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REFUTING SOME WELL-KNOW FACTS ABOUT EQUINE DENTISTRY

Introduction

Equine dentistry was a poorly researched area until the late 1800s when it developed to some degree, but in the early 1900s, with the advent of motorised transport and agricultural vehicles, the role of the horse in society reduced greatly, and most equine scientific studies, including dentistry, declined greatly. With the exception of the work of Ernst Becker and colleagues, very little advancement in equine dentistry was made in the 20th Century until recently. In the 1970s, certain groups of American lay people, promoted some older unsafe procedures and developed dangerous “rules” for equine dentistry that unfortunately have continued to be used to the present day, including by some veterinary surgeons. There has been a major scientific revival of equine dentistry studies over the last 20 years, and using this newly acquired knowledge, we should now strive to perform evidence-based equine dental procedures.

Reduce Incisor height to promote “increased molar contact”

This procedure was initially popularised by lay people performing equine dentistry over 100 years ago. Even at that time, it was realised by veterinary surgeons that the incisors could not keep the cheek teeth apart, but as Merrilat and Campbell (1935) wrote some years later “it was easier to trim the incisors and collect fees than to give lectures on anatomy without pay”. Equine cheek teeth are mainly composed of equine type-1 enamel which is extremely hard, and these cheek teeth have 14 times the surface area of the incisors which additionally, are composed of the softer equine type-2 enamel. Consequently, it is mechanically impossible for “overlong” incisors to prevent the cheek teeth from contacting. Incisor reduction (odontoplasty, grinding, floating) can cause pain to horses by exposing sensitive incisor dentine; removing normal healthy incisor tissue; and on occasion causing more painful pulpar exposure resulting in the risk of apical infection and tooth loss.

When the mandible is forced sideways the incisors should separate by a defined amount

Some workers have used the findings of this manoeuvre to justify incisor reduction. The basis of this procedure is dependent on the angulation of all of the cheek teeth being 15°, which has shown to be untrue (see below). Normal horses can vary greatly in their dental and craniofacial anatomy and consequently, some normal (often young) horses have immediate and marked separation of the incisors when their mandible is forced sideways, whilst other completely normal (often older) horses may only achieve the same degree of incisor separation once the mandible has been moved considerably further (sometimes twice the distance). The latter finding is no excuse to reduce normal incisors!

There is no danger of causing cheek teeth pulpar damage in normal horses with routine dental procedures

It was previously believed that all cheek teeth had 10 mm or more of subocclusal secondary dentine overlying the pulp horns, and also that this subocclusal secondary dentine was even thicker in older horses. Consequently, it was believed that even with marked reduction of normal teeth, there was no risk of pulpar exposure (pulpar thermal damage must also be considered). Work by White and Dixon (2010) has shown great variation in the subocclusal dentinal thickness of normal horses, that can be as low as 3-4 mm, with a subsequent risk of pulp exposure or thermal damage with excessive reduction in tooth height.

Cheek tooth overgrowths should be reduced to a normal height in a single procedure

Until a decade or so ago, it was standard practice to reduce all overgrowths to the height of adjacent normal teeth in a single procedure - even using dental shears (that fractured teeth) in some cases. Recent studies have shown that overgrown cheek teeth often have much reduced sub-occlusal secondary dentine, even less than the normal height teeth. This is probably because they do not have normal contact with their opposite tooth – a process that appears necessary to stimulate subocclusal secondary dentine deposition. It has been observed that some overgrowths, even 20 mm in height, may have less than 5mm subocclusal secondary dentine (Marshall and Dixon.
2011). Consequently large overgrowths should be reduced in stages, for example, 3 to 4 mm at a time, at 3 monthly intervals in order to prevent pulpar exposure and also to stimulate the underlying pulp to lay down subocclusal secondary dentine. Some horses have quite marked dorsal curvature of the cheek teeth occlusal surface in both the rostral and caudal direction (Curve of Spee) and “correction” of these normal anatomical features should not be performed. Likewise, horses that have developed marked wavemouth, often have good occlusal contact between all of their teeth. Attempts to change these occlusal surfaces to a more normal outline can be painful to horses, and will actually reduce cheek teeth occlusal contact for a long while, and so is not warranted.

**All transverse ridges should be reduced or removed**

The 11-13 rows of transverse ridges on the occlusal surface of equine cheek teeth have evolved over 55 million years to give a larger occlusal surface contact area for more efficient food mastication. These ridges can vary in height, depending on the individual breed, horse and age. Some lay people have somehow come to the conclusion that the presence of tall, but normal ridges are “exaggerated” or “accentuated” and “prevent rostral movement of the mandible” and so they should be reduced/removed. The alleged scientific basis of this importance of rostro-caudal mandibular movement and consequent removal of normal tissues has not been explained!

