The teeth – Ageing and a practical approach to dentistry

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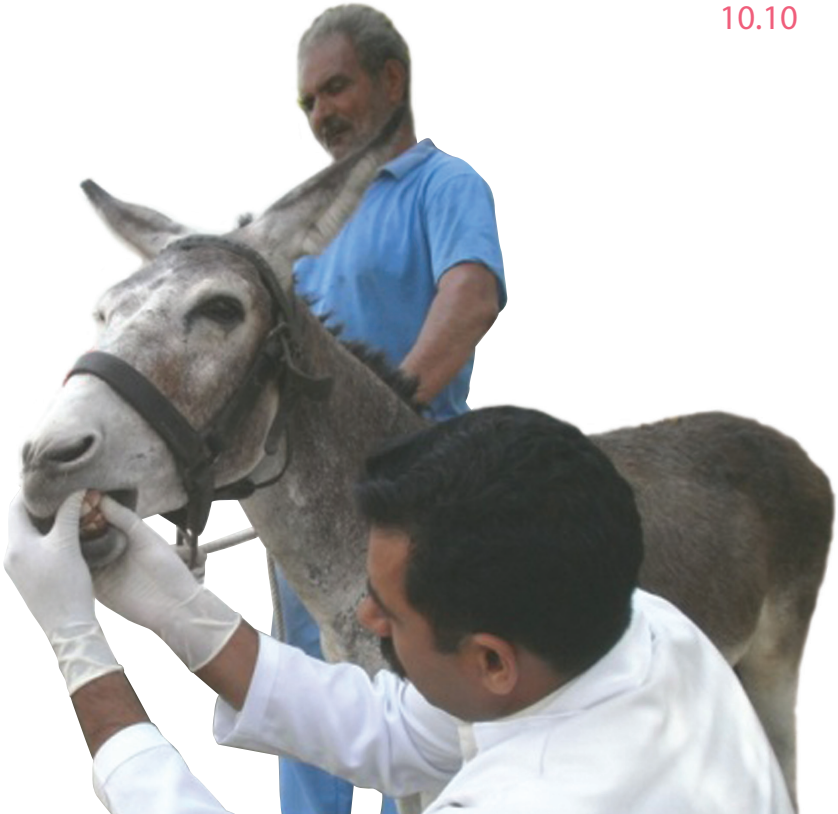

10.1 Introduction

Equine teeth are constantly erupting throughout the animal's life. Unlike carnivores, whose jaws move in an up-and-down 'biting' motion for catching prey, equine jaws move in a lateral motion, simultaneously grinding the food and wearing down the teeth. However, many things prevent even wear of the teeth, causing discomfort and preventing proper digestion of food. Pain in the mouth, caused by ulceration or pressure from the bit, can result in behavioural changes.

Definition of words used in dentistry

Occlusal surface The surface of the tooth in contact with the food (and other teeth). This is large in size in cheek teeth and thin in incisors.

Lingual surface Tongue-side (medial aspect)

Buccal surface Cheek-side (lateral aspect)

Mandibular Bottom of the mouth (teeth inserted into the mandible bone)

Maxillary Top of the mouth (teeth inserted into the maxilla bone)

Rostral Towards the front of the mouth (nose end)

Caudal Towards the back of the mouth

Arcade Describing the teeth on half or one side of either the upper or lower jaw

Apex or Apical point The surface of the tooth which has contact with the gum

Dental charts

It is good to get into the habit of numbering the teeth from 1 to 11 on each quarter (upper right, upper left, lower left, lower right) for ease of identifying teeth and tooth problems and for case records. See Section 10.4 of this chapter for more information on the Modified Triadan system of numbering teeth (Dixon and Dacre 2005). Record charts make dentistry more interesting and meaningful, and is necessary if an animal has severe dental problems and requires regular treatment. It means that areas of known pathology are recorded so can be rechecked regularly, any changes can be tracked and different people can follow up the same case.

> It is important to involve the owner and help compliance with treatment by good owner management.

Review of the anatomy and physiology of equine teeth

10.2

Like other domestic animals, equids have temporary or 'deciduous' teeth which are lost at a young age and replaced by permanent teeth, apart from the 4th, 5th and 6th molar cheek teeth which erupt only as permanent teeth.

Dental anatomy in the equid

- Incisors The six teeth at the front of the mouth. These are used to 'cut' grass when grazing, and help in estimating the age of equids, as described in Section 10.3 (see Figure 10.2.1).
- Canines These teeth are sometimes present between the incisors and premolars. They erupt between 4 and 6 years of age and are uncommon in females (Figure 10.2.2).
- Wolf teeth Only present in some animals, these teeth are vestigial premolars that sit right against the first premolar (further back in the mouth compared to canines); they have a greater significance in animals which have a bit placed in their mouth as they may cause interference.
- Premolars Cheek teeth (CT) 1, 2 and 3. These teeth erupt within the first 2 weeks of life as deciduous teeth which fall out and are replaced with permanent forms appearing from 2.5 years of age (Figure 10.2.3).
- Molars CT 4, 5 and 6. These are permanent teeth only, with CT 4 being the oldest tooth in any equine mouth.

Combined premolars and molars act as a single unit for food breakdown as they are so close together they effectively form one long occlusal surface (see Figure 10.2.3). There is an angulation in the occlusal surfaces between the mandibular and maxillary cheek teeth in the lateromedial (buccolingual) direction, with the maxillary teeth being longer on the lateral (buccal) aspect, and the mandibular teeth longer on the lingual (medial) aspect (Brown et al. 2008).

> Most of the dental work relevant to working equids will focus on the cheek teeth (molars and premolars).

Figure 10.2.1 Deciduous incisor teeth.

Figure 10.2.2 Canine tooth visible in upper jaw between the incisors and the corner of the mouth.

Figure 10.2.3 Molar arcades seen from the cranial view. Note: Packing of food material in teeth and dental caps on 3rd premolars bilaterally.

Structure of the teeth

Enamel forms the outer covering, it is very hard and has no ability to repair itself.

Dentine makes up the bulk of the tooth, with secondary dentine laid down constantly over the animal's life thus preventing exposure of the pulp as the tooth wears down whilst chewing.

Pulp is the substance with the inner cavity of the tooth containing vascular tissue and nerves.

Cement is the white, hard layer seen at the occlusal surface.

Occlusal surface is the erupting surface of the tooth, seen when examining the teeth.

Figures 10.2.4, 10.2.5 and 10.2.6 illustrate the appearance of occlusal surface of the incisor teeth. It is possible to distinguish the different layers of enamel, dentine and cement. The appearance changes over the animal's life as the teeth wear down. These changes are used to estimate the age of equids. See equine dental texts such as Easley et al. (2011) for more detailed descriptions of dental anatomy.

Donkeys

Research into the dental anatomy of donkeys shows general similarities to that of horses (du Toit et al. 2008b). Differences in the timing of appearance/disappearance of occlusal surface structures used in ageing are explained in the next section (Section 10.3).

Figure 10.2.4 Occlusal surface of a 3 to 4-year-old equid showing the linear dental stars (buccal side) and infundibula cups (lingual side).

Figure 10.2.5 A 10 to 15-year-old equid, the dental star (secondary and tertiary dentine) is seen as a more oval shape on the labial side of the teeth; the cups are beginning to disappear.

Figure 10.2.6 An equid over 16 years old; the stars have disappeared and the pulp cavity (mark) has been occluded by secondary dentine.

