Summary
The most common clinical sign of equine dental disease is quidding (dropping partially masticated food) due to oral pain from sharp dental overgrowths, which can also cause bitting problems and occasionally head shaking. Weight loss is not a common sign unless dental disease is severe and chronic. With apical infections of the cheek teeth, mandibular swellings and fistulas; or alternatively in the upper jaw, rostral maxillary swellings or fistula and with caudal cheek teeth infections to paranasal sinusitis with nasal discharge can occur. The more common incisor disorders include overbite, underbite, retained deciduous, supernumerary and fractures of the incisors. A variety of abnormal incisor wear patterns occur, some traumatic in origin and others secondary to cheek teeth disorders. The major cheek teeth disorders included retained deciduous teeth, diastema, rostal positioning of the maxillary cheek teeth rows, developmental displacements and supernumery cheek teeth. The main acquired disorders of the cheek teeth are enamel overgrowths, secondary periodontal disease and traumatic and idiopathic fractures of the cheek teeth. The current treatment of these disorders will be reviewed.

Clinical Signs of Equine Dental Disease
The most common dental (and indeed oral) disorder in horses is caused by lacerations of the cheeks and the tongue by sharp dental overgrowths ("enamel points") that develop on the lateral (buccal) edges of the maxillary and the medial (lingual) edges of the mandibular CT. Dental overgrowths may also occur with other developmental and acquired dental disorders. Oral pain can also occur due to deep periodontal food pocketing, such as occurs with dental displacements and Diastema (ata). Oral pain may result in small boluses of masticated food falling from the mouth during chewing, a condition termed "quidding," which may be visible on the ground outside the animal’s box or beneath the forage rack. Many horses will not show any signs of dental disease, and in particular will not lose weight until dental changes are very advanced.

Painful, dental-related lesions may also cause bit (bitting) problems, including abnormal head carriage and headshaking during work. One cause of such problems are overgrowths on the upper CT which traumatisate the buccal mucosa due to noseband or bit pressure.

Signs of CT infection include facial swellings (possibly with sinus tracts), especially unilateral swellings of the mandible or the rostral aspect of the maxillary bones, the latter are almost pathognomonic for apical infections. The presence of a unilateral nasal discharge (persistent and purulent, possibly malodorous) may be due to dental sinusitis.

Examination of Equine Teeth
The equine incisors and canine teeth are readily examined. This examination should be systematically performed prior to placing on a gag (speculum) to examine the CT. Due to a combination of factors, including the limited angle of opening of the equine mouth, the rostral positioning of the lip commisures and the great length of the CT rows, it is difficult to visually examine the CT, particularly the caudal CT and even more so in unsedated horses. Palpation through the cheeks may reveal food pocketing or major irregularities (such as a missing tooth or large overgrowth) of the CT particularly of the rostral 3 upper and lower CT. Even if no abnormality is palpable, the presence of pain during this procedure may indicate the presence of sharp enamel overgrowths on the lateral aspect of the upper CT. During eating, horses may show restricted mandibular movements that may be totally confined to one side of the mouth. With the mouth closed, the mandible should be moved sideways and the degree of movement (e.g. 1 cm) prior to separation of the incisors (as the angled occlusal CT
surfaces come in contact) should be assessed. The occlusal contact of the CT can also be assessed now by visual examination with the lips retracted laterally, one side at a time. Sedation is required in most horse to perform the latter maneuvers.

A Detailed Equine Oral Examination Can Only Be Performed Using a Gag
Most horses can be safely examined with a gag in place without sedation. Some horses may require the use of a nose twitch. For reasons of safety and efficacy of treatment, difficult horses should be sedated during this procedure. If it is difficult to open horse’s mouth using a gag, first check that the nose-band is loose enough. Pushing a thumb on the horse’s hard palate will usually cause the horse to open its mouth further. Food retained in the oral cavity (which further retards visual examination) can be removed by flushing the oral cavity with a large dental (dosing) syringe of water or dilute disinfectant. The use of a headlight (a penlight torch is much less satisfactory), a long dental mirror and a long metal “toothpick” greatly facilitates visual oral examination. Nevertheless, major problems, especially of the caudal upper and lower CT, and of the adjacent periodontal membranes can readily be missed unless all the teeth and adjacent soft tissues (gums) are carefully visually examined and palpated. It is also useful to smell one's hand after oral examination for the presence of foul smelling odours, which as noted, usually indicates anaerobic infections most commonly of the periodontal tissues, but also of the teeth themselves. Many equine CT disorders, especially in the younger horse are due to localised periapical abcessation, that is usually accompanied by infection of the supporting bones. In most cases, little change is usually visible in the clinical crown, except in some maxillary CT apical infections, where fractures and gross dental caries of the exposed crown may be present. Radiography is therefore essential in the investigation of such disorders.