**All cheek teeth occlusal surfaces should be ground to a 15° angle**

The older textbooks state that all equine cheek teeth have an occlusal angulation 15° in the buccal to palatal/lingual direction and this angle is supposed to be related to the angles of the temporomandibular joints. A study by Brown et al. (2008) has shown this information to be inaccurate. The mandibular cheek teeth normally have angles of circa 15° at their rostral aspect of the cheek teeth row and of 30° to 35° at their caudal aspect. In contrast, the maxillary cheek teeth have an angulation of approximately 15° rostrally, that decreases to circa 10° at the caudal aspect of the row. Important takeaway messages from this new information are that one should not mistake the normal higher angles of the caudal mandibular cheek teeth as being excessive and then subsequently reduce them to the lower angles normally present in the maxillary cheek teeth. Similarly, one should not reduce the angulation of the mandibular cheek teeth to make them similar to the lower angles normally present in the maxillary cheek teeth.

**All wolf teeth must be removed**

It has been a common mantra for over 100 years that all wolf teeth can cause great harm so they should always be removed. Consequently, any veterinarian who does not extract every wolf that is identified, “does not know anything about equine dentistry”. However, some horses that perform dressage, showjumping and other ridden disciplines at the highest level still have their wolf teeth! Wolf teeth do not always contact the bit and even if they do, they may not cause any problems. If such horses have no pain around this area and there is no history of biting problems, the wolf teeth should just be left in place. However, if wolf teeth are very large, displaced or there are associated painful soft tissue lesions on palpation, they can then be rationally removed.

**Horses should have a good “bit seat” cut to improve the bitting performance**

The more severe types of “bit seating” procedures (reduction of the rostral aspect of the 06s) appear to be largely from the 1900s. The use of very aggressive “Texan bit seats” that remove nearly half of the clinical crown (from the rostral gingival margin to the occlusal surface just in front of the 07) appears to be a more recent development. Aggressive “bit seats” certainly do not improve the horse's comfort with the bit, because sensitive dentine is exposed. Sometimes the most rostral (06th) and other pulp horns are exposed because of the above-noted misconception about the depth of the normal subocclusal secondary dentine. Some horses with pulpar exposure due to bit seating develop pulpitis with later chronic apical infection and death of the tooth. Whilst a sharp rostral edge should not be left on the 06 cheek teeth, there is no scientific indication to perform bit seating, particularly as the bit is not designed to make contact with the rostral aspect of the cheek teeth anyway.

**All canine teeth should be reduced in height**

Another popular misconception is that all adult male horses should have the canine teeth reduced in height. This procedure is performed to allegedly prevent damage to the hands of dental operators when performing dentistry and some also allege that it prevents undue contact between the bit and the canine teeth. In all cases, canine
reduction will cause painful exposure of sensitive dentine. In some cases, pulpar exposure will occur during canine reduction that may lead to apical infection. There is no scientific rationale to reduce normal canine teeth.

**Recommended Reading**

AETIOLOGY, DIAGNOSIS AND TREATMENT OF EQUINE CHEEK TEETH APICAL INFECTIONS

Aetiology
Apical infections of equine cheek teeth are often caused by blood or lymphatic borne bacterial infections (anachoresis) and inflammation of the pulp due to dental impaction may predispose to such infections. In other cases, oral bacteria may gain access to the pulp and thus the apex, by gross or fissure dental fractures or by a deep periodontal disease (such as those caused by diastemata at supernumerary and displaced teeth). Infection of the upper cheek teeth may be due to food accumulation and fermentation deep in cemental defects in the two infundibulae (infundibular caries) leading to infection of the pulp (or sagittal midline fractures).

Clinical Signs
Because many apical infections occur in younger horses which have long reserve crowns, the infection is usually unable to drain into the oral cavity, and the infection also involves the alveolus and the supporting bones adjacent to the infected apex. Mandibular apical infections are inevitably accompanied by unilateral mandibular swellings that will often develop external draining tracts. Infections of the upper Triadan 06s (PM2) and 07s (PM3) (occasionally the 08s) cause focal swellings of the rostral maxilla, which are almost pathognomonic for dental infections. In some such cases, an external sinus tract will develop; less commonly a tract will drain into the nasal cavity. Infections of the caudal 4 maxillary cheek teeth generally results in a secondary sinusitis, with the presence of a chronic, malodorus, unilateral nasal discharge.