Ageing of equids using the incisors

10.3

The eruption of deciduous and permanent incisors can be used to estimate, fairly accurately, a horse's age until it is 5 years old but, after that, ageing by teeth becomes less reliable. For donkeys, remember that the eruption times of the incisor teeth have been reported as up to one year later than that of horses (Muylle et al. 1999). The presence of hooks and Galvayne's groove are unreliable in ageing donkeys (see also Section 1.4).

The information below details how an equid's age can be estimated, but always warn the owner that this is an estimate and, once an animal is over 6 or 7 years old, it is increasingly difficult to give a reliable age.

Ageing in the first 5 years – Incisor eruption

Incisor teeth are either deciduous or permanent. It is important to be able to distinguish the difference in order to estimate the age of an equid.

Deciduous teeth are whiter in colour and more rounded at the apex (Figure 10.3.1).

Permanent teeth are squarer in shape at the gum margin and yellower in colour (Figure 10.3.2).

Table 10.3.1 shows the reported eruption age for incisor teeth of horses and donkeys.

Teeth	Age of deciduous teeth eruption		Age of permanent teeth eruption	
	Horse	Donkey	Horse	Donkey
Central incisors	0–1 week	0–2 weeks	2.5 years	3–3.5 years
Middle incisors	4–6 weeks	8 weeks	3.5 years	4 years
Corner incisors	6–9 months	12 months	4.5 years	5–5.5 years

Table 10.3.1 Incisor eruption timing for horses (Tremaine 2012) and donkeys (Muylle et al. 1999).

Figure 10.3.1 Erupting incisors. It is important not to confuse these with an injury or as being the chipped or missing teeth of a much older animal. Note that the shape of the gum line for deciduous incisors is rounded.

Figure 10.3.2 Permanent incisors: more yellow in colour and squarer at the gum line (apex).

Dental stars are reported to appear in donkeys at an earlier age than in horses (Muylle et al. 1999), with appearance of the dental star in the central incisors at 3.5–4 years old, the middle incisors at 4–4.5 years old and the corner incisors at 5.5–7 years old. Reported appearance of stars in horses does not occur until after 5 years old (Muylle et al. 1996).

Ageing between 5 and 15 years – Occlusal surface and angle of incisors

As the animal increases in age, the shape of the occlusal surface changes from oval to a binomial or triangular shape; the incisor slope angle becomes greater when viewed from the side (Figures 10.3.3 and 10.3.4).

Structures of the occlusal surface of incisor teeth change as the animal ages (see also Section 10.2 of this chapter).

- Infundibular 'cup' This funnel-shaped structure appears as a round, white circle when the permanent tooth erupts, becoming blacker (filled with food) and smaller (getting towards the funnel base) as the tooth grows. In horses, it is reported to disappear from the central incisors by 7 years old, middle incisors by 7 to 10 years old and in the corner incisors by 10 to 14 years old, leaving a 'mark' (Muylle et al. 1996). In donkeys, the cup disappears from the central incisors by 11 years old, indicating a later date for loss of this structure than in horses (Muylle et al. 1999).
- Enamel spot or 'mark' A small ring of infundibular enamel which is left once the cup has disappeared. It is found on the lingual aspect of the incisors.
- Dentine 'star' (See Figure 10.3.5) Reported to appear in horses in the central incisors from 5 years old, middle incisors from 6 and corner incisors from 7 or 8 years old (Muylle et al. 1996). The reported age of appearance of the dental star in donkeys is younger than that reported for horses, with appearance of the dental star in central incisors at 3.5–4 years old, the middle incisors at 4–4.5 years old and the corner incisors at 5.5–7

Figure 10.3.3 Lateral (side) view of deciduous incisor teeth, showing steep occlusion angle.

Figure 10.3.4 Lateral view of permanent incisor teeth, showing a more acute occlusion angle.

Figure 10.3.5 The 'star' is seen as the darker line on the buccal side of the incisor teeth; the 'mark' is seen as the ring-like structure on the lingual side of the teeth.

years old (Muylle et al. 1999). At around 7–8 years, secondary dentine starts to deposit in the pulp cavity, becoming larger and changing position on the occlusal surface with age.

After 15 years of age, the appearance of the biting surface does not alter greatly.

Ageing between 10 and 30 years – Upper lateral (corner) incisors

- Galvayne's groove This is a dark vertical line which appears on the upper corner incisor teeth (Figure 10.3.6). Historically it was considered to appear at the gum line after 10 years of age in horses, to be half way down the tooth at 15 years, and reach the occlusal surface at 20 years of age.

> Galvayne's groove is now considered to be an unreliable indicator of age, due to differing ages of appearance, growth and bilateral asymmetry (Muylle et al. 1996).

Therefore, Galvayne's groove should not be used alone to age an animal, but may add to the overall impression.

Figure 10.3.6 Galvayne's groove present on the corner incisor.

- Donkeys Galvayne's groove has been reported as present in some animals over 12 years old, but is too inconsistent in presence and growth to be useful as an estimator of age (Muylle et al. 1999).
- Hooks on the upper corner incisors Historically this was reported to appear at 7 years old, disappear then reappear at 11 years old (due to uneven wear of incisors). However, recent reports dispute the reliability of this, and state that hooks can appear at any time from 5 years old in some horses and can be unilateral (Muylle et al. 1996). Again, in donkeys, hooks are reported to appear from 6 years of age and can be present at any age after this, with no consistent and reliable age category (Muylle et al. 1999).

> Presence of a hook is, therefore, not a reliable indicator to use to estimate the age of equids.

Ageing the donkey

As stated above, the eruption times of incisor teeth are generally a little later than in the horse, and the corner incisors may not be in wear until 9 or 10 years old (5 or 6 years in the horse). The following differences have also been noticed:

- Cups in the teeth of some donkeys may not disappear until 20 years old, whereas they are gone in most horses by 14 years.
- Dental stars appear earlier on permanent incisors.
- Galvayne's groove does not appear in all donkeys.
- Hooks on the corner incisors are not reliable in donkeys.

10.4 Complete oral examination

If oral disease or pain is suspected, attempt to do a complete visual and manual examination to assess the mouth and dentition and ensure all findings are communicated to the owner.

History and clinical signs of dental disease

As usual, carry out a thorough clinical examination to assess all body systems, see Chapter 1.

> Remember, many illnesses can result in a thin animal (Figure 10.4.1) that is not eating, with associated behaviour changes.

When a problem in the mouth is suspected, take a detailed history, looking out for clinical signs of dental disease (Tremaine and Casey 2012).

- Reluctance to eat? It can be very useful to watch the animal eat if the owner reports problems associated with this.
- Quidding (oral dysphagia: dropping of balls of food from the mouth), or does the animal only chew on one side of the mouth?
- Hypersalivation?
- Halitosis (bad-smelling breath)?
- Food packing? Food can collect in the cheeks of equids with dental pathology or pain. This can be easily identified when the mouth is opened, and sometimes even palpated through the cheeks.
- Dropping food from the mouth whilst eating?
- Slowness in prehending and eating food?
- Inappetance?
- Faecal consistency changed?
- Weight loss?
- Nasal discharge (may be unilateral)?
- Pain or bahavioural changes when opening the mouth to put in the bit?
- Changes in behaviour when working, or in general?
- Problems with the bit in ridden/driven animals? Head shaking, abnormal head carriage and/or reluctance to accept the bit?
- Intermittent colic signs?
- Facial swellings/asymmetry/discharging sinus tracts?