Disorders of Incisor, Canine and 1st Premolar Teeth
Compared to the CT, significant disorders of the equine incisors, canine or "wolf teeth" are uncommon. However as the incisors can be readily examined in comparison to the CT, even minor incisor disorders can be readily observed by both clients and veterinarians.

Overbite ("Parrot Mouth")
Very many horses have some degree of what the older textbooks term brachygnathism ("parrot mouth," "overshot jaw," "overbite"). However, some studies have shown that there is no shortness of the mandible in some of these cases, but instead an overlong maxilla, which also induces disorders of wear in the CT. Consequently, a major significance of "parrot mouth" is that it very commonly occurs in conjunction with overgrowths of the rostral aspect of the 1st upper CT (Triadan 106&206) and of the caudal aspects of the lower 6th CT (311&411).

In older horses with overbite, the absence of wear on the central upper incisors may cause them to develop a convex occlusal surface, which has been termed a "smile." If very severe, the upper incisors will lie in front of, and therefore trap the lower incisors and may even retard mandibular growth. This may directly cause or worsen the previously noted overgrowths of the CT. Unless contact between opposing incisors is totally absent, this condition rarely causes the horse trouble in prehending food, but it is aesthetically undesirable, especially in show horses.

Foals can have their upper incisors braced off their CT (and a biteplate attached to keep the lower incisors in occlusion (best at <6 months of age while fast maxillary bone growth is still occurring), but the ethics of these orthodontic procedures, especially in animals that may be used for breeding, are debatable. In adults, these incisor overgrowths should be initially reduced with power or manual instruments. Once the incisors have been ground level, they should be rasped level bia-annually along with 06 and 11 overgrowths. In contrast to CT floating, many horses greatly resent incisor teeth floating and will require sedation for this procedure.

Underbite ("Sow Mouth")
Prognathism ("sow mouth," "monkey mouth," "undershot jaw," "underbite") is very uncommon in the horse and is also usually clinically insignificant unless there is total lack of occlusion between the upper and lower incisors. Severely affected horses will eventually develop a concave upper incisor occlusal surface, which has been termed a "frown" and may develop lower 06 and upper 11 overgrowths.

Retained Deciduous Incisors
Deciduous incisors, which normally lie rostral (i.e. on the labial aspect) to their permanent counterparts, are occasionally retained beyond their normal time of shedding. If retained for a prolonged period they will cause the permanent incisor to be displaced further caudally and may even cause permanent changes in the incisor arcade. If retained incisors are very loose
they can be removed digitally or using small-animal dental forceps. If more firmly attached, they will need to be extracted under sedation and local anaesthesia using dental elevators. Retained incisors must be differentiated from supernumerary incisors (see below).

**Supernumerary Incisors**

Supernumerary (incisors that are additional to the normal 6 incisors on each arcade) permanent incisors have very long (<7.0 cm long) reserve crowns, that are usually intimately related to the reserve crowns and roots of the normal permanent incisors. Additionally, as the supernumerary incisors are identical in appearance to the normal incisors (i.e. are termed supplemental teeth) they are impossible to differentiate from the normal incisors. Consequently, extraction of these supernumerary teeth is both very difficult and also risks damaging the normal teeth. As supernumerary incisor teeth cause little clinical problems unless grossly displaced, they are usually left alone (with the exception perhaps of show horses), with bi-annual rasping of unopposed teeth to prevent overgrowths.

**Fractures of the Incisors**

Fractures of the incisor teeth, and often of the supporting mandibular or premaxillary bones can occur due to trauma, usually from kicks, and commonly result in exposure of the pulp cavity. Idiopathic incisor fractures are rare in contrast to CT. All teeth of young horses contain very wide apical foraminae (root canal openings), along with a very large and vascular pulp, which can resist the infection that will inevitably develop in exposed pulp from oral bacteria. Consequently, pulp exposure, especially in younger horses, does not necessarily lead to deep pulpal infection and subsequent necrosis with tooth loss, as usually occurs with pulp exposure in brachydont (e.g. human or canine) teeth. However, all incisor fracture cases should receive tetanus anti-toxin and prolonged (7 - 10 days) antibiotic (e.g. trimethoprim/sulfadiazine) therapy. Endodontic (root canal) treatment can be performed by specialist veterinary surgeons (from the damaged occlusal aspect) to save the tooth, or even debridement of the exposed pulp and application of calcium hydroxide paste – to speed up reparative dentine repair and reduce the post-trauma pain. However, in most young horses, the pulp will, without treatment, become sealed off at the site of exposure by reparative (tertiary) dentine formation, with the tooth remaining vital and continuing to erupt normally.

