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Horses have been around for many, many years. Some experts have determined from fossil evidence that horses have existed for over 55 million years. These early horses were probably browsers that ate soft, leafy vegetation and groundcover in the prehistoric woodlands. The horse evolved over time, and the current form and type of dentition in the horse is believed to have evolved about 15 to 20 million years ago. This evolution allowed adaptation that was better suited to grazing. The changes included a longer cheek teeth row and a deeper skull and jaw to better accommodate the hypsodont (high-crowned) tooth. The hypsodont tooth (a tooth that continues to erupt from the jaw over a very prolonged number of years) is better equipped to handle the increased wear that occurs when grinding the more abrasive grass (which may often have trace amounts of grit from the surrounding soil surface and plant roots).

The horse as we know it today has a hypsodont tooth and an anisognathic jaw conformation; the upper jaw, the maxilla, is wider than the lower jaw or the mandible. This arrangement allows horses to maximize their chewing efficiency, prolong the effective life of their chewing equipment (premolars and molars), and hopefully, remain adequately fed for a long, long period of time.

The hypsodont tooth erupts on average about three to four millimeters per year to compensate for the wear from the daily grinding action of the food processing. The average permanent (adult) premolar or molar (grinding or “cheek” teeth) have a reserve crown of approximately four inches (100 mm); under ideal conditions one could estimate that the happy, healthy horse should have teeth that should not wear out for 25 to 30 years.

In order for the horse to obtain food, it must firstprehend or grasp the food. If they are grazing, as they lower their head to the ground surface the maxilla (upper jaw) slides slightly forward as the mandible (lower jaw) slides backward. As the head comes into position at the ground surface, the incisors (front) teeth should be aligned to cut or shear off the grass pasture. This allows the horse to graze or cut the pasture very close to the ground surface without disturbing a significant amount of surrounding grit, dirt and debris. Under normal circumstances, the horse will cut the grass off at ground level, rather than pulling the plant out by the roots.

The lips, tongue, cheeks and hard palate all serve a role in moving the food along the conveyor belt into the oral cavity for further processing. The lips act as a sorting/selection tool to find, test and pull food into the mouth. The tongue acts as an auger to work the food back in the mouth, where the bolus is pushed out onto the grinding surface of the cheek teeth (premolars and molars).

The chewing cycle is a repetition of a cyclical movement of the rhythmical contraction of the muscles that control the opening and closing of the jaw. There are three parts to the chewing cycle; the dropping or lowering of the mandible and its sliding sideways in relation to the maxilla, the closing of the mandible against the maxilla and the grinding of the mandible across the maxilla. The steps are called the opening, closing and power stroke phases of chewing. Some horses will consistently chew or process their food in one direction; others will process or chew their food in both directions. The important point to remember is that mastication (grinding) requires significant motion of the mandible and maxilla in relation to each other. Studies that have examined how the different types of feed affect how a horse chews its food have shown that a much larger range of motion is required to grind hay than a concentrated feed source (i.e. grain).

As the food is ground, it is moved across the occlusal surface of the tooth, out into the buccal oral cavity; the cheek contains the feed and pushes it back onto the occlusal surface of the cheek teeth where it is crushed again. The palatine ridges on the roof of the mouth in the hard palate aid in the direction of the food bolus, passing it further back into the mouth where the tongue pushes it out onto the occlusal surface for additional grinding. This process is repeated multiple times until a thoroughly chewed bolus arrives in the back of the mouth at the glottis for swallowing. Any changes in this finely tuned, delicately balanced and “machined” process can greatly affect the horses ability to find, collect and process its food to nourish itself. Our domestication and current housing and management of the magnificent horse also can have a tremendous impact on the horses ability to maintain a balanced and healthy food processing machine (mouth).

Adult mammals have four types of teeth: incisors, canines, premolars and molars. Each tooth has several regions associated with it; the crown (visible, exposed portion), the reserve crown (portion that is hidden within the boney socket) and the root. Each tooth is made up of enamel, dentin, cementum and the pulp cavity.