Figure 10.4.1 A thin horse can be the consequence of many diseases, including dental.

> Excessive salivation can be associated with the dumb form of rabies (Section 16.1), especially in donkeys – a good reason always to wear gloves when examining the mouth!

Having considered all these signs, remember equids are 'flight' animals and are very good at concealing mouth/tooth problems and pain. Ask the owner about any symptoms which could indicate a dental problem. Open the mouth of every animal to look for signs of dental disease. Do a thorough oral examination if dental disease is suspected.

Extra-oral examination

Before opening the mouth, carefully observe the head and neck area for the following signs:

- Discharge Nasal and/or ocular
- Asymmetry Muscle wasting or swelling of the face
- Swellings of the submandibular lymph nodes: unilateral or bilateral
- Pain on palpation of the structures on the outside of the face surrounding the oral cavity
- Buccal retraction Retract the cheek at the sides of the mouth to visualise the evenness of the cheek teeth and do a preliminary check of the upper arcade for lateral points or injury to the buccal cheek surface.
- Lateral excursion test Gently move the mandible laterally in each direction to assess the range of lateral movement. The mandible should move an equal distance to both sides. Note any pain on excursion (Pascoe 2010).

Initial examination will give an indication of the nature of the animal and inform the amount of sedation and restraint needed to continue with a full examination of the mouth (Tremaine and Casey 2012). Figure 10.4.2 shows an initial examination without a speculum.

Note: Always take care when examining near the mouth, and do not put a hand in the mouth without a dental speculum (gag) in place.

Studies have shown that horses should utilise both sides of the mouth equally; unilateral favouring may indicate, pain, pathology and shear mouth (Pascoe 2010).

Figure 10.4.2 Preliminary examination of the mouth without a dental speculum.

Just as a clinician would observe a lame horse walking, it is good to watch an animal with a history of mouth/dental problems eating in order better to identify the potential problem.

Examination of mouth with a dental speculum

Placement of the speculum

Sedation If the animal is fractious or in pain, ensure adequate sedation before placing the speculum on the head. An animal fitted with a metal speculum can cause injury to people handling or treating so, if in doubt, sedate the animal (Tremaine and Casey 2012).

> Accurate placement is absolutely essential to do a good oral examination which is safe and allows effective manual and visual assessment.

The size of the speculum needs to fit the animal well, so a different size would be needed for large horses compared with smaller donkeys; smaller 'pony' plates are available for donkeys.

It is no longer acceptable practice to pull the tongue out for dental examination and rasping (as was done in the past). A full examination and rasping is only possible with the use of a specialised equine speculum, e.g. the Hausmann, which is safer than side-placing gags.

When positioning a Haussmann gag, ensure the strap over the head is sitting directly behind the ears, not further down the neck because, if it moves forward, the mouth-pieces could come away from the teeth and the animal will close its mouth, most likely on the clinician's arm!

Examine with hands first (speculum in place)

Before washing out the mouth, always feel for food impaction (Pascoe 2010). Next, wash out the mouth using a large syringe and copious water. Inspect the mouth both manually and visually, using a bright light source.

> Palpate the entire oral cavity – feeling the buccal, occlusal and lingual surfaces of all arcades.

Any deviation or asymmetry in cheek teeth should be noted and each tooth should be grasped between the thumb and forefinger and checked for instability, movement or a pain reaction (see the following section on loose teeth). Feel for sharp edges, hooks or spikes, or other major pathology such as fractured/missing teeth and lesions/swellings on the soft tissues.

Visual examination (speculum in place)

Using a bright light source (head torch or pen torch – Figure 10.4.3) examine the soft tissues for evidence of ulceration (due to sharp buccal/lingual ridges), bit trauma or other wounds, swellings or tumours. The commissures of the lips and the inside of the cheeks are common areas for injury. Evaluate all three surfaces of the teeth on each arcade. If there is food impaction re-flush, or examine carefully with a probe to evaluate for diastemata. Use a mirror with a long handle (purchased or made locally) to see the buccal sides of the teeth and gums more easily (Pascoe 2010).

Figure 10.4.3 Examination of the mouth with a dental speculum fitted, using a pen torch to visualise inside the mouth.

Inspect the gums and tongue for injury or ulcers. The upper and lower interdental spaces (where a bit sits in the mouth – between the incisors and first cheek teeth) should be observed (and palpated), checking for bone irregularities, mucosal ulcers/thickenings or trauma from bitting. The tongue should be checked for function as it can be easily injured by harsh bits or tongue ties, as can the lip commissures which are more easily visible.

The combination of oral and manual examination will indicate whether the animal is experiencing any pain or discomfort when eating or working.

Dental equipment 10.5

The equipment described below is a comprehensive list of equine dental tools. Although not all of these may be available or necessary, they have been included here for information.

Depending on the confidence of the clinician and the frequency of dental work conducted in the field, some of the equipment described below may be required. Ideally, aim to have a full-mouth dental speculum, e.g. Hausmann's, a bright light source (head torches are preferable to leave hands free for examination), a set of dental rasps and flushing equipment for dentistry (large syringe and bucket to collect the dirty water and dispose of somewhere away from the examination site). Local alternatives may actually be a potential source of equipment – provided that it is safe to use and does not cause any welfare problems or risks to the animal.

Dental records

Ensure that all findings are recorded.

A Modified Triadan system for dental nomenclature can be used (Dixon and Dacre 2005) with the teeth of the upper right arcade numbered from 101 to 111, the upper left numbered from 201 to 211, the lower left numbered from 301 to 311, and the lower right numbered from 401 to 411.

Examination equipment

Speculum or gag

- The Hausmann's is most commonly used – it is a safe oral speculum; however, there is a range of gags available.
  - A speculum is essential for complete oral examination (Tremaine and Casey 2012).
- A speculum avoids damage to the tongue, which is very common if the tongue is pulled aside to examine and rasp teeth.

Light source

- This is essential for viewing the oral cavity, especially the caudal part.
- Head torches are preferable as they leave both hands free (Tremaine and Casey 2012); cheap versions are widely available.
- LED lights are better as they don't produce heat and have good battery life.

Dental syringe, mouthwash and bucket

- These are all readily available.
- Use chlorhexidine gluconate (< 0.1% concentration) ideally, or salt water, for flushing (very dilute povidone-iodine can be used, but it tastes unpleasant).

> - Keep the animal's head down so that water falls out of the mouth and is not aspirated (Tremaine and Casey 2012).

- Collect the water falling from the mouth in a bucket so as not to flood the work area.

Dental mirror

- This allows a good view of the caudal oral cavity and all three sides of cheek teeth (to diagnose diastemata, etc.).
- Strong, rigid mirrors are best as they can move soft tissues, such as the tongue, out of the way to allow better visualisation of the teeth (Tremaine and Casey 2012).
- Mirror fogging can be a problem particularly in cold weather; warming the mirror before use (e.g. placing in some warm water) can reduce this (Pascoe 2010).
- The ideal size is 5 cm diameter and angled for ease of use.
- Care: They are fragile and can be broken!

Probes and picks

- Useful to investigate the condition of the occlusal surfaces or the depth of pockets between teeth
- Can identify sharp points and loose fragments (Tremaine and Casey 2012)
- Can be used to clean out diastemata
- A range of shapes and sizes available depending on your requirements (see further dental texts for more information)

Head stand

- Holding the animal's head at head height will make examination easier.
- A sedated equid's head can become very heavy for the handler to hold for the length of a full dental examination.
- Specially made equine head supports are available, but it is possible to improvise with items in the local environment to provide a comfortable support for the animal.