**Abnormalities of Incisor Wear**

On full, manual, lateral movement of the mandible, with the horse’s jaws closed, the incisors should separate by approximately the half the width of an incisor. Abnormalities of the occlusal surface of the incisors (or large overgrowths of the CT) will prevent this normal manoeuvre. These incisor disorders include "steps" due to the traumatic loss or maleruption (delayed or other abnormalities of eruption) of the opposing incisor and subsequent overgrowth of the opposite incisor, as well as the previously noted "smile" and "frown" with "parrot mouth" and "sow mouth," respectively. The abnormal wear pattern of the rostral aspect of the central and sometimes of the middle incisors in crib-biters is well known. Such cases can also develop small fractures of the occlusal surfaces of all of their incisors.

Another common abnormality of incisor wear is a tilted or slanted incisor occlusal surface, i.e. "slope mouth" or "slant mouth". This defect is invariably associated with a major unilateral abnormality of the CT that has caused a pronounced unilateral chewing action, which causes uneven wear of the incisors. Occasionally, this incisor defect can be caused by a slight twisting of the facial bones, i.e. "wry nose."

In conclusion, major abnormalities of wear of the incisors are frequently associated with abnormal occlusion of the CT which may lead to difficulties in mastication (chewing) as well as in prehension (grasping food). The CT should be carefully examined and using sedation and preferably power tools, irregularities of both CT and incisors should be treated, in stages if major overgrowths are present.

To remove incisor overgrowths, it is best to sedate the horse and use a wedge gag (the circular Swale’s gag can cause dental fractures). Focal incisor overgrowths (e.g. opposite a broken tooth, should be removed with a solid carbide blade or a power instruments and the incisor alignment assessed again. The practice of arbitrarily reducing the height of the incisor, sometimes very extensively, to purportedly allow the CT to develop better occlusal contact ("incisor bite alignment techniques") has little scientific or clinical merit and should be avoided. In all horses with masticatory or biting problems, the main emphasis should be on detecting and eliminating CT problems and only after these steps are completed should extensive incisor procedures be undertaken.

**Disorders of the Canine Teeth (Tushes)**

The canine teeth (absent or rudimentary in females) do not anatomically oppose each other, and this reason is given to
explain why calculus, often extensive, can accumulate on canine teeth (especially the lower canines). Unlike in species with brachydont (short crowned e.g. human or canine) teeth, equine dental calculus is not a major predisposing factor to periodontal disease. However, extensive calculus formation at this site may cause ulcers of the adjacent lips. This calculus can be readily removed with strong forceps. Occasionally, displaced or grossly enlarged canine teeth will interfere with the bit and such teeth should be ground down or very rarely (due to the great length - up to 7.5 cm long) extracted.

The sharp tip, or even circa half of the clinical crown the canine teeth is rasped off by some operators, to prevent these teeth from causing lacerations of the operator’s hands and arms during dental procedures and to prevent them allegedly interfering with the bit in some animals or their use in fighting. They should not be reduced below 1 cm in height in case the pulp is exposed.

**Wolf Teeth**

Wolf teeth (PM 1) are blamed for many behavioural problems in horses and for interfering with the bit, and therefore, these teeth are frequently extracted. Wolf teeth usually occur in the maxilla and lie in front of the 1st upper cheek tooth. It is anatomically difficult to envisage how, if of normal small size, these teeth could interfere with the bit. Mandibular wolf teeth can readily interfere with the bit. The presence of maxillary wolf teeth in many older horses that have performed to the highest level in disciplines such as dressage or show-jumping supports this viewpoint. Some veterinarians use the argument that because these teeth never do any good and may on occasions cause a problem, they should always be removed.

However, displaced, enlarged or partially erupted wolf teeth, especially if mandibular, may interfere with the bit. Wolf teeth are usually small structures (1 - 2 cm long) and can be readily extracted under local anaesthesia and usually with sedation, utilising a variety of specialised elevators e.g. Burgess and possibly then forceps. A large artery (the greater palatine artery) can be lacerated during wolf tooth extraction, and infections and tetanus can develop after such extractions.

