Dental Overgrowths and Acquired Displacement of Cheek Teeth

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Dental overgrowths causing malocclusions are common in the horse. Of primary concern is the fact that the overgrowths alter lateral excursion and affect normal mastication. Proper dental maintenance is necessary to prevent dental overgrowths from affecting mastication, because without regular correction, overgrowths become progressively more severe and detrimental to a horse's overall health.

Many causes have been proposed for the formation of these overgrowths.[1] The normal structure of equine cheek teeth consists of hard enamel folds sandwiched between softer cementum and dentine. The difference in wear between the three materials causes a self-sharpening effect: the sharp enamel becomes exposed as coarse feed materials wear the softer cementum and dentine away (Fig. 1). This also leads to raised areas on the occlusal surface in regions where there are an increased number of enamel folds. These lateral-to-medial raised areas, termed transverse ridges, are normal and function to increase the area of the occlusal surface.

Conformation is a major contributor to dental overgrowths. Discrepancies in length and position of the mandible and maxilla contribute to rostral and caudal focal ("hooks") and sloping ("ramps") overgrowths. Greater than normal differences in width of the maxilla and mandible can lead to buccal and lingual overgrowths, which can cause variations in the occlusal (table) angles of the cheek teeth. Domestication has decreased both the amount of time a horse spends masticating and the type of feed masticated. Feral horses graze up to 18 hours per day, while domestic horses spend little to no time grazing. Domesticated horses are fed processed feeds and concentrates that alter mastication. Processed feeds greatly alter the chewing cycle and decrease lateral excursion, which can lead to abnormal wear patterns.[a]

A retained deciduous tooth prevents the eruption of the underlying permanent tooth, leading to the super-eruption of the opposing tooth. This dominant tooth may then progress over many years to become a stepped tooth or part of a wave complex. Mechanical obstruction from overgrowths prevents normal lateral excursion, and this altered chewing pattern allows these overgrowths to progressively worsen. Mechanical forces caused by overgrowths are the primary cause of periodontal disease in the horse. Protruding overgrowths forceopposing teeth apart creating a diastema where feed accumulates. This feed then causes irritation and secondary infection to the soft tissues, with resultant gingivitis, and periodontal disease. Pain associated with periodontal disease and ulcerated soft tissue alters normal mastication and leads to further uneven wear.

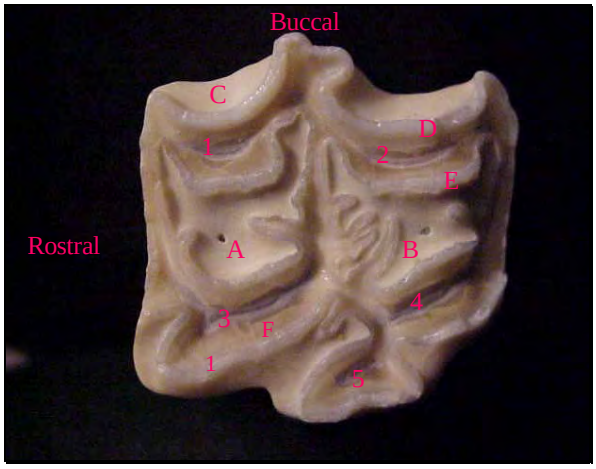

Figure 1. Pulp chambers 1, 2, 3, 4, 5 filled with secondary dentine. Infundibuli A and B filled with cementum with patent central canal. Peripheral cementum C. Enamel folds D and E. Primary dentine F.

The buccal side of the maxillary cheek teeth and the lingual aspect of the mandibular cheek teeth normally have sharp serrated edges of exposed enamel. As lateral excursion is decreased in the masticatory cycle and eruption of the teeth continue, sharp enamel overgrowths occur at these sites. These sharp enamel points cause painful ulcerations to adjacent soft tissues that further alter mastication. This altered masticatory cycle perpetuates abnormal wear of the cheek teeth and incisors.