> - ENSURE that the support does not constrict the airway (throat) of the animal.

Manual instruments

Dental rasping blades

- A large range of dental rasps are available to deal with the teeth in different parts of the mouth. However, most things can be done with three or four (a minimum of one straight and one angled).
- There are many different types; the angle and blade on the head is more important than the handle type which is usually a question of personal preference.
- Blades can be set in the handle head so the cut is on push or pull; again, this is personal preference.

The following blades are the most commonly used:

- Tungsten chip blades Rough chips of tungsten carbide bound on to a solid steel backing plate. These can be quite aggressive if not used correctly. They cut in both directions and are cheaper, but they blunt and corrode quickly. Studies show that they cut deep grooves into the surface of the teeth and damage cement and enamel (Kempson et al. 2003).
- Solid tungsten blades Serrations are cut into the blade surface by a machine, and there are many different degrees of blade coarseness available. However, the coarse blades are often too aggressive and blunt easily so most dentists prefer a medium/fine cut. They cut in one direction only and can be re-sharpened. They are medium price but better wearing, and are a good option if available. Studies show these blades leave a smooth surface to the teeth post-rasping (Kempson et al. 2003).
- Diamond coated Diamond bonded onto steel. Cut in both directions. These are durable, but expensive and can corrode.

> - Take care: It is easy to over-rasp with this type! (Tremaine and Price 2012)

Rasp design

There are many different types of rasp handles/heads which can accept different blades, with variations in the style and shaft necessary to fit different parts of the mouth (Tremaine and Price 2012). There is not one rasp that can do everything so ideally have a selection.

Straight blades

- Short straight
  - Used for rostral cheek teeth in both upper and lower arcades
  - Set to cut on the pull as this is easier and less likely to damage soft tissues
- Long straight
  - Used on middle-caudal part of the upper and lower arcades
  - Ensure blade set to cut on the pull stroke

Angled blades (for use on the upper arcade only; the angle makes rasping of uppers easier)

- Short open-angled
  - Rostral upper arcades
  - Blade usually set to cut on the push stroke
  - Cannot rasp rostral hooks on 06s

- Medium open-angled
  - Middle-caudal upper arcade
  - Blade set to cut on the pull stroke
- Up-angled rasp
  - Used for upper 10 and 11, especially the caudal aspect where hooks are hard to reach
  - Set to cut on the pull stroke as soft tissues are easily damaged in this area
- Short offset rasps (down-angled)
  - Used to address rostral hooks on upper and lower 06s and round them off
  - More useful than other angled rasps
  - Blade set on the push or pull stroke

Use of any type of tooth-cutting instrument is contra-indicated.

Motorised equipment

- A variety of motorised rasps are available, with varying sources of power-switches, blade movement (disc, axial) and power sourcing.
- Motorised rasps can offer greater precision than manual instruments, and can be good for long overgrowths. However, proper training is required to operate them because, if used incorrectly, they can result in a serious amount of damage.
- They can be very dangerous in inexperienced hands due to the possibility of excessive reductions of teeth, soft tissue trauma and thermal trauma. However, these dangers can be minimised with good training, skill and sedation of the animal, and an efficient cooling system.
- The power source may not be reliable when in the field; there are also additional safety concerns.
  - Cases of severe over-rasping have been seen with improper use of power tools.

  Over-rasping results because it is often difficult to stop the machine in time. This is very distressing for the animal and owner, as the animal has no occlusal surfaces to grind its food with, and is in pain because the sensitive dentine and pulp is all exposed (Lundstrom 2010).
- Take care in older animals as motorised equipment may loosen previously functional teeth (Lundstrom 2010).

Motorised equipment should NEVER be used without sedation and a dental speculum.

Table 10.4 shows the advantages and disadvantages of both manual and motorised dental rasping equipment. Consider and be aware of these when deciding on and using dental rasping equipment.

Advantages	Disadvantages
Manual equipment	
Easy to use	May be less precise
Inexpensive	Inefficient on large overgrowths
Less traumatic to soft tissues	Physically demanding for operator
Less likely to require sedation	Causes surface damage to the teeth (enamel and cement)
Motorised Equipment	
More precise	Difficult to use correctly and requires training
Efficient	Expensive
Less soft tissue damage in the caudal mouth (if used correctly)	Traumatic to soft tissues
Less physical effort for the operator	Requires sedation
	Produces dust and heat (which can damage the tooth pulp); always use with a cooling system
	Never to be used without a dental speculum
	Requires efficient, safe power supply which may be difficult in the field
	It is easy to over-rasp
	May loosen previously functional teeth in older animals

Table 10.4 Relative advantages and disadvantages of manual and motorised dental rasping equipment.

10.6 Common problems due to mastication and wear

Due to the infrequent grazing patterns of many working equids, and the diets they consume, there is often evidence of dental problems, especially in older animals (du Toit and Dixon 2012). In a study of 203 working donkeys in Mexico, the prevalence of dental disease was 62% with sharp enamel points in 98% of animals examined (du Toit and Dixon 2012). Dental disease is reported as most prevalent in older donkeys aged 16–20 years (du Toit et al. 2008a).

An equid's teeth depend on constant lateral movement for them to wear evenly. If this does not occur, due to disruption of normal grazing/eating behaviours (such as working for many hours per day), then dental problems occur.

Sharp enamel points – buccal (lateral) and lingual (medial) overgrowths

These are a very common abnormality associated with equine teeth worldwide (du Toit and Dixon 2012). The hard points of enamel on the buccal surface of the upper (maxillary) teeth and the lingual side of the lower (mandibular) cheek teeth become very sharp often lacerating the cheeks.

Studies indicate that tight nosebands and head-collars contribute to ulcers and calluses in the mouth (du Toit et al. 2008a) possibly by pressing the cheeks and soft tissues onto the sharp points resulting in trauma and wounds. As well as rasping these sharp points, loosening the noseband could make equids more comfortable.

Besides affecting the ease with which equids can grind food (and hence affecting digestion capabilities and thus the nutritional value of feed), these enamel points can produce painful sores and ulceration of the mucosa lining the cheeks and tongue (Figure 10.6.1) making eating painful, which further exacerbates the problem of overgrown teeth and associated weight loss.

Figure 10.6.1 Laceration of the tongue due to sharp enamel points.

Although focal overgrowths on the first few (rostral) cheek teeth can be visualised, it is necessary to do a thorough examination, with a dental speculum and bright light, to pick up problems at the back of the mouth. Feeling the back of the mouth with a gloved hand can also pick up pathology in hard to see places. It is crucial that the sharp points at the back of the mouth are not missed as these are more likely to result in cheek lesions and pain.

See Section 10.8 of this chapter for treatment and rasping of sharp enamel points (Figure 10.8.1).

Rostral and caudal overgrowths of cheek teeth (hooks)

If the maxillary and mandibular arcades are misaligned or different lengths, uneven wear may produce overgrowths on the front and back (rostral and caudal aspects) of the cheek teeth, in addition to or instead of the lateral overgrowths described above.

Dental overgrowths cause pain and discomfort when eating and can affect the prehension and biting of food, especially grasses.

Hooks on the rostral aspect of the 1st cheek tooth (06) are easily seen and rasped in a good dental examination; however, hooks on the caudal aspect of the 6th mandibular cheek tooth (11) are often missed (Figure 10.6.2) and it is these which can cause the most pain.