**Developmental Disorders of the CT**

**Retained Deciduous Teeth**

Retention of the remnants of the deciduous CT ("caps") can occur in horses between 2 - 5 years of age. When very loose or just partially retained by gingival attachments, they may cause oral pain and affected horses may show quidding, playing with the bit, and occasionally, loss of appetite for a couple of days. Such signs in this age group warrants a careful examination of the rostral 3 CT for evidence of loose "caps". If present, loose caps should be removed using specialised "cap extractors", cheek teeth extraction forceps or a long slim screwdriver.

The prolonged retention of caps has been alleged to cause delayed eruption of and the development of large "eruption cysts" ("3 y.o. or 4 y.o. bumps") under the apices of the permanent CT. The presence of very enlarged eruption cysts, especially if unilateral (one sided), should prompt a thorough oral and if necessary, radiographic examination for the presence of retained deciduous CT. However, the practice of methodically removing deciduous teeth at rigidly set ages in horses will result in the premature removal of some deciduous CT.

**Diastema**

The occlusal surfaces of all 6 CT are normally compressed tightly together and the CT function as a single grinding unit. This is achieved by the action of the angled first and last two CT compressing together the occlusal aspect of all 6 CT. Even with age (the CT taper in slightly from crown to apex) the progressively smaller reserve crowns usually remain tightly compressed at the occlusal surface. However, if spaces (often 2 - 5 mm wide) that are termed diastema (plural diastemata), develop between the teeth, clinical problems will occur. In some cases, the diastemata will be due to lack of sufficient angulation of the CT to provide enough compression of their occlusal surface. In other cases, diastemata occur along with displacements and apparently normal angulation, indicating that the dental buds developed too far apart.

Food will become impacted into these abnormal interdental spaces and will lead to progressively deeper secondary periodontal disease. Such a disorder will be recognised by visually or digitally detecting small spaces between the CT, along with food fibres packed deep in the periodontal spaces between these teeth. In longer standing cases, this food pocketing will extend along the full width of affected teeth and can even extend deep into the mandible or into the maxillary sinuses. Diagnosis can be difficult to confirm but the use of an endoscope, or obtaining 15 - 200, latero-oblique radiographs with the horse’s mouth open, can be very useful to demonstrate diastemata.

Treatment of diastemata is problematic. Cleaning out the periodontal pockets will just give temporarily relief. In younger
horses with mild diastemata, the abnormal spaces may close when further dental eruption occurs, provided there is sufficient angulation of these teeth. Many horses show severe clinical signs when fed hay and improve greatly when at grass. Feeding only a chopped (milled) diet e.g. grass or alfalfa cubes often reduces or removes clinical signs also. If diastemata are mainly unilateral, secondary overgrowths may develop on adjacent teeth due to preferential use of the opposite, less painful side of the mouth. Such overgrowths should be removed and may help. Abnormal transverse ridges may develop on the opposite teeth opposite diastemata which may widen the diastema and selectively force food into them and so should always be removed. If marked diastemata are present just between a small number of teeth, especially in older horses, widening of the diastema or even extraction of a tooth on one side of the diastema may result in complete cessation of quidding. Some young cases with severe, widespread diastemata will be difficult to treat.

**Rostral Positioning of the Maxillary CT Row**
A common dental abnormality in horses is a rostral positioning of the maxillary CT relative to their mandibular counterparts, invariably in conjunction with "parrot mouth". This disorder eventually leads to the development of obvious focal overgrowths (hooks) on the rostral aspect of the first upper CT (106, 206) that may cut the cheeks and interfere with the bit. These "hooks" may take many years to develop. If small, these hooks can be rasped level with a carbide rasp. If large, a power tool is best to reduce it. Cutting these teeth with shears risks fracturing the tooth, especially in younger horses.

Similar overgrowths on the caudal aspect of 311&411 frequently go undetected and such overgrowths can lacerate the adjacent oral mucosa. There is very little room between the occlusal surfaces of the caudal CT and even less so, if a large overgrowth is present on one of these teeth. There is also little space between the caudal aspect of 311 and 411 and the vertical ramus of the mandible and so it is easy to damage this bone when vigorously rasping the 6th lower CT- use solid carbide blades "on the pull".

"Molar cutters" and percussion guillotines (e.g. "equichip" that encircle this caudal hook) can be used to remove large 311/411 overgrowths, but fracture of the tooth with pulp exposure can occur, especially in smaller breeds (e.g.s. Arabian and Welsh ponies) that have marked dorsal curvature (i.e. marked "Curve of Spee") of the caudal occlusal surface of their CT. This dental fracture and pulp exposure can lead to septic infection of the mandibular and pharyngeal areas in some horses, unless antibiotics are administered. Consequently, power tools are now commonly used to safely and controllably remove these overgrowths.