Enamel is the hardest, most dense substance in the body. Although it is extremely hard, it is also very brittle. In most areas of the tooth it is covered by the cement; the exception is on the occlusal (chewing) surface of the tooth.

Dentin makes up the bulk of the tooth. One of the main purposes of the dentin is to act as “crack stoppers” should any micro fractures (tiny, microscopic fractures) occur in the adjacent, brittle enamel. Another equally important function of the dentin is that it allows a rough, irregular wear pattern to develop on the occlusal surface of the premolars and molars. This creates a more efficient grinding surface for the food to be processed on.

Cementum has several critical functions. It acts as a protective covering over most portions of the tooth, including the crown. The cementum also serves to attach the tooth to the bony socket as it continues to erupt throughout the life of the horse. Cementum helps protect the coronal enamel from cracking. It helps in forming the protruding enamel ridges on the occlusal surface and also makes up a significant portion or bulk of the clinical crown (i.e. exposed, visible portion of the tooth).

Pulp is a collection of soft tissues including blood vessels, nerves and connective tissues. The pulp fills the pulp cavity of the tooth; the size and shape of the pulp cavity changes throughout the life of the horse and the hypsodont tooth. The pulp cavity is much larger in the young horse that has the newly erupted, fully mature tooth than in the geriatric horse with minimal, remaining reserve crown.

Incisors begin to erupt within a few days of birth. The deciduous (baby or milk teeth) incisors are whiter and wider than their permanent replacements. These teeth are primarily used for collecting food and grooming. There will be normally 12 deciduous incisors in the juvenile horse and 12 incisors in the mature horse. Both the deciduous and permanent incisors are frequently used to “age” the horse.

The eruption of these teeth occurs at predictable time frames in the age of the horse and therefore, ageing the horse with the help of these teeth within the first five years of age is relatively accurate. Other “wear” related features of the incisors (infundibular cup’s, Galvayne’s groove, incisor hook) are much less reliable in determining the actual age of a mature horse. Individual and breed differences, differences in diet, stereotypical behaviors (windsucking, cribbing, fence rubbing), environmental conditions and many other factors all play a role in how the horse’s teeth will wear. Determining the approximate age of a horse older than five years of age is at best an educated estimate.

Canines are also known as the “bridle teeth.” Deciduous canines, if present, are extremely small and do not erupt through the gum line. The permanent canines usually erupt between 4 and 6 years of age. Males usually will have four canine teeth, with many females never developing canines. This tooth does not continue to erupt throughout life; so it is common to have long reserve crowns in older horses. There is a wide pulp cavity in the canine; in young horses this pulp cavity comes with 5 mm of the occlusal surface of the tooth. It is possible to overheat this tooth and/or expose the pulp cavity with excessive use of either hand or motorized dental equipment.

Premolars typically erupt at birth or within the first few days after birth. The deciduous premolars do not include the “wolf tooth.” Although the wolf tooth is considered the first premolar, it does not have a deciduous precursor. If a wolf tooth (teeth) erupts, they are adult teeth. They may erupt at anytime between six months of age and a couple of years. An individual horse may have anywhere from zero through four (extremely rare) wolf teeth. This tooth (teeth) does not serve any useful function and may be a source of discomfort in the young horse when they begin training in earnest.

The permanent premolars begin to erupt at about 2½ years of age and are complete by about 4 years of age. There will normally be between 12 and 16 permanent premolars depending on the life stage of the horse and the presence or absence of “wolf teeth”.

Molars begin to erupt at one year of age and are normally complete at about 3½ years of age. Molars do not have deciduous precursors. The mature horse will normally have 12 molars. In younger horses, the molars are mostly comprised of unerupted reserve crown, which is secured in the bony socket of the jaw. This unerupted crown can be up to six to eight centimeters in the young adult horse. The maxillary molars are wider and more square than the mandibular molars. The unerupted reserve crown and apical root of the maxillary molars, depending on the age of the horse may extend into the maxillary sinuses. The unerupted reserve crown of the mandibular molar extends deep into the mandible.