Rasps with solid carbide blades can treat this problem effectively, although it requires patience as it can take a long time. Molar cutters are not recommended since they increase the chance of exposing the sensitive dental pulp (Tremaine and Price 2012).

For large dental overgrowths, gradually reduce over a number of examinations rather than in one go.

See Section 10.8 of this chapter for more information on treatment.

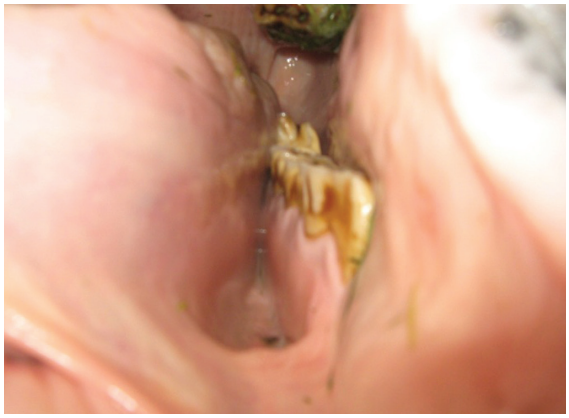

Figure 10.6.2 Caudal hook on tooth 311.

Excessive transverse ridges of the occlusal surfaces (ETRs)

The occlusal surfaces of equine teeth are naturally uneven due to the natural jaw movements and varying rates of wear of the enamel and dentine. This unevenness is related to effective mastication (Tremaine and Price 2012), see Figure 10.6.3.

There is little current evidence to show that ETRs contribute to equine dental problems; it is inadvisable to rasp occlusal surfaces unless they are causing obvious pain.

Occasionally there may be an excessive ridge that protrudes far beyond the level of the others. In this case it may be appropriate to reduce this ridge to the level of the others to allow effective mastication (Tremaine and Price 2012).

It is absolutely essential that the occlusal surfaces have some ridges and roughness as this is the grinding surface that breaks up the food in mastication. If this is rasped smooth, the equid will not be able masticate effectively and this may result in weight loss and quidding (Lundstrom 2010).

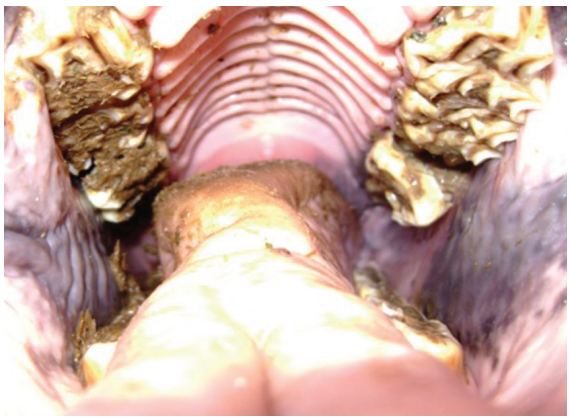

Figure 10.6.3 Transverse ridge pattern seen in these cheek teeth.

Wave mouth

This is when there is a wave-like or undulating appearance to the arcade in a rostro-caudal direction and is especially seen in older horses and donkeys (Dixon and Dacre 2005, du Toit and Dixon 2012). Large focal overgrowths or diastemata may contribute to producing a wave mouth (Dixon and Dacre 2005, Tremaine and Price 2012).

It is rarely possible to correct such chronic changes (wave mouth) with rasping.

Ideally overgrowths should be treated early on to prevent wave mouth (Dixon and Dacre 2005). Rasp little and often (twice-yearly) to attempt to correct wave mouth.

Step mouth

Focal overgrowths can occur which result in a 'step' in the mouth where one tooth is a lot 'taller' than that the rest of the arcade. This overgrown tooth will stop the other teeth in the arcades coming together in a bite and, therefore, will interfere with the occlusal grinding surface and ultimately may severely disrupt mastication. Severe soft tissue damage can be the result if a tooth overgrows extensively and chewing results in trauma to the opposite gums.

These focal overgrowths commonly occur if a tooth is lost. Equine cheek teeth erupt continuously and are continually worn by the process of mastication. If a cheek tooth is lost the opposite tooth will no longer be worn and will become overgrown. Without any wear this overgrowth will get larger and larger until it causes a serious impact on mastication; it can stop the cheek teeth from meeting, and always results in serious soft tissue injury and pain in the mouth.

It is really important these overgrowths are treated as they will severely impair mastication (chewing) and will result in severe dental pain.

Furthermore, without treatment they will only get worse. The overgrowths do not need to be rasped right down to the level of the other teeth, but sufficiently to allow normal mastication (du Toit and Dixon 2012). See Section 10.8 for more information on treatment.

Shear mouth

Normally the occlusal surfaces of the cheek teeth sit at a slight angle of 10–30 degrees (Tremaine and Price 2012). If the angle becomes greater than 45 degrees this is termed 'shear mouth' (Dixon and Dacre 2005). If the enamel edges become too long the occlusal surfaces end up sitting at a steeper angle, causing pain, and reduce the occlusal surface available for grinding food.

In extreme circumstances it can altogether stop the animal eating normally. Instead of a side to side movement of the jaw to grind food the eating pattern ends up like a carnivore's with an up-down chewing motion. This is very dangerous for equids and further exacerbates the overgrowth.

Severe shear mouth leads to quidding and weight loss; further gum and tooth disease can occur due to the large amounts of food which sit in the mouth for long periods as they cannot be chewed.

Severe shear mouth is ideally treated by dental experts with mechanical burring done in stages. With a manual rasp, reduce the buccal and lingual points as normal. This may require frequent (every 3 months) reviews to maintain an adequate functional arcade (du Toit and Dixon 2012).

Smooth mouth

This mostly occurs in older animals (du Toit and Dixon 2012) or where there has been excessive rasping of the teeth, often with a power tool (iatrogenic) (Lundstrom 2010).

> Beware rasping too much off the points in older animals – they may be the only occlusal surface the animal has left for eating!

Smooth mouth cannot be cured and permanent feeding of soft food is required. It is essential that owners are aware of the correct diet for these animals to maintain their daily requirements, especially if they are still working.

Other dental abnormalities seen in working equids 10.7

Retained deciduous crowns ('caps')

The first three cheek teeth (excluding wolf teeth) are the premolars (06, 07, 08) and all have deciduous teeth that grow and fall out before the permanent teeth develop. The last three cheek teeth are the molars (09, 10, 11) and do not have deciduous forms, erupting for the first time as permanent teeth; they are not present in foals.

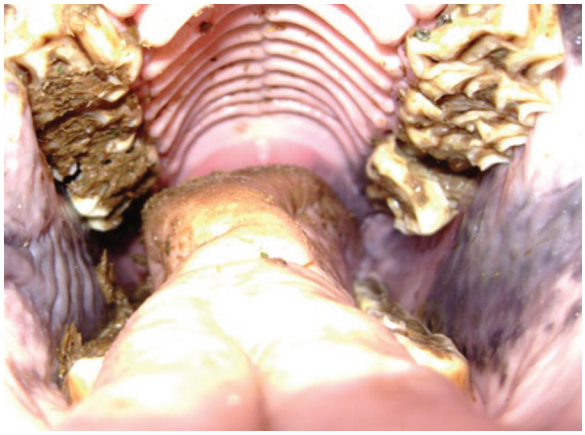

Figure 10.7.1 Dental caps seen on 108 and 208.

Around the age of 2–4 years old the crowns of the deciduous cheek teeth can become loose or rotated as the permanent teeth erupt, causing discomfort and trouble eating.