**Disparity in the Length of the CT Rows**
A disparity between the lengths of the upper and lower CT rows can result in overgrowths occurring unilaterally or bilaterally on the first and last CT, both upper and lower. Such overgrowths should be removed as previously described.

**Displacements of the CT**
Two different causes of CT displacements can occur in horses. In most cases, the medial or lateral displacements appear to be due to overcrowding of the dental rows during eruption, and this type of displacement is often bilateral. Rotation of the displaced tooth is also sometimes present. Gross dental overgrowths then develop on areas of the displaced tooth and their occlusal counterparts, which are not in contact. The displaced CT may have diastemata between the displaced and adjacent CT. In such cases, abnormal positioning of the developing tooth appears to be the cause of the displacement. Acquired CT displacements (usually mandibular CT) can develop in older horses and are usually associated with lesser degrees of CT displacement and of limited overgrowths (the latter indicates that the displacements were recent).

Abnormally protruding areas of displaced CT and secondary overgrowths can lacerate the oral soft tissues and cause bitting and quidding problems. In some cases, deep periodontal disease can occur due to deep food pocketing, and secondary sinusitis (oro-maxillary fistula) or maxillary or mandibular bone infections can occur. Smaller abnormal protrusions or overgrowths can be removed with a rasp but larger areas will require a motorised tool for removal. If very extensive food pocketing is present, the displaced tooth may have to be extracted and these are readily performed per os in the sedated horse. Such cases respond excellently to these procedures.

**Supernumerary CT**
Supernumerary CT (i.e. presence of more than 6 cheek in a row) are not uncommon in horses. The supernumerary teeth are usually abnormally large and irregularly-shaped, as if formed from two or even three vestigial CT. They most commonly develop at the caudal aspect of the CT rows. Because of their irregular shape, periodontal food pocketing occurs between
them and the 6th cheek tooth, with resultant pain and perhaps deeper infections. Additionally, if the supernumerary teeth are in just one row, and are thus unopposed, they will later form large overgrowths. In some cases, supernumerary CT should be extracted (per os if possible), in others removal of overgrowths is all that is required. Developmentally reduced numbers of CT (ologiodontia) is rare in horses and may be associated with enamel defects.

**Maleruptions of CT**

Some cases of "stepmouth" and "wavemouth" are caused by delayed eruption of the permanent CT in either the maxillary or mandibular rows. This can then cause an overgrowth of the temporarily unopposed, opposite cheek tooth. These overgrowths may remain for life and thus initiate the above major abnormalities of wear. Recognising and removing such overgrowths at an early stage is the key to their treatment.

**Acquired Disorders of the CT**

Because of their prolonged eruption (for circa 20 - 25 years), any areas of equine teeth that are not in full occlusion will continue to erupt and such areas will eventually project beyond the normal occlusal surface as overgrowths. These overgrowths are caused by absence of attrition (normal dental wear), possibly combined with an increased rate of eruption when full occlusal contact is absent. The horse has evolved over 55 million years to eat a coarse forage diet, spending up to 18 hours per day grazing coarse forage such as grass or hay, during which it moves it mandibles maximally in a lateral direction. Domestication has greatly altered the equine diet with many horses being fed large quantities of concentrates and consequently eating much less forage. Feeding concentrates also greatly alters the masticatory action of horses, causing them to chew with a more vertical than lateral mandibular action. This restricted lateral movement predisposes horses to develop enamel overgrowths of the CT.

The equine maxillary CT rows are normally circa 23% further apart than their mandibular counterparts (termed anisognathia) with both upper and lower occlusal surfaces sloping ventrally at circa 10 - 15 degrees in the buccal direction (laterally). This absence of complete occlusal contact between the upper and lower CT, is a further predisposition to the development of enamel growths or "enamel points" which develop laterally on the maxillary, and medially on the mandibular CT. **The prime role in equine dental care is to prevent these overgrowths from developing by routine oral examinations and effective teeth rasping.** If these painful enamel overgrowths are neglected, the sharp enamel points will eventually merge into a steeply angulated (e.g. 45º vs normal 10 - 15º) occlusal surface termed "shearmouth" or "scissors mouth". A mechanical obstruction will now additionally obstruct the normal side to side jaw movements, and mastication will be even less effective.