Dental examinations should begin at the first “wellness” exam for your newborn foal. Your veterinarian will perform a brief visual and digital examination to check your foal’s bite. A normal bite will help ensure that your foal’s mandible and maxilla and their teeth will grow and develop in a healthy fashion. Identifying an abnormal bite at an early age (i.e.: parrot mouth, sow mouth or wry nose) will allow you to provide the appropriate care to minimize the impact of these conformation defects from impacting the quality of your horse’s life. Usually your veterinarian will only require a quiet location and a pocket flashlight to perform this initial foal wellness dental examination.

As your horse grows into a yearling, a 2-year-old and on to become an adult horse, bi-annual dental examinations are normally performed. Again, it is important to have a quiet, somewhat dark location for your veterinarian to perform this exam. Your veterinarian will use a bright light source to visualize in your horse’s oral cavity. Depending on your horse’s temperament, it may be necessary to use a mild sedative to perform a comprehensive dental exam. Should your veterinarian suspect that your horse has any potential problems (based upon the history that you have provided, your horse’s physical appearance or what they are able to ascertain from their physical examination) they will use a device called a speculum to hold your horse’s mouth open.

There are many different shapes and types of speculums that can be used. The speculum will allow the entire oral cavity to be examined. The horse’s muscles of mastication are incredibly strong, as they must deliver a tremendous amount of pressure to grind and process the food. A good speculum will distribute the pressure to the mouth equally on both sides of the horse’s jaw. Speculums that are designed to fit between the cheek teeth on one side of the mouth (i.e. wedge or gag speculums) are less desirable as they place a tremendous amount of pressure on a very small area of the mouth. This force can be so great that the horse may damage or fracture their teeth or even their jaw. A light sedative also will facilitate the relaxation of the muscles of mastication and make it less stressful for your companion (and yourself) to have a thorough, comprehensive dental examination.

After an initial look, your veterinarian will rinse your horse’s mouth out with copious amounts of warm water to allow better visualization of the oral cavity. Your equine veterinarian will be examining the mouth for odor, inflammation, ulceration, lacerations, and foreign bodies.

Each tooth and the surrounding gum tissue also will be examined and palpated to determine if there are any malocclusions, missing, loose or fractured teeth and/or gum disease. A bright, focal light source is extremely helpful in evaluating your horse's dental conformation and wear patterns. Frequently a dental mirror will be used to visualize areas deep in the oral cavity. Some equine veterinarians will even use intra oral cameras or rigid endoscopes to better visualize the finer details of your horse's mouth. On occasion, your equine veterinarian may recommend radiographs (either survey or intra-oral radiographs) or ultrasonography to assist them in reaching a diagnosis of a dental problem. Comprehensive dental care in the 21st century involves more than backing your horse into the corner of a stall with a low ceiling, grabbing the tongue and running a float over the sharp points on the cheek teeth.

The frequency with which your horse should receive a comprehensive dental exam and dental work is dependent on many factors. As a general rule of thumb, many equine veterinarians recommend at least a brief dental exam bi-annually until the horse reaches 5 years of age. During this time frame, there is a tremendous amount of activity going on in your horse's mouth; 24 deciduous teeth erupt and are shed and 36 to 44 permanent teeth erupt. Early identification of any potential problems allows for a faster intervention, which will hopefully minimize the impact of the problem over the lifetime of your companion. Between the ages of 5 to 15 years, many equine veterinarians will recommend a minimum yearly dental exam. This will commonly be performed simultaneously with your horse's "wellness" exam. Obviously each horse is an individual, and each situation is unique. However, the average pleasure or light performance horse that enjoys a significant amount of forage in their diet (either from pasture time or ad lib hay) should not require more frequent checks. It is also possible that although your veterinarian may perform a dental examination yearly at this life stage, they may not recommend dental work for your horse. Please remember that the horse's hypsodont tooth erupts throughout its life, however, it does have a finite amount of unerupted crown and that it can "run out" or expire. As our horses are now commonly living into their late 20s, or in many cases even their 30s or 40s, it is not in your companion's long term best interest to "overflow" or "over treat" dental issues. Once the occlusal surface has worn away naturally or by the equine dental care provider, it cannot be replaced.