Diagnosis is usually by palpation or visualisation (Figure 10.7.1), or by smell as food becomes caught. An irregularity or 'rattling' sound may be experienced when rasping – check the animal's age if this is so. In most cases caps will fall off naturally (Figure 10.7.2) and any remaining small pieces should not cause a problem. If small caps are present rasp any sharp hooks left behind, but avoid manual

removal of caps as this causes other problems if they are not ready to come off. If caps are very loose, and appear to be causing problems, they can be removed carefully using an appropriate instrument (Dixon and Dacre 2005).

Figure 10.7.2 Deciduous dental caps.

Incisors – Uneven, displaced or retained deciduous incisors

Most equids have fairly straight incisors, although sometimes they are crooked, uneven, or have retained temporary teeth behind or between them. A case of polydontia is shown in Figure 10.7.3.

Current thinking is that these conditions rarely cause problems with eating, and incisors should not require rasping or removal unless absolutely necessary (Tremaine and Price 2012).

Complete incisor removal can have disastrous consequences: these teeth keep the jaw balanced at the temporomandibular joint and allow the animal to prehend food.

Figure 10.7.3 Polydontia seen in a working horse.

Diastemata

These are abnormal gaps between teeth which occur for a number of reasons, including developmental conditions, periodontal disease, and focal overgrowths which force food down between the teeth, or dental extractions. These gaps allow food material to pack between the teeth causing periodontitis (Casey and Tremaine 2010) with resultant infection. Damage to periodontal ligaments will ultimately result in loose teeth which may fall out.

Studies report that diastemata are the most prevalent dental disorder in donkeys (du Toit and Dixon 2012).

Clinical signs Salivation, pain and a bad smell can indicate diastemata. Thorough inspection with a gag is necessary to identify this.

Diastemata are usually extremely painful for the animal.

Treatment in the field involves flushing out food from the tooth space using a high-pressure syringe (usually very painful therefore sedation may be required). Use a rasp to reduce the opposite transverse ridge slightly, as this acts to push food further into the diastemata. Be sure to look at the whole mouth and correct any hooks, sharp points, etc. which may be causing the problem. Reducing any overgrowths or sharp edges to improve food flow can minimise food packing. Widening of diastemata is carried out to try to prevent food trapping (du Toit

and Dixon 2012). Changes to the diet may also aid in reduction in food trapping (Casey and Tremaine 2010). NSAIDs are recommended for analgesia; antibiotics depend on the individual case.

There is good current evidence to show that simply flushing out food from the space and treating with antibiotics and anti-inflammatory drugs, along with a diet of larger-sized food particles (i.e. hay and no finely cut roughage such as chaff or short-chopped, hard feed such as alfalfa) (du Toit and Dixon 2012), can be adequate to manage diastemata.

Periodontal (gum) disease

This is inflammation and infection of the gums (alveoli, gingiva, periodontal ligaments and cement); periodontal meaning 'around the teeth'. It is most common in older animals and seen secondary to primary dental disorders such as diastemata and misaligned cheek teeth (Dixon and Dacre 2005, Casey and Tremaine 2010). It is reported as a very painful condition; however, correction of the primary problem may lead to reversal of the periodontitis ((Dixon and Dacre 2005).

Clinical signs can include the generalised signs of dental disease: halitosis, quidding, discomfort with the bit/bridle, behaviour change, nasal discharge (Casey and Tremaine 2010). However, facial and mandibular swelling is not a symptom as any infectious exudate associated with the condition can drain out of the mouth, rather than being trapped in the tooth root, as seen with a tooth root abscess.

If present for a long time, gum problems will lead to loosening and eventual loss of teeth, due to damage/loosening of the periodontal ligaments that hold the teeth in place.

Treatment Early regular attention will avert this problem. However, it may not be possible to reverse severe gum disease once it has passed the superficial stages. Correction of malocclusions/overgrowths and early treatment of diastemata is the key to prevention. In advanced cases, flushing with dilute chlorhexidine and owner management, including feeding practices, may be the only treatment option (Tremaine and Price 2012).

Dental disorders associated with trauma

Trauma is frequently seen in working equids due to road accidents, kicks, falls or biting hard objects. Fractures of the mandible and maxilla bones are common; most have a good prognosis with appropriate therapy. Some dental problems may go undetected until more serious complications develop and, without repair, may result in tooth loss, oesteomyelitis, malalignment of the jaws, or functional loss (Moll and Schoonover 2005). Incisors which are missing or damaged in one jaw will affect tooth balance, and opposing overgrowths will need regular attention (Dixon and Dacre 2005). Every attempt should be made to preserve the incisor teeth after trauma (Caldwell 2006).

Such cases may present with painful swellings and trouble eating, with associated lip or tongue trauma (see Section 11.4 The Gastrointestinal System – Conditions of the mouth and oesophagus), or more overt trauma (Figure 10.7.4).

The oral mucosa heals very well due to a good blood supply.

Even though the oral mucosa is exposed to food material and a large number of commensal bacteria, its ability to heal is very good. There is little merit in using topical medications,

although oral lavage with saline solution or water can temporarily assist in reducing food contamination. Chlorhexidine solutions can be used, but reports state not to exceed 0.2% (Caldewell 2006); dilute povidone iodine (PI) has also been reported for use (Moll and Schoonover 2005), but conflicting reports state PI may affect healing and is best avoided (Caldewell 2006). Similarly, unless wounds are full thickness and require closure to stop food contaminations, suturing of intra-oral injuries is generally not indicated.

If the animal can eat, unilateral fractures are well splinted by the other hemi-mandible and can be treated conservatively with broad-spectrum antibiotics, anti-inflammatory drugs (Caldewell 2006) and feeding only very soft food. Wire can be used for stabilisation in some cases (see surgical texts and references), a mental nerve block (see Section 10.8 of this chapter) is good for suturing broken gums and wiring jaws if necessary. If an injury penetrates the alveolar bone, apical infection and tooth loss can occur.

Daily flushing the area aids healing (Moll and Schoonover 2005).

When the incisor teeth have been involved in a trauma, they may be broken or loose. Fractures of these teeth with no pulp involvement will heal gradually with antibiotics and anti-inflammatory drugs; it is not recommended to remove fragments unless they are 'hanging loose'. Pulp exposure is seen as a gelatinous structure, muddy-red which becomes grey if it has been there for a few days (normally it is pink). Correct any sharp fragments with a rasp, although flattening the incisors too much will lead to problems with jaw alignment.

The rasping of incisor teeth is considered painful (Tremaine and Price 2012).

An example of a dental trauma is presented in the case study in Section 10.9 of this chapter. It involves a working horse which was hit in the mouth by a vehicle on a road, resulting in a fracture of the central left upper incisor (201) (see Figure 10.7.4).

Aim to make the animal comfortable and the teeth functional, rather than restore absolute cosmetic appearance.

Periapical infection, tooth fractures and neoplasia

These can all occur in working equids. Their diagnosis and management is a specialist area for veterinary dentists, often requiring equipment that is out of the scope of a field situation.

Suspect a tumour if there is a hard, slow-growing mass on the jaws, or if multiple teeth have been lost over a few months due to resorption of bone and teeth (Dixon and Dacre 2005). Sometimes a benign epulis behind the incisor teeth will cause the same symptoms.

For further information see the references at the end of this chapter.

Figure 10.7.4 Fracture of 201 incisor and maxilla in a working horse.