Rostral hooks forming on the maxillary teeth (106, 206 Triadan system, Fig. 2) and caudal hooks on the mandibular teeth (311, 411) are common malocclusions and often observed in horses with an overjet (Fig. 3). Rostral hooks are best visualized by looking across the mouth, as the hook is more obvious from the palatal side. When the horse is ridden, the soft tissues of the mouth are easily and painfully traumatized as they become trapped between the bit and these sharp dental protuberances. The soft tissue in the caudal region of the mouth is intimate to the teeth and is easily traumatized by sharp hooks. These rostral and caudal hooks can also limit rostral to caudal slide of the mandible as the head is raised and lowered. This is especially important in the performance horse when a noseband prevents the horse from opening its mouth as the position of the head is changed. Rostral and caudal hooks can form at both ends of a cheek teeth row when there is a discrepancy in length between the upper and lower arcades, i.e. one row is longer.

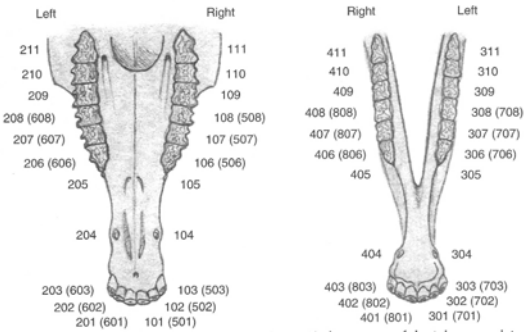

Figure 2. Triadan system of equine dental nomenclature.

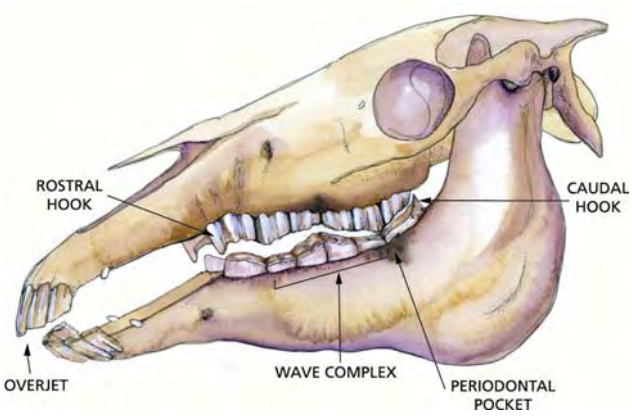

Figure 3. Overjet with corresponding rostal and caudal hooks and wave complex.

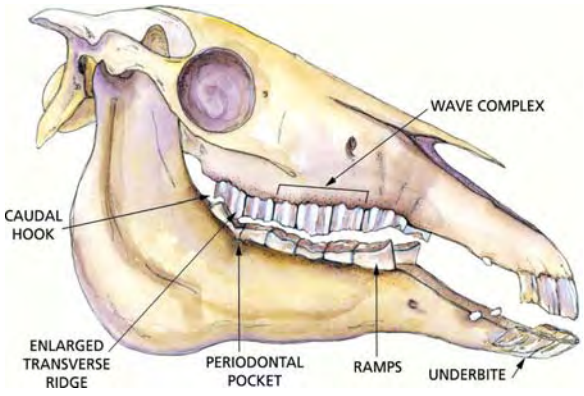

Figure 4. Rostral ramps with corresponding caudal hook and enlarged transverse ridge.

Ramps that form on the 306 and 406 can cause performance problems related to soft tissue trauma as well. They may force the mandible rostrally, putting extreme pressure on the temporomandibular joints. Mechanical forces on the 306 and 406 can cause the teeth to shift rostrally creating a diastema, which will lead to pocketing of feed and painful periodontal disease. When ramps of the 306 and 406 are observed, one must be sure to look for corresponding hooks or ramps on the 111 and 211 (Fig. 4). These overgrowths must also be reduced to allow for proper alignment and mastication. To determine whether an overgrowth exists, especially in the caudal region of the mouth, look and feel the height of the opposing tooth's exposed crown above the gum line. A strong dental mirror can be used to retract soft tissues in the back of the mouth and observe the height of the exposed tooth. The natural curvature of some jaws can make it appear that there is a ramp of the 06's and the Curve of Spee can often give the false impression that there is a hook on the 11's. If these teeth are unnecessarily reduced, an iatrogenic malocclusion will be created as the opposing tooth becomes dominant.

