The Equine Temporomandibular Joint

James Schumacher, DVM, MS

Author's address: Department of Large Animal Clinical Sciences, University of Tennessee, College of Veterinary Medicine, Knoxville, TN 37996; E-mail: jschumac@utk.edu.

Anatomy of the TMJ

The temporomandibular joint (TMJ) is the articulation between the condylar process of the mandible and the zygomatic process of the squamous temporal bone.[1] Fibrocartilage covers the articular surfaces, and a biconcave, fibrocartilaginous disc separates the joint into a dorsal compartment (i.e., the discotemporal joint) and a smaller ventral compartment (i.e., the discomandibular joint) and makes the surfaces of the joint congruent. One cadaver study showed communication between the compartments,[2] but other cadaver studies did not demonstrate any such communication.[3, 4]

Clinical Signs of Disease of the TMJ

Confirmed reports of disease of the TMJ in horses are uncommon, but the small number of reports may be due more to the difficulty in diagnosing disease of the TMJ rather than a low prevalence of disease. Most reports of disease of the TMJ describe sepsis of the joint or luxation or subluxation of the joint caused by trauma.[5-9] Septic arthritis of the joint is usually associated with trauma as the predisposing cause,[7] but in some cases, the cause of sepsis cannot be determined.[8,9] Non-septic arthritis of the TMJ associated with dental disease has also been reported, but authors of these reports were not able to determine if dental disease resulted in arthritis of the TMJ or if arthritis of the TMJ caused dental disease.[10,11]

Clinical signs of disease of the TMJ include signs of pain during manipulation of the mandible or palpation of the joint, atrophy of one or both masseter muscles, a fistulous tract over the joint (Fig. 1), bony enlargement of the region of the TMJ (Fig. 2), abnormal prehension and mastication of feed, dental malocclusion, and restricted range of motion of the mandible.[7-9] Less obvious problems associated with disease of the TMJ include abnormal behavior, such as a change in head carriage, bitting problems, headshaking, and quidding.[12] Disease of the TMJ may be overlooked in horses because clinical signs are often nonspecific.

Diagnosis of Disease of the TMJ

Standard radiographic projections of the TMJ include laterolateral, dorsoventral, and oblique projections.[13] The TMJ is difficult to image radiographically, because of the complexity of the region, because other regions of the skull are superimposed over the TMJ, and because a complex, three-dimensional structure is imaged in two-dimensions.[9]

Figure 1. Cutaneous fistula that connected to the right TMJ. The horse had suffered a penetrating injury to the joint months earlier.

Figure 2. Ankylosis of the TMJ causing a bony enlargement midway between the base of the ear and the lateral canthus of the eye.

Computed tomography (CT), which provides cross–sectional images and thus avoids superimposition of structures, provides both excellent sensitivity and specificity for evaluating the TMJ joint, but limitations of CT include the expense and limited availability of the procedure, a requirement for general anesthesia, and inability to effectively image soft tissue structures, such as the articular disc.[7,8] To my knowledge, evaluation of the equine TMJ using magnetic resonance imaging, which provides superior imaging of soft tissue, has not been reported. Gamma scintigraphy is likely to localize disease to the TMJ, but because it provides no information concerning the nature of the disease, the joint must also be examined using other means, such as radiography, computed tomography, or ultrasonography.[9]

Ultrasonographic examination of the TMJ joint was described in detail by Weller.[14] Using a 7.5 MHz linear array probe, the procedure allowed visualization of the joint space, articular disc, cartilage, subchondral bone surfaces, and surrounding soft tissue. Only the lateral aspect of the TMJ, however, could be accurately assessed. When ultrasonographic, radiographic, and scintigraphic examinations of the TMJ of a mare with temporomandibular joint arthropathy were compared, ultrasonography was the only imaging modality that both localized and characterized the lesion.[9]

Resolution of clinical signs of disease of the TMJ after administration of local anesthetic solution into the joint is diagnostic for disease of that joint. Arthrocentesis of the TMJ performed directly over the joint is difficult because articular cartilage and the meniscus primarily occupy this space[2] and consequently, arthrocentesis is most reliably performed over the caudal pouch of the dorsal compartment. Using the approach to the caudal pouch of the dorsal compartment described by Rosenstein *et. al.*,[2] the mandibular condyle is identified as a smooth protrusion approximately midway between the lateral canthus of the eye and the base of the ear. Its identity is confirmed by palpating the structure while an assistant maneuvers the mandible from side to side. The zygomatic process of the

temporal bone is palpated 1 to 2 centimeters dorsal to the mandibular condyle, and a line is imagined between these structures. The site of centesis is a depression or soft area midway between these structures and ½ to 1 cm caudal to the imagined line.

A 20-gauge, 3.8-cm (i.e., 1 ½-inch) needle is inserted slightly rostrally and ventrally (i.e., about 15^{o}) to a line perpendicular to the long axis of the head to a depth of approximately 1.25 to 3.8 cm (i.e., 1 to 1 ½ inches). Fluid usually fills the needle hub. If the needle hits bone, the needle should be partially withdrawn and directed more ventrally. If the needle is directed too far ventrally, it may become embedded in the articular disc, in which case it should be partially withdrawn.

After aspirating synovial fluid for cytological examination (if indicated), the TMJ is infused with 2 to 3 mL of local anesthetic solution. Although resolution of clinical signs after analgesia of a TMJ identifies that joint as the probable site of disease, it does not provide information concerning the nature of the disease. An elevated concentration of neutrophils, especially degenerate neutrophils, and protein or culture of bacteria from the fluid identifies the fluid as septic.