A thorough clinical examination, including intra-oral examination with a mouth gag, strong headlight and equine dental mirror, to help identify the presence of fractures or pulpar exposure, should be performed. Radiographic evaluation of the dental apices (lateral-oblique projections) should also be performed to confirm the presence of disease and determine whether a tooth needs to be extracted. The interpretation of equine dental radiographs is often difficult. In some cases of early apical infection, even very experienced clinicians may not initially be able to determine clinically or radiographically, whether a cheek tooth has an apical infection or not. In these cases, scintigraphy or computed tomography may confirm apical infection. If an external sinus track is present, e.g. as occurs with many mandibular or rostral maxillary CT infections, it is essential to obtain radiographs with a metallic probe in situ, to confirm the diagnosis.

Extraction of Cheek Teeth
Extraction of the long crowned (hypodont) equine CT is a major surgical procedure with many possible immediate and delayed sequelae and this procedure should never be undertaken lightly. If any doubt remains concerning whether a cheek tooth is infected or not, conservative treatment should be undertaken, such as antibiotic therapy for suspect mandibular or rostral (06-08) maxillary apical infections and maxillary sinus lavage and antibiotic therapy for suspect caudal (09-11) maxillary CT apical infections. Failure to respond to the above conservative therapy should prompt a further clinical and radiographic evaluation for dental infection. Only when definite evidence of dental infection is present should dental extraction be considered.

Repulsion of cheek teeth
The traditional method for extracting equine CT has been by repulsion of the diseased tooth under general anaesthesia. This procedure is associated with a high level of postoperative complications (especially in younger horses) because much damage occurs to the alveolar and supporting mandibular or maxillary bones during the repulsion. Some studies have shown that more than 50% of cases of equine dental repulsion will require a second surgery, usually to curette dental fragments or alveolar sequestra from non-healing alveoli. It also carries all of the inherent expense and mortality and morbidity risks of general anaesthesia.
Lateral Buccotomy Technique
In this technique, a lateral surgical approach is made directly through the skin and subcutaneous tissues into the alveolus, with the horse under general anaesthesia. This technique requires GA and carries risks of much surgical haemorrhage, facial paralysis and parotid duct leakage.

Oral Extraction of cheek teeth
This technique has the great advantage of being performed in the standing horse and thus removes the expense and risk of general anaesthesia. Additionally it allows the alveolus to remain intact, does not damage the supporting bones and consequently post-operative complications are relatively rare. The current availability of safe and effective sedatives and analgesics (e.g. an alpha agonist and butorphanol) has been a major reason for the revival of the oral extraction technique, because the instrumentation has remained unchanged for over a century. Local anaesthesia of the mandibular, maxillary or infraorbital nerves is frequently used. In many horses, the medial (palatal) aspect of the upper cheek teeth contains very little exposed crown with the gingival margin in some horses lying just 2-3 mm below the occlusal surface meaning that the palatal gingiva needs to be elevated to get a reasonable grip on the tooth with appropriate sized and shaped extraction forceps. After the tooth is sufficiently loose – it can be elevated onto the oral cavity.

Endodontic treatment of cheek teeth
A number of workers have attempted to treat infected teeth by use of endodontics (root canal therapy). A major advantage of successful endodontics is that the infected tooth is preserved and thus will then continue to erupt normally (at circa 2-3 mm/year). This prevents the development of overgrowths ("stepmouth") of the opposing cheek tooth, which occurs if a tooth is extracted by any technique. It will also prevent "drifting" of the adjacent CT into the site of the extracted tooth. Endodontic treatment can be performed retrograde (through the apex) using a surgical approach through the mandibular or maxillary bones or normograde (via the occlusal aspects of the tooth). The former technique requires prolonged general anaesthesia and has had poor results to date. The normograde endodontic technique is carried out in the standing horse and shows more promise.

Suggested reading
EQUINE DENTISTRY OF THE GERIATRIC HORSE, A PRACTICAL APPROACH

Summary
In the daily equine dental practice we have to treat more and more the teeth of the geriatric horse. This requires a different approach than a routine dental treatment of the younger horse. Equine osteoclastic tooth resorption and hypercementosis is a complex disease which we diagnose more in elderly horses. Also be aware that tumours can appear in the mouth and at other parts of the equine head.

The practical approach to geriatric dental treatment
First we have to check the general condition of the horse. Check if there are problems with the intake of food. Also listen to his heart before sedating the horse. Then check his incisors before putting in a mouth speculum, describe the occlusion of the incisors, do we see a smile, frown or a diagonal bite. Can we smell his breath (halitosis)? After that check his cheek teeth and check them also by hand if there is loosening of elements. At a certain age the individual teeth will be worn out so the surface may not be grinding well. We can find not only teeth which are loose but also missing elements. Most of the time the opposing element is then really dominant (protuberans). Periodontal disease can occur when you find several diastemata. After this thorough examination of the mouth you have to make your treatment plan. Try to spare every inch of the occlusal surface! After the treatment the horse should be comfortable. In the aftercare of the treated horse it is very important to discuss with the owner how to feed his older horse. Make a leaflet with some recommendations about feeding older horses which you can hand out to the owner.