Once your horse has passed their teens and begun to reach their retirement age, your equine veterinarian will likely recommend bi-annual dental examinations. As your horse's mouth continues to wear, the cheek teeth (i.e. premolars and molars) will begin to wear out (expire) and will become less effective at their role of grinding and processing the feed. During this stage of your horse's life, it may be necessary to make more frequent minor adjustments in your horse's diet and in their dental care. Your equine veterinarian can design a unique program to suit your horse's needs.

Incisor dental conditions tend to be the result of retained deciduous teeth (cap retention), traumatic injuries (such as kicks in the mouth or getting teeth caught on a solid object and pulling back), stereotypical behaviors (such as wind sucking or cribbing), congenital abnormalities (overbite also known as "parrot mouth" or underbite also known as "sow

mouth”) or abnormal wear patterns of either the incisors or the cheek teeth. Since the entire mouth functions as a single food processing unit, any abnormality in one component that causes pain or an abnormal amount of pressure in a given area over a prolonged period of time will tend to show up as an abnormal wear pattern in the incisors. The most common abnormal incisor wear patterns are ventral curvature (“smile”), dorsal curvature (“frown”) or an offset or diagonal wear pattern (“slant”).

Retained deciduous incisors are usually a cosmetic or minor concern and are typically removed during routine dental work. Traumatic injuries are usually considered an emergency and treated as such.

Congenital abnormalities, if addressed at an early age, can often be medically corrected or minimized so that the horse can process their food more effectively than if left untreated. In these horses, congenital abnormalities are normally considered to be heritable; clients are usually counseled to castrate the stallion in order not to perpetuate the problem further. Mares with congenital abnormalities should not be bred.

Abnormal incisor wear patterns that are caused by stereotypical behaviors are usually treated by making housing, management or environmental enrichment changes. Very small abnormal incisor wear patterns (such as smiles, frowns or slants) can have a significant impact on the horse’s ability to effectively process its food. These patterns make it difficult for the horse to complete a normal chewing cycle as the mandible cannot effectively complete the power stroke phase of the grinding process. These patterns should be corrected in small increments as small changes in the incisor alignment cause very significant changes in how the cheek teeth contact each other and how they are able to grind the food. Aggressive incisor alignments may cause significant problems for your horse’s mouth such as overheating or exposing the incisor pulp and/or placing undue stress and strain on the cheek teeth and temporomandibular joint. In some cases, aggressive incisor alignments have caused horses to be so uncomfortable eating that they have gone off feed for days. Remember, if it took awhile for a condition to develop in the mouth; trying to correct it in one session is probably not the right thing to do for your horse. Frequent, small adjustments are normally best in situations such as this.

Cheek teeth dental conditions tend to cause overgrowths or malocclusions of an opposing or adjacent tooth. These conditions can cause a wide array of problems ranging in seriousness from minor discomfort and pain while eating, to it being impossible for the horse to complete a normal chewing cycle. The more common problems with these teeth include sharp enamel points, retained deciduous caps, hooks, ramps, wave mouth, shear mouth, step mouth, and supernumerary teeth.

Sharp enamel points develop along the outer (buccal) edge of the maxillary cheek teeth and along the inner (lingual) edge of the mandibular cheek teeth. These points usually develop in the young horse and can be present as early as 2 years of age. If left untreated, they can cause discomfort to the horse, biting and performance issues, inflammation, irritation and ulceration or mucosal thickening of the cheek tissue and/or the tongue. Dental prophylaxis that involves removing the sharp points is commonly referred to as “floating.” Floating with the use of sedation, a full mouth speculum and a full range of equipment allows the equine veterinarian to reach all areas of the mouth; it is then possible to visually check that all

sharp points have been reduced. Digital palpation of all cheek teeth post floating is the most sensitive indication of whether or not all sharp points have been removed.

Retained deciduous caps can cause discomfort and an unwillingness to chew evenly. If left untreated, they may become impacted (infected) or cause a more serious, abnormal wear pattern to develop in the cheek teeth.