Treating dental conditions in the field

10.8

Health and safety

Although health and safety is important in all veterinary interventions, safety awareness in dentistry is even more important as many procedures involve standing right in front of the animal which is a common place for injury (Pascoe 2010). Also, when a full-mouth dental speculum, such as the Hausmann gag, is used in dental examinations, this heavy piece of equipment can result in injury to bystanders if the animal moves its head suddenly. Therefore, it is crucial always to restrain the animal correctly (consider sedation), and keep one hand on the gag to be aware of its position and avoid injury.

> Never kneel in front of the animal to look in its mouth as this may result in injury if the animal moves forwards.

Use of sedatives in equine dental treatment

Any of the sedation techniques (see Section 7.1) can be used to settle the animal if the mouth is painful or the animal is fearful; it should always be considered early on in the procedure for both the clinician's safety and that of the owner/handler and animal. Many working equids will never have worn a dental speculum or had their mouth examined before so, until they become familiar with the process, they may find it distressing.

> Administering sedation before the animal is very excited or nervous improves the efficacy.

If a procedure is going to be painful then ensure pain relief is provided pre-emptively before the procedure. This improves the efficacy of the analgesia.

Analgesic cover needs to be provided for a suitable period of time. Analgesia, offered by alpha2-agonists and/or butorphanol used for sedation, is very short acting, wearing off before the animal recovers from the sedative effects. Therefore, this should be combined with an NSAID, e.g. phenylbutazone or flunixin meglumine, which will provide analgesic cover for 24 hours (see Section 5.2).

Advantages and disadvantages of using sedation during dental treatment

When considering whether to sedate an animal for a dental examination, consider the behaviour and pain experienced by the animal, as well as the planned examination and treatment, and any increased levels of pain or distress this may cause. Always know the effects of the sedative agent to be used and advise the owner of these effects. Table 10.8.1 on the next page lists the advantages and disadvantages of sedative use for dental interventions.

Advantages	Disadvantages
Increased safety for the animal, veterinarian and owner/handler	Results in a lowered, heavy head (requires head stand or a person to hold it up)
Improved experience for the animal (decreased pain, fear, distress from the unfamiliar experience of wearing a speculum)	Possibility of an adverse reaction
Enables thorough oral examination and opportunity to do the treatment properly and precisely	Animal may fall, or choke on the water used for flushing the mouth
Provides some pain relief	Potential for increased haemorrhage
Aids the education of client or other health professional.	Requires time for recovery and this needs to be supervised

Table 10.8.1 The advantages and disadvantages of using sedatives for dental interventions in working equids.

Correction of dental problems with rasps

Rasping (floating, filing) should be done with care and attention – never go too fast as this may result in over-rasping. The objective is just to remove any sharp projections, thus improving dental health and overall mastication.

Enamel points

The jaw curves naturally upwards at the front and back, and is straight in the middle.

The teeth of the upper arcade are slightly wider that those of the lower arcade. This results in a distinct wear pattern whereby:

- the outside edges of the maxillary (upper) cheek teeth develop sharp edges
- the inside edges of the mandibular (lower) cheek teeth develop sharp edges.

These sharp points can cause injury/wounds to the cheeks and the tongue resulting in significant pain when eating and with bitting. It is common for this soft tissue injury to be made significantly worse by tight nosebands (du Toit et al. 2008a) which press the delicate cheek tissue onto the sharp enamel edges resulting in lacerations and wounds.

Diagnosis

- Signs of dental pain are often present – quidding, resentment of the bit, loss of condition.
- Oral examination – visualise/feel these sharp points.

Treatment

- Hold the rasp with either one or both hands and carefully remove these sharp enamel points. Aim to rasp only these points and do not rasp the entire occlusal surface smooth – i.e. do not place the rasp horizontally on the arcade, but at an angle so only the points are removed (Figure 10.8.1). Equids need this occlusal surface to be ridged to grind their food. If it is smooth they will be unable to masticate (chew) effectively and will lose weight.
- Using rasps with angled heads can help rasp these enamel points effectively – an angled rasp is helpful for the rostral cheek teeth of the upper arcade, whereas straight rasps (without angled heads) are useful for the lower cheek teeth and caudal upper cheek teeth.
- Only rasp the sharp edges of the tooth (buccal in maxilla and lingual in mandibular arcades) and do not flatten down the occlusal surfaces.

Figure 10.8.1 Using a manual rasp to file sharp enamel points on the lingual side of the maxillary cheek teeth.

- Rasp the back molars (11s) on each arcade as these are commonly missed but are often problematic for equids.

Complications of rasping – what to avoid

- Avoid over-rasping – particularly in older animals. The older the animal the slower the eruption of teeth and the less residual tooth crown (that above the gum-line) so, in older animals, it is even more important to avoid excessive rasping – many problems such as wave and shear mouth will never be corrected. Often in older animals rasping is done to prevent soft tissue trauma from overgrown or deformed teeth and to facilitate eating. As a guide, only rasp one-third to half of what is necessary in older animals. Excessive rasping may loosen otherwise functional teeth (Lundstrom 2010).
- Common problems of older horses, such as weight loss, reluctance to eat and reluctance to work, may be prevented with even slight amounts of rasping.
- Be sure to check the whole mouth, and that any sharp points or hooks at the back of the mouth have been successfully treated. There is no point in correcting the mild enamel points at the front of the mouth if there are large hooks left caudally which are causing much more of a problem.
- Be very careful not to injure the mucosa or cause excessive bleeding.

- Aggressive correction, or rasping at an angle which produces flattening of the occlusal surfaces, can completely remove arcades from occlusion making it impossible for the equid to chew its food (Lundstrom 2010). It doesn't matter how it feels, or looks, but how it works for the animal.

- Excessive rasping can also expose the sensitive parts of the tooth, causing pain and shortening the tooth's life (Dixon and Dacre 2005).
- Always consider analgesia. Rasping may be painful for the animal due to the presence of sensory nerves within the dentine (Tremaine and Price 2012).
- If the animal is eating normally, there is no evidence of soft tissue trauma visible in the mouth and no dental pathology that could produce trauma, then do not rasp.

Correcting overgrowths/step mouth

In treatment of focal overgrowths of one tooth (a step) or multiple dental overgrowths (e.g. wave mouth), the correction principles are the same: reduce to a more normal function. Remember, an overgrowth is the symptom not the cause of a problem. Have a good light source and check the opposite arcade.

- Excessive rasping of overgrowths can expose dentine and cause pain (Tremaine and Price 2012). Always stop and check with a good light source.
- It is crucial that during corrective rasping the pulp is not exposed as this will result in severe, potentially permanent damage to the tooth (Dixon and Dacre 2005). It is also extremely painful for the animal as the pulp contains the nerve supply to the tooth. Stop rasping if a pink colour is visible at the centre of the tooth as this indicates that the sensitive pulp has been damaged.
- If an overgrowth is large, ideally it should be gradually reduced over a period of treatments/months, so the pulp is not exposed (Tremaine and Price 2012).
- Tooth cutters are generally not advised as they can result in serious side effects including:
  - tooth fracture – Splitting cheek teeth will result in severe dental pain and will permanently damage the teeth. This can lead to severe and long-term pain/infection.
  - exposure of the pulp – If too much tooth is cut the pulp will be exposed. As explained earlier, this can result in permanent damage to the tooth and chronic pain.
  - iatrogenic wounds in the mouth/jaw fracture – from over-zealous molar cutting.

Tooth removal

> Tooth removal is very rarely indicated in working equids – unless the tooth is loose enough to be easily extracted orally.