Food stagnation will occur at the gum margin due to lack of normal food and saliva movement around the oral cavity and this will then cause secondary periodontal infection. As dental eruption is dependent on the presence of a healthy periodontal membrane, teeth that have marked periodontal disease may erupt more slowly than the adjacent teeth, which have healthy periodontal membranes. This may lead to the occlusal surface of the CT developing an uneven or undulating occlusal surface, termed "wavemouth". Some cases of "wavemouth" however are unrelated to periodontal disease. Deep periodontal disease (or other disorders) can lead to tooth loss, especially in older horses with short reserve crowns. Following tooth loss, the opposing tooth will erupt more rapidly, leading to the dental irregularity termed "stepmouth" although many of these overgrowths are more wave-like than rectangular in shape. In many horses, a combination of enamel overgrowths, "shearmouth," "wavemouth" and "stepmouth" will occur together.

In advanced cases of dental overgrowths, affected animals may not be able to fully clear their mouth of food. Semi-permanent "hamster-like" cheek swellings may occur in badly affected horses, due to the accumulation of fibrous food wedges between the lateral aspects of the CT and the cheeks. In the presence of oral pain, and later also to mechanical factors due to large dental overgrowths which prevent the normal sideways jaw movements, some horses may also chew very slowly, make soft slurping sounds during chewing forage (rather than the normal vigorous crunching sounds). Some affected horses may use just one side of their mouth for chewing rather than using alternative sides, or they may hold their head in an abnormal position during chewing.

Affected horses may readily eat grass or mashes but are reluctant to eat hay. Decreased food intake and possibly inefficient food digestion and utilisation may eventually occur, possibly leading to weight loss. Long strands of forage and undigested cereal grains may be visible in the faeces. Halitosis may be present if widespread periodontal disease or advanced caries (infection of the mineralised components of teeth) involving the erupted (clinical) crown are present. Painful dental-related lesions may also cause bit (bitting) problems, including abnormal head carriage and headshaking during work, because the
enamel overgrowths on the upper CT cut the inside of the cheeks due to noseband pressure and the overgrowths on the lower CT may be forced against the tongue by the bit and also cause pain.

Treatment of these abnormalities includes removal of major overgrowths using solid carbide manual or power tools then rasping of treated teeth to smooth out any sharp edges. As unopposed CT may erupt abnormally fast, there is danger that if a large cheek tooth overgrowth (e.g. a 3 cm long "stepmouth") is cut to the level of the remaining CT, the pulp may be exposed. This is because sufficient secondary dentine may not have developed at that level to occlude the pulp cavity. Very loose teeth can be extracted orally using equine "molar extractors" in standing sedated horses. However, all loose teeth do not have to be extracted, especially in older horses, because even though loose, these teeth will have some function. However, all overgrowths should be removed, and in such cases it is advisable to warn the clients in advance that these teeth (short reserve crowns and inevitable periodontal disease) may fall out when overgrowths are being cut or rasped. As noted, the aim of the veterinarian should be to prevent the development of such-end stage disorders by regular (bi-annual) dental inspections and removal of any detected overgrowths, thereby encouraging normal chewing activity and allowing the free movement of food and saliva around the oral cavity.

Smooth mouth, i.e. absence of enamel on the occlusal surface of CT is common in older horses, however many others lose their CT from secondary periodontal disease prior to when complete enamel wear and "smooth mouth" would occur. Teeth without enamel are ineffective at grinding food. They will wear quickly and often have a convex occlusal surface termed "senile excavation". Such abnormal wear is caused by absence of the enamel folds, due to wearing out of the infundibular enamel (in upper CT) and of the peripheral enamel infoldings (in both upper and lower CT) that normally prevents such excessive wear of the dentine. Later, the individual roots will become exposed and will display the characteristic hypercementosis of aged equine teeth.

**Periodontal Disease**

Unlike brachydont animals (e.g. humans and dogs), primary periodontal disease does not appear to be a significant problem in the horse. During the eruption of the permanent dentition, a transient inflammation of the periodontal membrane occurs in many horses and can be recognised by a reddening of the gum around the erupting tooth. Due to the prolonged eruption and continuous development of new periodontal fibres in the horse, equine periodontal disease is not necessarily irreversible, as is usually the case with brachydont dentition. Many horses will have non-significant periodontal disease due to calculus of the canine teeth. Most clinically significant periodontal disease in the horse occurs secondary to marked dental overgrowths or malocclusions, where teeth are not in proper opposition and is caused by food impaction or stagnation at the periodontal margin, particularly on the buccal (lateral) aspect of mandibular CT.