Hooks may develop on the front of the second premolars or on the back occlusal edge of the third molars. They are the result of incomplete occlusal contact when the horse grinds its food. If left untreated, they will continue to develop and get larger with time. They may cause oral pain and ulcers.

A wave mouth describes adjacent cheek teeth that have unequal crown heights. The opposing arcade would have corresponding reciprocal unequal crown heights.

Wave mouths cause a severe inability for the horse to process food. Horses with a wave mouth are inefficient grinders, will require more frequent dental care and dietary modification to ensure adequate nutrition is maintained. Overzealous correction of a wave mouth can have disastrous results for the horse.

Ramps may develop on either the second premolar or the third molar. A ramp is a gradual lengthening of the crown in affected tooth. The opposing arcade would have a corresponding reciprocal shortening of the crown. This inequity of crown height can make the grinding of food less effective and can lead to premature tooth attrition (loss). Treatment will require more frequent dental care. Adjustments should be made gradually to minimize the changes in pressure points on the teeth and to reduce the risk of the horse going off of their feed.

A shear mouth develops when a horse loses the ability to chew in a circular cyclic pattern. Usually there is an underlying condition that makes it painful to chew in a regular pattern and the horse begins to chew in an up and down fashion only. This allows the buccal (outer) edges of maxillary cheek teeth to develop extremely long sharp edges; the lingual (inner) edges of the mandibular cheek teeth develop extremely long sharp edges as well. This conformation really only allows the horse to “squash” the feed between the occlusal surface of their cheek teeth. This is much less effective way to process food. Typically it will be difficult for the horse to maintain body condition without extensive diet modifications. Treatment can be difficult. It is aimed at identifying the underlying problem and correcting it and then making frequent, small adjustments that will allow the horse to begin to chew in a normal fashion over time. This condition can be life threatening to your horse.

A step mouth condition usually is the result of an absent tooth. In a normal, healthy cheek tooth dental arcade, the premolars and molars are packed tightly together. When a cheek tooth is absent, it allows the adjacent teeth in the same arcade to drift out of place. The corresponding tooth on the opposing arcade also will no longer have an abrasive surface to grind against. This allows the opposing tooth to become too long. In some instances the over length crown will fit or wedge into the missing space in the cheek tooth arcade similar to a post fitting into a hole. This makes it difficult for the horse to chew in a regular motion; the horse must chew in an up and down fashion. Again, this “squashing” of food is much less efficient than grinding the food.

Treatment is aimed at reducing the over length crown. Your horse will require more frequent dental care if they are diagnosed with a step mouth.

Supernumerary teeth are extra or additional teeth, above and beyond the normal complement of equine teeth. They are quite rare, but do occur. When found, they frequently will be a fourth molar. They usually will only cause abnormal wear patterns that can be treated with appropriate dental care.

Other common dental conditions that frequently occur are periapical abscesses, fractured teeth, teeth with exposed pulp cavities, periodontal disease and diastemata. There are a myriad of other less common dental conditions as well; this is not a comprehensive list. Your equine veterinarian is skilled in diagnosing, treating and providing on-going care for your equine companion.

Dental procedures have been performed on horses for more than 100 years. Veterinarians, horse owners, blacksmiths, farriers and lay people all have provided dental services to the horse over the years. In recent years, a debate has developed in the horse world as to who should provide dental care to the horse. Current common standards of equine dental care range from having a blacksmith or farrier use an old hoof rasp to “float” the teeth to an equine veterinarian providing a comprehensive dental examination, developing and implementing an on-going treatment plan for your individual horse. Many horse owners provide dental care for their own horses. The laws governing the provision of veterinary care and what constitutes veterinary care and veterinary dentistry are complex, confusing and vary by state (and/or provincial) jurisdiction in North America. What is legal in Georgia may be illegal in Florida and vice versa.

A trip to the tack shop or feed store will often show a bulletin board with business cards advertising “equine dentist” or “dental specialist.” An on-line “Google” search produced 1,190,000 hits for the phrase Equine Dentistry. How do you, the horse owner, know who to believe and more importantly, who to have work with you and your equine companion to provide on-going dental care?

