraction, and the alveolus flushed and subsequently filled with iodine-soaked gauze swabs (tampons). Packing is used merely to retain the alveolar haematoma and to prevent acute impaction of feed material.
within the socket, and is removed if it is still in place after 14 days.

In the absence of severe internal disease of the tooth, and with appropriate equipment and experience, oral extraction can be highly successful, thereby avoiding more invasive techniques. However, additional techniques become necessary in fractured teeth or teeth that fracture during attempted extraction due to severe internal cavitary disease.

Minimally invasive buccotomy and screw extraction

This approach, which was pioneered in Germany by Manfred Stoll, with equipment as shown in Figure 3, involves placing a cannula through the cheek through which instruments can be placed directly into the alveolar socket. This provides additional working space and offers greater mechanical advantage through the use of straight instruments as opposed to right-angled ones. The periodontal attachments can, therefore, be severed more effectively. Indications for mini buccotomy include fracture of the clinical crown, retained reserve crowns and root fragments and displaced or deformed teeth that are not amenable to the use of spreaders and forceps.

Cementosis within the alveolus can also be debrided using this approach. Sedation and regional anaesthesia are similar to oral extraction, with the addition of infiltration of the skin and cheek muscle at the level of the target tooth.

Any buccotomy approach requires a good understanding of the local anatomy to avoid serious complications. The variable locations of the buccal branches of the facial nerve must be identified, marked if necessary and carefully avoided. The parotid duct can easily be catheterised retrograde using a tracheal wash catheter, making it easier to identify and avoid externally.

A Gunther speculum with a sliding bite plate (Figure 2a) is very advantageous as it leaves the cheeks uncovered and allows the upper and lower dental arcades to be offset during extraction. After the mouth is opened skin staples are placed to mark the mesial and distal borders of the occlusal surface of the target tooth, the occlusal surface of the opposite cheek tooth, and the approximate location of the reserve crown and roots to guide the direction of instrument placement and drilling.

After making a 2cm to 3cm longitudinal incision, the buccotomy trocar-cannula unit can be inserted bluntly through the cheek (Figure 4a). Straight instruments can then be passed directly into the alveolus (Figure 4b). After elevation and extensive loosening, several options exist for final extraction: oral extraction using forceps as above; screw extraction; or intraoral segmentation and removal in fragments. Screw extraction involves drilling a 5.5mm tract into the tooth, aiming for solid tooth material located at the apex between the roots. The drill tract is lavaged carefully and tapped prior to insertion of a customdesigned screw, which can be used to further loosen the tooth and finally extract it from the socket (Figure 5).

For a successful outcome using this technique, repeated radiographic monitoring is imperative to
determine an appropriate direction and depth of drilling. After extraction, the incision is lavaged and the skin closed with staples. A head bandage may be placed if swelling and/or emphysema are evident. For this contaminated procedure, broad-spectrum oral antibiotics and NSAIDs are routinely administered for five days postoperatively. The alveolus is packed with gauze as for the routine oral extraction.

The major risks of this procedure include damage to the alveolar bone, injury to the buccal branches of the facial nerve or any of the other anatomical structures of the cheek. Incisional infection is a possibility due to the contaminated nature of the surgery, but the cosmetic and functional outcomes are excellent, in contrast to traditional buccotomy and lateral bone plate resection, which carries a greater risk of iatrogenic buccal nerve and parotid duct injury due to the larger size of the buccotomy (Boussauw, 2003).

**Intraoral cheek tooth segmentation via mini buccotomy**

In cases of severe cavitary disease or complex fracture, the screw may not hold. A second drill tract can be created or the tooth segmented intraorally and removed in fragments. A burr with a long shaft can be placed through the buccotomy to segment the remaining tooth into individual roots, which can then be elevated more easily, or the tooth can be fragmented with narrow gauge chisels and osteotomes.

**Minimally invasive trephine and Steinmann pin repulsion**

Repulsion has become the treatment of last resort in most cases, due to the inherent nature of the collateral damage created, and is rarely required. It is reserved for intractable patients that resent work in the mouth or for intractable wellattached fragments where loosening by oral extraction or mini buccotomy have failed. The apical alveolar bone is inevitably penetrated, with potential for greater morbidity in the form of orosinus fistulation or sequestration of bone.

Careful radiographs and external marking guide the placement of a small trephine – just large enough to accommodate a Steinmann pin. The Steinmann pin may then be advanced to the apex of the tooth or fragment. Pin position should be confirmed frequently in the rostro-caudal plane with radiographs and for the mediolateral plane with a hand in the mouth. The tooth or fragment can then be pushed into the mouth. Previous loosening should mean the force required to achieve repulsion will be limited and, therefore, this procedure can be performed in the standing horse.

Aftercare is similar for other techniques, however, the alveolus must be packed with watertight dental impression material due to penetration of the alveolar bone plate – in particular in cheek teeth with apices in the sinuses. Although this repulsion technique theoretically creates less collateral damage than traditional osteotomies, experience is necessary for successful extraction and to avoid frequent repositioning of the pin prior to repulsion.
Full osteotomy or trephine and repulsion (GA)

Full osteotomy and traditional large punch repulsion are generally considered obsolete techniques, except in horses intractable to work in the mouth under sedation in the standing position. These approaches create broad collateral damage compared to the other techniques and, as a result, they increase the overall expense of extraction. The rate of complications from this technique is high at 32 per cent to 70 per cent (Dixon, 2000; Prichard, 1992; Tremaine and Dixon, 2001).

Conclusion

Advances in instrumentation and techniques, and the availability of advanced imaging and dental endoscopic equipment mean traditional techniques of equine cheek tooth extraction – which have suffered from widespread collateral damage and high complication rates – can often be avoided. Most extractions can be completed without recourse to a surgical approach. However, when surgery becomes necessary, standing, minimally invasive techniques should be considered.

• Please note some drugs mentioned are not licensed for veterinary use.

References