The arthroscopic approach and arthroscopic anatomy of the equine TMJ have been described.[12,15] Although in one report,[12] the ventral compartment (i.e., the discomandibular joint) was determined to be arthroscopically inaccessible, because of the position of the transverse facial artery and vein, another study[15] found that both the dorsal (i.e., the discotemporal joint) and ventral compartments could be accessed arthroscopically. Because of the bipartite anatomy of the equine TMJ, separate approaches were necessary to inspect each compartment,[15] but investigators concluded that the need to explore the small ventral compartment is low.[12] Because of the curvature of the mandibular condyle, arthroscopic exploration of the TMJ was restricted to the lateral aspect of the joint.[12,15]

Treatment of Horses with Disease of the TMJ

Rostral luxation of the TMJ of one horse was successfully corrected by placing a metal mouth gag between the molars on the side of the dislocated TMJ, while the horse was anesthetized, and applying pressure to the rostral portion of the maxillae and mandible to close the mouth.[6] Although the horse was permanently blind, seemingly from damage to the eye caused by pressure from the coronoid process of the mandible, return of the horse's ability to normally prehend and masticate food was immediate.

Two horses with septic arthritis of a TMJ responded favorably to administration of antimicrobial drugs alone or to administration of antimicrobial drugs coupled with surgical excision of septic tissue, despite evidence provided by computed tomography that sepsis had extensively destroyed the articular surfaces of the affected TMJ of each horse.[8] The authors of that report concluded that the prognosis for recovery of function after resolution of sepsis, even after extensive destruction of the TMJ, is apparently good without mandibular condylectomy, perhaps because the mandibular condyle is capable of considerable remodeling. Another horse with septic arthritis of a TMJ developed

ankylosis of that joint, but mandibular condylectomy satisfactorily restored the horse's ability to eat.[15]

The technique of mandibular condylectomy was described by Barber *et. al.*[16] In that study, only minor abnormalities were noted in horses without disease of the TMJ that received unilateral condylectomy, but horses that received bilateral condylectomy experienced more severe, longer lasting abnormalities in prehension and mastication.

Balancing of the arcades and correction of dental abnormalities, such as dental overgrowths, along with dietary changes and administration of analgesic drugs, may aid in resolution of disease of the TMJ.[11] Major dental overgrowths should be corrected in stages. Instillating a corticosteroid into an arthritic TMJ may be beneficial in resolving clinical signs caused by osteoarthritis of the joint (Author's experience).

References

1. Sisson S, Grossman JD. The Anatomy of the Domestic Animals. *The Anatomy of the Domestic Animal*. 4 ed. Philadelphia: WB Saunders Co; 1953:247.
2. Rosenstein DS, Bullock MF, Ocello PJ, Clayton HM, Arthrocentesis of the temporomandibular joint in adult horses, *Am J Vet Res*, 2001; 62:729-733
3. Moll, H. D. and K. A. May. A review of conditions of the equine temporomandibular joint, in *Proceedings*. Am Assoc Equine Pract. 2002;48:240-243.
4. Weller R, Maierl, Bowen IM, May SA, Liebich H-G. The arthroscopic approach and intra-articular anatomy of the equine temporomandibular joint. *Equine Vet J*, 2002, 34:421-424.
5. Hurtig MB, Barber SM, Farrow CS, Temoporomandibular joint luxation in a horse, *J Am Vet Med Assoc* 1984, 185:78-80.
6. Hardy J, Shiroma JT, What is your diagnosis? *J Am Vet Med Assoc* 1991, 198:1663-1664.
7. Devine DV, Moll HD, Bahr RJ., Fracture, luxation, and chronic septic arthritis of the temporomandibular joint in a juvenile horse. *J Vet Dent*. 2005, 2: 96-99.
8. Warmerdam EPL, Klein WR, van Herpen PBJM, Infectious temporomandibular joint disease in the horse: computed tomographic diagnosis and treatment of two cases. *Vet Rec* 1997, 141: 172-174
9. Weller R, Cauvin ER, Bowen IM, May SA, Comparison of radiography, scintigraphy and ultrasongraphy, in the diagnosis of a case of temporomandibular joint arthropathy in a horse. *Vet Rec*, 1999, 144:377-379.
10. May KJ, Incisor problems that may result in inflammation of the temporomandibular joint. *Pferdeheilkunde* 1996, 12: 716.
11. Baker GJ, Equine temporomandibular joints (TMJ): morphology function, and clinical disease, in *Proceedings*. Am Assoc Equine Pract. 2002;48:442-447.

12. May KA, Moll HD, Howard RD, Pleasant RS, Gregg JM, Arthroscopic anatomy of the equine temporomandibular joint. *Vet Surg*, 2001, 30:564-571.
13. Wyn-Jones G, Interpreting radiographs 6: radiology of the equine head. *Equine Vet J*, 1985:417-425.
14. Weller R, Taylor S, Maierl J, Cauvin ERJ, May SA, Ultrasonographic anatomy of the equine temporomandibular joint. *Equine Vet J* 1999, 31: 529-532.
15. Patterson LJ, Shappell KK, Hurtig MB. Mandibular condylectomy in a horse. J Am Vet Med Assoc 195:101-102, 1989.
16. Barber SM, Doige CE, Humphreys SG. Mandibular condylectomy in the horse. *Vet Surg* 1985, 14:79-86.