The causes of this secondary periodontal disease includes oral food entrapment caused by chronic enamel overgrowths and shear mouth; the presence of supernumerary CT, diastema; displaced and/or rotated CT (especially the 4th and 5th), and sagitally fractured CT. With chronic periapical abscessation of any aetiology (especially in older horses), infection may eventually track retrograde up the periodontal space to the coronal aspect of the periodontium, rather than forming an external sinus tract.

Due to a combination of diastema and other abnormalities of wear, especially enamel overgrowths, many if not most older horses suffer from secondary periodontal disease. Treatment includes promotion of the normal masticatory activity by mechanically levelling the dental arcades to alleviate painful overgrowths and to allow free lateral jaw movement. Additionally very loose or diseased teeth should be orally extracted and antibiotic therapy administered (e.g. i/m penicillin). With dietary management, such old horses can be satisfactorily maintained after loss of many if not a most of their teeth.

**Procedure for Routine Rasping of Equine CT**

If a horse is believed to have sharp enamel overgrowths, as evidenced by flinching of the head when digital pressure is applied through the cheeks onto the lateral aspect of the occlusal surface of the maxillary CT, these maxillary CT overgrowths can be floated prior to placing a gag on the horse. This is to prevent further damage to the buccal mucosa by forcing the mucosa against these dental overgrowths when a gag is fully opened. The oral cavity is then carefully examined by palpation and visual examination of all areas. If the examination shows that enamel overgrowths are the only disorder, then the teeth can be rasped using the following procedure.

**Mandibular CT**

A long straight handled rasp is initially used on the caudal CT. As noted, solid carbide blades in these handles should be
fitted to cut in a rostral direction ("on the pull"). Care should be taken not to traumatise the vertical ramus of the mandible or the protrusion of soft tissue that normally lies caudal to the 6th mandibular CT (311, 411). One hand (the right hand in a right-handed operator) should be on the rasp handle to move it in a caudo-rostral direction (lightly at first), whilst the fingers of the other hand should be placed on, or close to the back of the blade, to both control the exact position and angle of the blade and also to apply additional lateral pressure on the blade.

The blade should initially be at an angle of approximately 450 degrees to the medial aspect of the occlusal surface of the tooth to remove any enamel overgrowths. However this 450 angulation should not be rigidly maintained throughout the rasping procedure, otherwise, two sharp angles would be left on the tooth. This can be prevented by latterly varying the angle of the blade from almost vertical to almost horizontal positions relative to the occlusal surface while continuing to rasp the teeth in a rostro-caudal direction. The fingers within the oral cavity should intermittently be used to check the progress of the rasping procedure. The occlusal surface of the tooth should not be rasped, for the previously noted reasons.

The rostral mandibular CT can then be rasped, using the long-handled straight rasp if necessary, but more readily using a short-handled straight rasp. If a solid carbide blade is used, it should be fitted to cut in a caudal direction ("on the push"). Having removed all enamel overgrowths, some operators now like to lightly re-float all of the border of the lingual (medial) border of the mandibular CT with a fine gritted "S" float.

Some horses tend to develop relative overgrowths of the first mandibular CT (306, 406) with inexplicable excessive wear of their (larger) occlusal maxillary counterparts (106, 206). It is worthwhile in such cases to reduce the height and slightly round off the rostral aspect of 306 and 406. This can be performed during routine floating using carbide chip blades (with difficulty) or solid carbide blades more readily. However, these teeth can most effectively be reduced using a power tool such as a Dremel ® instrument and tungsten carbide burrs.

Maxillary CT

Following completion of mandibular CT floating, the mouth gag is temporarily removed because it is more difficult to rasp (the lateral aspects) of the upper CT if the cheeks are tightly stretched over them if the mouth is open. Because the lateral aspect of the maxillary CT row is convex, especially rostrally, it is difficult if not impossible to rasp lateral (buccal) overgrowths of these teeth using straight handled rasps. Consequently, a rasp with an angled head or alternatively one with an offset head, is required to rasp the rostral 2 - 3 CT, which is an important area because it is a potential site of contact with the cheeks due to pressure from a nose band. Alternatively, the convex side of a small "S" float can be used, with the buccal mucosa protected from the back of the rasp by having the operators fingers on the concave side of the float. The rasp blade is again initially maintained at an angle of approximately 45 degrees during the maxillary CT rasping, with this angle varied latterly to round off the buccal edges of the teeth.

