



Original Research

Effects of the Oral Examination on the Equine Temporomandibular Joint



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ABSTRACT

Despite the increasing number of oral examinations performed, reports on temporomandibular joint (TMJ) assessment after the use of full-mouth specula are lacking in the literature. The aim of this study was to investigate whether prolonged application of a full-mouth speculum (60 minutes) would result in alterations in the clinical, thermographic, and synovial fluid (SF) findings. Horses were randomly divided into two groups. In one group, the speculum was kept in place in a closed position (CP group). In the other group, animals remained for 60 minutes with the mouth speculum at full range of aperture (opened position [OP] group). All TMJ joints were evaluated using digital palpation and thermography previous to (baseline values) and 6 hours after the removal of the mouth speculum (M6h). Synovial fluid was collected and analyzed. Six hours after full-mouth speculum use (M6h), pain on digital palpation, skin temperature, and total cell count in the OP group were higher when compared to baseline values. Moreover, pain on digital palpation and total cell count were higher in the OP group when compared to the CP group at M6h. There was no difference in total protein, chondroitin sulfate, hyaluronic acid, and prostaglandin E2 SF concentrations. Based on clinical, thermographic, and SF cell cytological findings, we concluded that TMJs environmental modifications followed the application of a full-opened mouth speculum for 60 minutes. However, these alterations were mild and mainly of inflammatory nature, and there was no indication of an increase in extracellular matrix degradation products in the SF.

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1. Introduction

In horses, dental problems remain among the most common reasons for seeking veterinary advice, and accordingly, dental procedures appear in the list of the most common tasks performed by equine practitioners. Interest and knowledge in equine dentistry have increased with the recognition of the importance of equine oral health along with client expectations and perceptions of

oral soundness on the athletic performance of their animal counterparts. As awareness of these issues increase, examination of the oral cavity in horses for the detection of dental lesions and occlusion problems becomes more frequent and a part of the well-run stable routine, justifying an evidence-based approach toward them [1,2]. Although agreement among the results of dental procedures on performance is still controversial [3–5], a thorough oral cavity examination is mandatory for diagnostic, therapeutic, and prophylactic procedures and is only achieved with the use of a full-mouth speculum [6–8].

Equine practitioners are often questioned about the effects on the wellness and welfare of patients during oral cavity procedures that use forced-mouth opening. In

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addition, practitioners are frequently asked for advice on how to proceed with the horses' regular work and routine. Despite the increasing number of oral examinations performed, reports on temporomandibular joint (TMJ) assessment after the use of full-mouth specula are lacking in literature [8].

The TMJ is the complex diarthrodial articulation between the caput of the condylar process of the mandible and the base of the zygomatic process of the temporal bone. It comprises a smaller ventral pouch (discomandibular joint) and a larger dorsal pouch (dis-cotemporal joint), which are separated by a fibrocartilaginous intraarticular disc. Both pouches contain rostral and caudal compartments according to Rodriguez et al [9], but there are discrepancies about the communication of these pouches and their number of compartments. The joint is supported by lateral and medial ligaments [9], and it is innervated by the mandibular branch of the trigeminal nerve [10]. The TMJ has singular anatomic and phenotypic features; it is a singular synovial joint, with articular surfaces covered by fibrocartilage instead of hyaline cartilage [11], and probably undergoes age-related remodeling related to shape and density [10]. Furthermore, in the horse, like in other herbivores, its incongruent articular surfaces allow for more mediolateral excursions, which are vital for molar occlusion during grinding of forage [12].

Overall, data on equine TMJ are lacking. It is known that TMJ is subjected to great amounts of stress and cyclic loading, as the horse is estimated to graze for 16 hours during a 24-hour observation period under natural conditions [13]. Considering that grazing was the sole mean of nutrient intake, TMJs functionality, robustness, and integrity were of paramount importance to assure the species' survival throughout the horses' evolutionary process. Some efforts have aimed to characterize the translational or rostrocaudal movement of the jaw in relation to occlusion [3]. Bonin et al [14] described in detail the TMJ rotational and translation movements during each phase of the chewing cycle; the authors observed that this joint allows considerable mobility of the mandible relative to the skull during chewing.

Confirmed cases of TMJ disorders (TMDs) in horses are scarcely reported, probably because it represents a diagnostic challenge due to multiple and subtle presentations [5]. Usually, a traumatic onset resulting in sepsis, luxation, or bone fractures is the originating causes. Septic arthritis has been reported [15–18] as well as traumatic injuries, with [12] or without [19] mandibular fractures. Tearing of the articular disc was found in one horse presenting with a head tilt (J. BOENING, personal communication). Degenerative changes associated with abnormalities of the incisors [20–22] were also described. Iatrogenic arthritis, after protracted use of an oral device under general anesthesia, has been reported in one horse [22] and congenital dysplasia in another (H. GERHARDS, personal communication).

Diagnosis of TMDs is not straightforward, and even in man, a combination of a detailed history, clinical examination, imaging, motion studies, and questionnaires is necessary to identify and classify TMDs accordingly. The

low incidence of reported TMDs in horses compared to that of humans probably reflects this diagnostic challenge, and it is not surprising that the diagnosis in the equine species will not equal the standards achieved in human medicine [8]. Furthermore, the resilience of horses' TMJ is noteworthy; the ability to sustain the magnitude of the stresses imposed by continuous daily demands allowed efficient and sufficient energy acquisition throughout the evolutionary process when natural forage was the only source of nutrients. More than that, evidence supports the observation that equine TMJ is somewhat resistant to pain and inflammation [23].

Despite the scarcity of TMD reports, whether from low prevalence or misdiagnosis, equine veterinarians have been frequently asked to evaluate the function of these joints in the context of equine welfare and performance [5,8,24].

This experimental *in vivo* study aimed to evaluate the impact of a mechanical overload on equine TMJ imposed by the application of a full-mouth speculum, mimicking the clinical scenario of an oral cavity examination.

Mechanical stresses, such as repetitive mouth opening, are known to be a risk factor for the development of TMJ osteoarthritis [25–28] in laboratory animals. In horses, there is not enough evidence indicating risk. Therefore, we hypothesized that the application of a full-mouth speculum for 60 minutes would result in TMJs clinical, thermographic, and synovial fluid (SF) alterations; thus, dental procedures should be performed in shorter periods than an hour to avoid damage to TMJ.

2. Materials and Methods

2.1. Animals

The experimental protocol used in this study was approved by the Institutional Animal Care and Use Committee (protocol number: 615/2011). Twelve mixed-bred mares, mean age of 12.1 ± 1.5 years, clinically healthy, were selected. All animals were kept under extensive grazing, receiving pelleted feed twice a day and water *ad libitum*. Left and right TMJs from each animal were used in the experiment.

2.2. Study Design

The experiment was conducted in three separate moments: preexperimental, M0h, and M6h. A total of 24 TMJ joints were assessed during a preexperimental clinical evaluation. This evaluation consisted of inspection and digital palpation of all joints to detect enlargements, heat, and tenderness. Any signs of resentment to manipulation were recorded and used as exclusion criteria. Next, all joints were aseptically prepared for SF aspiration. Synovial fluid samples of each TMJ were collected. Care was taken to avoid interference of a possible arthrocentesis done in M0h in the evaluation of SF, digital palpation, or thermography at M6h.

At M0h, each TMJ was again evaluated by means of digital palpation and thermography, verifying that arthrocentesis held previously did not change the data of these parameters. Mares were then randomly divided into two

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