In Florida, for example, it is legal for a non-veterinarian to provide routine dental prophylaxis (i.e. “floating”) in the horse. It is not legal, however for a non-veterinarian to sedate a horse, perform extractions or do other dental procedures.

As veterinary medicine advances and develops there is a rapidly increasing amount of services that a veterinarian must stay abreast of. There are over 100 different fields that a vet can pursue a special interest in. Not all veterinarians will practice equine medicine. Some equine veterinarians will provide a general practice that includes lameness, medicine, surgery, reproduction and dentistry. Other equine veterinarians will limit their practices to perhaps only one aspect of veterinary medicine (i.e. surgery). Surgery is one field in veterinary medicine where a veterinarian can work towards a specialty accreditation. This process is extremely demanding and time consuming. Only when the veterinarian has passed the qualification examination process, can the veterinarian then call himself or

herself a “specialist” or board certified in surgery. Although there is a board certification process for veterinary dental medicine, there currently is no specific “equine only” tract for this specialty. Should a veterinarian wish to become board-certified in dentistry, they would be required to learn and study all species (including equine) as they pertain to dentistry. Your local state veterinary medical association is responsible for the process of licensing and to a certain extent enforcing the laws as they pertain to veterinary medicine. However, the laws and rules can only be enforced on licensed veterinarians.

Lay persons that represent themselves as “equine dentists” or “equine dental specialists” may have any degree of training. Since these individuals are not licensed veterinarians, they are not held up to the licensing standards of our profession. A horse owner has little or no recourse should they have any concerns with the quality or subsequent outcome of the work performed by the layperson in their horse’s mouth.

Horse owners that request their regular attending veterinarian to sedate their horse for the lay person to perform dental work are opening themselves up to a complex issue of “who is responsible for what when it comes to working in the equine mouth.” Technically, the veterinarian is responsible for diagnosing a problem, developing a treatment plan and then overseeing it. This would mean that the veterinarian would make the diagnosis, select an appropriate amount and type of sedation and analgesia for that the work that is required, administer the sedation and analgesia and then oversee all work performed by the lay person. Often times, this is not the case. Frequently, the layperson examines the horse’s mouth, makes a diagnosis and describes the sedation and analgesia that they will require to perform the procedure. The veterinarian then would administer the sedation and analgesia; the layperson would then perform the work that they felt was warranted.

With this last scenario in mind, ask yourself who is responsible should your horse be inappropriately or inaccurately diagnosed, medicated or treated? Is the horse owner responsible should something go wrong? Would the layperson be responsible? Would your regular veterinarian be responsible should your horse develop complications from a procedure performed by a layperson?

Complications of dental procedures, no matter how routine can and do occur. Horses chewing on floats can fracture and loosen teeth. Soft tissue damage can occur which may lead to infections in the tissue or bloodstream. Overzealous grinding of malocclusions, to place bit seats or while shaping canine teeth can open pulp chambers which may lead to tooth decay and or eventual tooth loss.

Only a licensed veterinarian should administer a sedative or analgesic to a horse. In my opinion, only a veterinarian should perform dental procedures in your horse’s mouth. It is in both the horses and your best interest to be aware of the rules surrounding equine dental care in your area. If your regular attending veterinarian does not provide comprehensive equine dental care request them to refer you to a veterinary colleague that does.

The horse’s mouth has evolved over millions of years into the highly efficient

food-processing machine that we know today. What the horse eats, as well as where he eats it (i.e. at ground level or off an elevated rack) will all affect how your horse's teeth wear. The type of job that your horse has (i.e. a broodmare or a performance horse) will also affect the frequency with which your horse may require dental care.

Be aware of who is providing your horse's dental care. Only allow a licensed veterinarian to administer a sedative or analgesic to your horse. Only allow a licensed veterinarian to diagnose dental problems in your horse and to develop and implement the treatment plan.

If you have questions or concerns about who is best suited to care for your horse and their dentition, please discuss them with your regular attending equine veterinarian. They truly have the best interests of your equine companion at heart.

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