The 3rd - 5th maxillary CT can readily be floated using straight handled rasp, but alternatively, a long handled, angled or offset rasp can be used to rasp these teeth. Because of the marked dorsal curvature of the caudal maxillary occlusal surface ("Curve of Spee") in some horses, especially Arabian type horses, it is not possible to rasp the occlusal surface of the caudal maxillary CT using a straight handled rasp. Consequently, a long handled rasp with an obtusely angled head is required. Alternatively, a long handled "S" float can be used to rasp these areas. Rasping of the middle and caudal maxillary CT should be performed with both hands on the handle of the rasp (possibly with some fingers of the left hand of a right-handed operator beneath the noseband of the headcollar) to provide as much control and power as possible, because it is dangerous and difficult to have one’s fingers close to the rasp blade while rasping these specific areas in a horse without a gag.

As noted, overgrowths of the rostral aspect of the 1st upper CT (106, 206) are common and in some cases smaller overgrowths can be difficult to access using a rasp in rostro caudal direction. In such cases, these teeth should be floated transversely across the mouth, with the shaft of the rasp in the oral cavity.

Following completion of floating of the maxillary CT, the mouth gag is again applied and the maxillary CT are carefully palpated and visually examined to assess if any further sharp areas remain. Remaining focal overgrowths if present, can be rasped with the gag still in situ and the teeth palpated again, to ensure that in all that all sharp areas have been removed. At this stage, some operators like to lightly re-float all of the lateral surface of the maxillary CT with an S float.

Additional dental procedures in horses that are ridden particularly, in performance horses, such as dressage horses or show jumpers can include removing the ventral aspects of the lateral ridges off the rostral maxillary CT and removing and then
rounding off the rostral aspects of the crown of the 1st upper and lower CT - termed creating "bit seats". A full description of these procedures is given by Scrutchfield (1999b).

**Traumatic Disorders of CT**
In addition to the more common swellings caused by the developing permanent CT (eruption cysts) or apical infections, swellings of the maxillary and more so of the mandibular bones can also be caused by external trauma (usually due to kicks) and less commonly by bone or dental tumours. Following trauma, unilateral facial paralysis may present as a facial distortion whilst bilateral facial paralysis presents as drooping upper and lower lips that may (usually only in the short term) interferes with prehension. In the young horse traumatic mandibular fractures will inevitably cause some damage to the CT reserve crowns which occupy much of this bone. In most cases conservative therapy (1 - 2 weeks antibiotics and feeding a soft diet) will be adequate, with the undamaged hemimandible acting as an effective splint. Even if external sinus tracts do develop, it is worthwhile persevering with conservative therapy, until radiographic changes (using a metallic probe in any sinus tract) confirm the presence of definitive dental infection. Extraction should be delayed to minimise the chances of re-fracturing the mandible.

Bit-induced injuries to the mandibular interdental space (bars of mouth) can occur due to very excessive force. In most cases, a superficial periostitis or sequestration of the mandibular cortex will occur. However, pathological fractures of the mandible and also widespread bone infection can also occur. In some cases the bone infection may lead apical infection of the 1st mandibular cheek tooth, which may need to be extracted.

**Idiopathic Fractures of the CT**
Fractures can also occur in the CT, mainly the upper CT, in the absence of known trauma. In most cases these are lateral slab fractures of the two lateral pulp cavities. The fracture space becomes filled with food, thus laterally displacing the smaller portion which may cause buccal lacerations. Removal of the smaller loose fragment with forceps will usually resolve the problem. Less commonly, midline (sagittal) fractures of the maxillary CT occur. These are believed to be secondary to advanced infundibular caries and deep-seated infections of the alveolus and sinus frequently accompany these fractures in younger horses. Extraction of the affected tooth and sinus irrigation (if sinusitis is present) are required with sinusitis.

**Oral Tumours**
Dental tumours can include non-calcified epithelial tumours (which are derived from the epithelium that forms enamel) which are termed ameloblastomas. Dental tumours also include a wide variety of calcified tumours from dentinal tissues (odontoma) or cement (cementoma) or combinations of all three dental components compound odontoma or ameloblastic odontoma. These cases usually present as slowly growing, hard focal mandibular or maxillary masses that are usually very radiodense. The prognosis depends on how well defined they are to allow surgical excision.

**Tetanus Prophylaxis**
During many equine dental procedures, especially if extensive, or if sudden movement of the horse’s head occurs during such procedures, soft tissue trauma and subsequent slight oral bleeding may occur.

**References**

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