The middle cheek teeth have five pulp chambers each, while the teeth at the ends of the cheek teeth rows (106, 206, 306, 406, 111, 211, 311 and 411) have additional pulp chambers.[2] Knowing the position of these extra pulp chambers is extremely important when overgrowths on these teeth are reduced. The sixth pulp chamber of 106, 206, 306 and 406 is at the rostral most aspect of these teeth. This pulp chamber is most commonly damaged when overgrowths are reduced or aggressive 'bit seat' reductions performed. Pulpal exposure or heat damage (from mechanical instruments) to the tooth causes pulpitis, pain, excessive salivation, and dysphagia. The damaged tooth often dies and becomes infected over months to years. Damage caused by thermal trauma may take several years to become clinically apparent (Fig. 5). The open pulp chambers become packed with feed as the intact secondary dentine on the occlusal surface is worn away. Often, these teeth form fistulous tracts that exit within the oral cavity adjacent to the affected tooth (Fig. 6) and in other cases may just discharge through the open pulps.

Figure 5. Four open pulp chambers on 206 due to aggressive dentistry 3 years prior.

Figure 6. Draining fistula at gingival margin from infected 206.

Single, enlarged transverse ridges occur frequently across the occlusal surface of the cheek teeth (Fig. 4). These overgrowths are often associated with a rostral to caudal misalignment of the mandibular and maxillary cheek teeth rows. Areas on the occlusal surface with more enamel folds can wear into the opposing occlusal surface that has less enamel. Enlarged transverse ridges can mechanically force two opposing teeth apart, creating a diastema. These enlarged transverse ridges commonly occur on the caudal portion of the 110, 210 or rostral 111, 211 causing excessive wear and/or a diastema between the 310-311 and 410-411 (Fig. 7). The enlarged ridge could also form as a result of an existing diastema – due to lack of wear. As these overgrowths become more prominent, they continue to force the opposing teeth apart and mechanically force feed into the open space. Impaction of feed leads to painful periodontal disease. Over time, periodontal disease leads to alveolar bone loss, osteomyelitis, dental infection, and loss of the tooth. Disease of the caudal maxillary cheek teeth 108-111 and 208-211 and surrounding tissue can lead to septic paranasal sinusitis or even an oromaxillary fistula that allows the paranasal sinuses to become packed with feed.

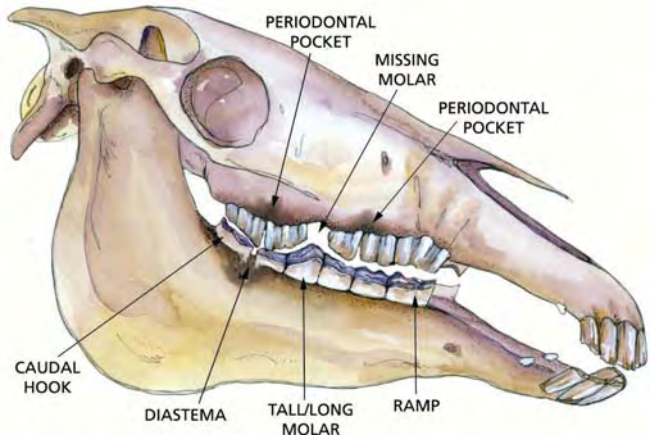

Figure 7. Missing molar and opposing tall molar. Diastema with periodontal pockets.

Figure 8. Use of a cheek retractor to check cheek teeth occlusion with mouth closed.

An enlarged transverse ridge opposite an existing diastema should be reduced level to or 1-2mm beyond the level of the normal occlusal surface. This type of transverse ridge may need to be reduced every 6 months. Reduction of transverse ridges should be limited to obviously enlarged ridges. These may be partially reduced while leaving the normal transverse ridges untouched. There are some who would advocate total reduction of all transverse ridges on the occlusal surface, claiming that transverse ridges impede rostral-caudal movement of the mandible. This thinking is flawed because when the jaws are centered there should be limited molar occlusion in the normal mouth. This aggressive dentistry can shorten the life of the teeth as well as cause abnormal forces on the teeth as the horse masticates. Often, the end teeth in the row (306, 406, 311 and 411) shift due to this increased rostral to caudal movement during mastication, causing diastemata to form. In addition the resulting smooth occlusal surfaces decrease the surface area available for grinding; thereby decreasing feed efficiency.