For a cheek tooth to be loose, over 50% of the periodontal ligament attachment must be lost. This damage to the periodontal ligaments commonly occurs through dental disease such as periodontal disease secondary to food packing in a diastema. Once a tooth is lost, this always results in a focal overgrowth (step) in the opposite cheek teeth arcade (Dixon and Dacre 2005). Equine cheek teeth erupt continuously and are continually worn by the process of mastication. If a cheek tooth is lost the opposite tooth will no longer be in wear, resulting in an overgrowth. Without this wear the overgrowth will get larger and larger until it causes a serious impact on mastication. It can stop the cheek teeth from meeting and always results in serious soft tissue injury and pain in the mouth.

Loose teeth can be identified with a thorough oral investigation. Carefully palpate all teeth

and test whether any of them wobble with manual pressure. Loose teeth tend to be painful; therefore, if any area of the mouth is painful to this palpation or rasping, look carefully for any evidence of laxity.

Unless the tooth is extremely loose and can be pulled out with forceps, do not attempt molar removal in the field.

Complications for this surgery are high, and cheek tooth removal is an advanced surgical technique that requires specialist veterinary dental skills, equipment and extensive aftercare. In the context of working equids, suitable facilities are rarely available and the risks of complications, resulting in significant pain, poor welfare and actually making the dental pathology worse, makes tooth extraction impractical and ill-advised. Complications are higher in younger animals (Tremaine and Price 2012).

Complications of tooth removal

- Sequestration – leaving a piece of tooth in the alveolus
- Oro-nasal fistula – damaging the bone separating the oral and nasal cavities
- Super-eruption of opposite tooth – overgrowth of the cheek tooth in the opposite arcade because it is no longer being worn down by the tooth that has fallen out, requiring frequent rasping of the opposing arcade
- Chronic sinusitis and discharging sinus tracts – infection in sinus as a result of incomplete tooth removal or iatrogenic infection

Care after tooth removal

If a cheek tooth is loose and can be easily removed orally – by wobbling until it comes free – it is still important that careful aftercare is provided to ensure rapid healing and to reduce complications.

- Provide soft palatable food (e.g. mashes), not coarse/fibrous hay/straw. This minimises trauma to the healing tooth socket.
- NSAID cover should be provided – for analgesia and anti-inflammatory effects.
- Animals with marked infection may require a course of antibiotics.
- Administer tetanus antitoxin.

- AFTER TOOTH REMOVAL the teeth of that animal will require very regular rasping every 6 to 12 months as a minimum.

Regular care is needed to prevent an overgrowth in the opposite cheek tooth. This will need to be done for the rest of the animal's life. It is essential that owners are fully aware of this requirement to avoid problems in the future.

Dental nerve blocks

To aid certain dental procedures, the administration of the following nerve blocks can make the experience less painful for the animal and allow standing dental treatments for minor surgeries

(Lowder 2012). The local anaesthetic (LA) agent of choice is lignocaine, although mepivicaine, bupivicaine and prilocaine can be used (Tremaine 2007) depending on the procedure and length of LA time needed; mepivicaine is shorter-acting than bupivicaine. Know the anatomy well and understand potential complications of the procedure (Lowder 2012). Owners should be aware that recovery time is needed before the animal can eat again or work.

Four nerve blocks are reported: the first two on the list are the most effective (Lowder 2012):

- Maxillary
- Mandibular (inferior alveolar)
- Mental
- Infraorbital

Below are summaries of the different nerve blocks. When planning to carry out one of these blocks, study detailed anatomy and procedures in dental texts or refer to Tremaine (2007). Practice on cadaver specimens will enable the precise location and technique to be mastered.

Maxillary nerve block

Caution! This technique runs the risk of arterial puncture. Other side effects include swelling of the face, exophthalmos and Horner's syndrome (Tremaine 2007).

Administer LA around the maxillary foramen. A number of approaches are documented, the most reliable being the approach just ventral to the zygomatic arch, passing in a rostroventral direction until maxilla bone is contacted. This will block sensation to all maxillary cheek teeth. A spinal needle of 7–10 cm in length and 18–19G is recommended (Tremaine 2007).

Mandibular nerve block

Administer LA around the mandibular foramen on the medial side (inside) of the mandible. This nerve has sensory and motor fibres and will block sensation to the mandibular teeth and parts of the gingival mucosa. A very long needle is essential, e.g. a spinal needle of approximately 12 cm for an adult horse (Tremaine 2007). The needle is advanced on the medial side of the mandible close to the bone from the cranial insertion of the masseter muscle towards the medial canthus of the eye until the foramen is encountered; approximately 10 ml of LA can be administered.

Mental nerve block

Administer LA agent around the mental nerve at the mental foramen, ventral to the interdental space on the lateral side (outside) of the mandible. This blocks the lower lip, labial parts of the gingiva and some of the interdental space. If removal of sensation for the incisors and premolars is required, then the LA needs to be administered deeper into the mental foramen canal (Tremaine 2007); a small 23G needle is recommended.

Infraorbital nerve block

Caution! Only perform under heavy sedation or GA due to the reaction if the nerve is hit with the needle (Tremaine 2007).

Administer LA around the infraorbital foramen, found between the end of the facial crest and the nasoincisive notch; this will block sensation to the face around the nostrils, muzzle, and upper lip. By advancing the needle further into the foramen, motor innervation can be blocked to the cheek teeth. A 21G needle is recommended for this procedure.

Case study – Fracture of an incisor tooth

10.9

Location Pakistan

Attending veterinarian Dr Javaid Khan

History

Grey mare, 16 years old, used to transport goods by cart, with a recent history of a road traffic accident when the horse was hit in the muzzle by a moving vehicle.

Clinical findings

The horse was frightened and bleeding from the mouth; the tongue was protruding in and out. There was obvious pain with reluctance to allow examination. Diagnosis was facilitated after sedation (xylazine), and analgesia (flunixin meglumine). Oral examination revealed a fractured incisor 201, there was a broken piece of tooth loosely attached to gum tissue. The fractured line was carefully explored. Upper and lower incisors were examined and were found not to be displaced from the alveoli. There was an obvious gap between the upper central incisors. Neurological examination of the horse was also carried out in order to assess cranial nerves: menace reflex, PLR, palpebral reflexes and facial nerve, all assessments were normal.

Figure 10.9.1 Fracture of 201 in a working horse.

Treatment

The mouth was rinsed with normal saline. The broken piece of 201 was carefully removed. The injured gum line was coated with a proprietary ointment (Lignocaine 0.6%, Cetylpyridium chloride 0.02%, Menthol 0.06%, Eucalyptol 0.1% and Ethanol 33% v/w) to reduce the pain. Broad-spectrum antibiotic cover was given (procaine penicillin and metronidazole), analgesia was continued (flunixin meglumine) daily.

The owner was advised to check the mouth daily and to remove any food material lodged in the gap between the upper incisor teeth to allow for normal healing. He was also advised to offer soft feed, such as wheat bran with added molasses.

Outcome

The prognosis was good and the horse started eating and drinking soon after initial therapy. Follow-up was encouraging, with no infection noted at the site of gum injury; prehension and mastication were normal. Healing of the injured mucosa was progressive.

Discussion

In this case report, surgical repair was not proposed as the fracture did not involve avulsion of the incisor and the teeth remained embedded in their alveoli. The tooth was not extracted, except for a broken fragment, to avoid future complications (Caldewell 2006).

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