E.O.T.R.H.
Equine Osteoclastic Tooth Resorption and Hypercementosis is a degenerative dental and periodontal equine disease of the anterior dentition which mainly affects older horses and progresses from the Triadan -03 towards the -01. Icelandic horses appear to be predisposed to this disorder. Calculus formation was found to represent a secondary event rather than contributing to the initiation of EOTRH disease.

EOTRH is a recently described syndrome, which predominantly affects the anterior teeth and periodontal tissues (3). Clinical signs including halitosis, masticatory problems – especially when eating hard food with the incisors, and weight loss. These are the major reasons for seeking veterinary advice.

Referred horses usually present with variable stages of gingivitis, including fistulous tracts and vesicles at the mucogingival junction. Signs of periodontal disease and calculus are also commonly present. In advanced disease, the thickened alveolar outline of affected teeth can be seen subgingivally. Typical diagnostic radiographic findings include variable combinations of resorptive lesions, hypercementosis and disintegration of the lamina dura.

The histopathological features of EOTRH have been described in detail but there is limited information on the clinical and radiographic features of this disease. In the outstanding article of the German Austria group of experts the clinical and radiographic findings of 60 patients with EORTH were described (4). While the hypothesis of Staszyk et al. that EOTRH affects predominantly aged individuals was confirmed, it remains unclear why significantly more male horses were affected by EOTRH. The reason why Icelandic horses were significantly more frequently affected by EOTRH in the German Austria study than other breeds is also unclear. A genetic predisposition and/or specific types of diet may be considered as possible factors promoting the onset and progression of the disease. Interestingly, several patients presented with large cementomas, yet showed only minimal resorptive lesions. This observation suggest that more than one mechanism contributes to EOTRH-development and progression.

ORAL NEOPLASIA IN THE HORSE (5)
Equine oral neoplasia is overall uncommon. When oral masses are found upon examination, a proper diagnosis is imperative as not all oral masses carry poor prognoses. Literature published regarding equine oral oncology is limited and usually involves only a series of case reports or broad non-specific reviews of book additions. The most comprehensive review of the literature can be found in the third edition of Equine Dentistry (6). Neoplasia within the oral cavity can be characterized either by tissue of origin or by clinical behaviour and pathologic features. There is value
to recognizing all these qualities within a mass as all components help to identify the neoplasm and determine an appropriate treatment plan. Clinical signs that can accompany oral neoplasia are: distortion of normal anatomic features, oral bleeding, dysprehension, dysmasesis, dysphagia, weight loss, recurrent fever, depression, halitosis, nasal discharge, and airway restriction. With sedated oral examinations, intraoral and extraoral radiography, and biopsy, a diagnosis if not at least a category of disease can be reached. As treatment planning and prognosis for oral masses varies dramatically, narrowing of the diagnosis to at least a general characterization of benign vs. malignant is helpful.

As with long bones and bony imaging elsewhere on the body, a clinician can start to get a feel for the aggressiveness of tumours by their appearance on radiographs. In the cited article you can find a chart representing a simplified version of this differentiation.

(7)

Which neoplasias can we find in and around the head of the horse?

- (Cystic masses)
- Odontogenic tumors
  - temporal teratoma
- Osteogenic tumors
  - Osteoma
  - Osteosarcoma
  - Osteoblastoma
  - Chondrosarcoma
  - Fibrosarcoma
- Soft tissue tumors
  - Squamous cell carcinoma (SCC)
  - Sarcoid
  - Melanoma
  - Ossifying fibroma

2. Rucker BA. Dental conditions affecting the geriatric horse. AAEP Focus on dentistry, Indianapolis 2006; 229-236.
4. Clinical and Radiographic Findings in 60 Horses Diagnosed With Equine Odontoclastic Tooth Resorption and Hypercementosis (EOTRH). Martina Kowelka, Dr. med. vet. Astrid Bienert-Zeit, Dr. med. vet. Katharina Ros, Dr. med. vet. Hubert Simhofer, Assistant Professor, Dr. med. vet. Proceedings AAEP Focus on Dentistry August 4-6, 2013 Charlotte, North Carolina
5. Review of Oral Neoplasia in the Horse Jennifer Rawlinson, DVM, Diplomate AVDC Proceedings AAEP Focus on Dentistry August 4-6, 2013 Charlotte, North Carolina