A wave mouth forms when multiple teeth in a row become dominant in a rostral to caudal direction (Fig. 3). Dominance occurs from a number of factors. Delayed eruption of a permanent tooth due to a retained deciduous tooth or crowding of the permanent teeth can give the opposing teeth a growth advantage. Infundibular decay of the maxillary cheek teeth or premature attrition of a short infundibulum results in less enamel on the maxillary occlusal surface, allowing the opposing mandibular teeth to become dominant. This can involve any of the maxillary cheek teeth, but especially the first molars, (i.e., 109 and 209), which are the oldest teeth in the maxillary arcades. A wave complex can also form over time as the horse chews with less and less lateral excursion. The maxillary cheek teeth rows have a curvature in the buccal direction when viewed from front to back (Fig. 2). The straighter mandibular cheek teeth rows become dominant in the middle on the lingual side as the horse chews with less lateral excursion, eventually causing the dominant mandibular teeth to form a wave complex. Wave complexes often involve the entire cheek teeth row. These extensive malocclusions should be reduced gradually in stages. Occlusion should be maintained on the healthier or more normal teeth, and more reduction performed on the teeth in opposition to compromised or defective teeth. It is important to remember that the excessively worn tooth, not the high tooth, is the compromised or defective tooth. Care must be taken to leave enough proper occlusion to allow the horse to masticate normally. A cheek retractor and a bright light can be used to check cheek teeth occlusion by forcing the molars together as the mandible is moved laterally (Fig. 8). It is normal for there to be very little cheek tooth occlusion when the

jaws are centric. The cheek teeth should come into occlusion evenly as the mandible is moved laterally. Unwanted dominant areas of occlusion can be observed as the rest of the teeth separate and one area maintains occlusion (Fig. 9). Many wave complexes must be corrected in stages over a number of years. Some waves are not completely correctable due to the severity of the wave or the advanced age of the horse. Some extremely compromised teeth should be taken out of occlusion completely, but if possible they should be left in the arcade to act as spacers. If a tooth is removed the adjacent teeth will drift toward the open space causing diastema, food retention and periodontal disease between other cheek teeth in the row (Fig. 7). Radiographs are helpful in determining the integrity of the tissues surrounding the tooth. In many cases, mildly loose teeth reform attachments and become more solid after they are taken out of occlusion. With generalized malocclusions, staged reduction and the use of water irrigation during reduction of overgrown teeth will prevent damage to the sensitive pulp.

Disparities in eruption can cause the arcades to become stepped, but more often a stepmouth with tall teeth is the result of a damaged or missing opposing tooth (Fig. 7). Stepped teeth disrupt normal lateral excursion, leading to more generalized overgrowths, such as wave complexes or sheared molar tables. Reduction of stepped teeth and their corresponding overgrowths should be done in stages to prevent damage to the sensitive pulp.

Horses exhibit anisognathism in which there is a normal disparity in the width of the mandibular and maxillary cheek teeth jaw widths. This differential in width leads to an angulation of the occlusal surface normally reported to be 10-15 degrees[3], but occasionally higher. Normal cheek teeth table angles differ greatly between horses due to varying conformations. The angulation can also vary on individual teeth or groups of teeth within the cheek teeth row. Sheared or steep molar table angles occur in many horses (Fig. 10). This condition can occur bilaterally if there is a greater than normal discrepancy in the width between the maxillary cheek teeth and the mandibular cheek teeth rows. Bilateral involvement also may occur if the horse masticates with limited lateral excursion. Sheared molar table angles occur more frequently on one side of the mouth. This type of malocclusion can result from a malformation in the conformation of the bones of the head (e.g. wry nose). More often, unilateral shear mouth results from the horse lacking lateral excursion in one direction. Damaged teeth, injuries to the temporomandibular joint, buccal ulcerations, or periodontal disease cause pain and can result in avoidance of lateral excursion in one direction, resulting in a steeper cheek teeth table angle on one side of the mouth. Mechanical blockages due to damaged, stepped, hooked or ramped teeth and wave complexes can also result in less lateral excursion in one direction. The cause of the steep molar table angle should be determined, and a plan for correction made. The corrections should be made gradually over months to years. Often, these conditions are not completely correctable, and so, the horse must be treated biannually. Aggressive corrections can cause pain and dysphagia for an extended time. Care must be taken to avoid damage to the buccal and lingual sensitive pulp chambers when these corrections are performed.

Figure 9. Dominant area of occlusion left after dental procedure.

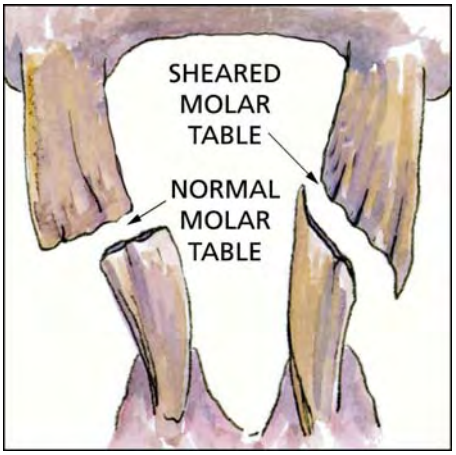

Figure 10. Sheared molar table angle.

Staged reductions of overgrowths can occur during the initial procedure by reducing a portion of the overgrowth, and then going on to other areas of the mouth to allow time for heat dispersal, and then coming back for more reduction later in the procedure. One must also realize that the total height of an overgrowth does not have to be reduced at one time. Unopposed teeth do not have the normal occlusal surface stimulation to form secondary dentine, so the sensitive pulp is often closer to the occlusal surface. Additionally, they erupt much faster than usual. Reduction of a tooth past the sclerotic layer of dentine exposes sensitive odontoblastic projections causing pain, inflammation and possible damage to the sensitive structures inside the tooth.[4] Aggressive reduction of large overgrowths in an aged horse may prevent the tooth from ever being in occlusion again. Reducing a large overgrowth by 3mm, while leaving adjacent normal occlusal surfaces untouched, will take it out of occlusion and free up lateral excursion. This partial reduction will also stimulate the tooth to produce secondary dentine in the pulp chambers and allow for further reduction several months later. To further prevent damage to the teeth, a power instrument should be kept in constant motion. Water irrigation and sharp cutting instruments are also important in preventing thermal damage to the teeth.

Iatrogenic malocclusion can result when a molar table is “over floated” and the normal molar table angle changed. It is very easy to over float the mandibular cheek teeth destroying the normal transverse ridges and changing or reversing the molar table angle. It is also common to dome or round the mandibular cheek teeth by removing too much tooth material from the lingual and buccal aspects of the teeth. The resulting changes can cause pain and dysphagia, but generally self-correct over many months. When reducing an overgrowth, care should be taken to match the molar table angle with that of the more normally occluded teeth within the cheek teeth row. It is often difficult to observe high areas on the mandibular cheek teeth. Palpation of the mandibular teeth and observing the maxillary teeth for excessive wear can help locate these overgrowths. It is also very common for mandibular overgrowths to be reduced more completely on the lingual side as the cheek often prevents easy reduction of the buccal side. This will adversely alter the

normal molar table angle and lead to abnormal occlusal pressures. Once again it is important to palpate the mouth completely after the work is complete to check for areas that have been missed. The most important point to remember is to do no harm. Small corrections of a large malocclusion can be made over many years. Malocclusions should be diagnosed, shown to the owner and recorded. A plan for correction can be mapped out and schedule for return visits made. Prevention and early detection of cheek teeth malocclusions are best accomplished by thorough biannual examinations. Early detection and correction of malocclusions will allow the horse to better maintain its own teeth by masticating correctly. A regular maintenance schedule can prevent dental overgrowths from affecting horses health and performance.

References and Footnote

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