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EOTRH: Macroscopical and Pathohistological Investigations

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Take Home Message

The etiological and predisposing factors of equine odontoclastic tooth resorption and hypercementosis (EOTRH) are not fully understood. However, pathohistological findings suggest an etiological contribution of biomechanical stresses.

Introduction

Painful incisor disorders have been increasingly recognized during the last several years preferentially affecting aged horses. Clinical examinations reveal oral/dental pain, incisor mobility, gingival swellings, severe gingival regression and gingivitis which are occasionally associated with ulcerations and draining tracks with purulent discharge.

Radiographs display characteristic changes in the intraalveolar parts of the teeth and their periodontal surroundings, i.e. the periodontal ligament and the alveolar bone. Although the radiographic appearance varies between diseased teeth and between patients, there are two major radiographic findings which usually occur in combination. First, the intraalveolar parts of the teeth are affected by substantial tooth destruction in terms of resorption of the calcified dental tissues. Second, the intraalveolar parts of the teeth display bulbous enlargements caused by radiopaque masses. In addition, loss of the periodontal space, disaggregation of the alveolar bone and tooth fractures are frequent radiographic findings. Clinical reports indicate a progressive course of the disease with extraction of the affected teeth being the treatment of choice.

Hitherto, neither a comprehensive etiological and pathogenetic explanation for the described syndrome nor a tooth-preserving treatment has been presented. The purpose of the present study was to examine affected teeth in different stages of tooth resorption and hard substance hypertrophy to reveal the underlying pathological processes. The results might serve to identify etiological factors and also provide a basis for further studies addressing prophylactic procedures and tooth preserving therapies.

Materials and Methods

Macroscopical Examinations
Specimens were obtained from 53 horses with characteristic symptoms (46 geldings, 7 mares, ranging in age from 9 to 35 years, mean age 20 years).

Three hundred-twenty extracted teeth (297 incisors, 21 canines, 2 premolars) were cut into sections of approx. 10 mm in height using a diamond blade saw. Sectioned teeth were assessed using a dissection loupe (magnification 1.25-fold) to identify resorptive lesions, penetrations into the pulp cavity and presence of hypertrophic dental substances.

**Histological Examinations**

Selected specimens were decalcified using 25% EDTA at pH 7.4 and 37°C (requiring between two and four weeks). Subsequently specimens were embedded in paraffin wax and 3 micron serial sections were prepared. Alternate sections were grouped separately for different staining protocols (Masson-Goldner trichrome, picrosirius red, toluidine blue, haematoxylin eosin, tartrate resistant acid phosphatase [TRAP]) and microscopic procedures (light microscopy, polarized light microscopy). Examinations focused on the dental hard substances, the periodontal tissues and the dental pulp. Special attention was paid to detecting odontoclastic cells by means TRAP staining.

**Results**

**Macroscopical Examinations**

The intraalveolar part of the teeth featured characteristic appearances. A bulbous enlargement predominantly protruded in a lingual direction. The grossly irregular surface in such areas was suspected to be irregular dental cementum. The labial aspects of the teeth appeared unaffected with normal dental cementum. In some areas necrotic tissues was identified, especially in areas of irregular cemental deposition.

Sectioned surfaces in areas covered by normal cementum (labial aspects of the teeth) showed retained normal dental substances in most teeth. In areas covered with irregular cementum, the sectioned surface of the tooth often displayed a destroyed integrity of the tooth substances. Resorptive lesions extended beneath the normal peripheral cementum into enamel, dentine or even pulp.

**Histological Examinations**

Reflecting the macroscopical findings, two prominent histopathological findings were demonstrated, i.e. resorption of tooth substances and apposition of a calcified tissue. Tooth resorption was mediated by TRAP positive multinucleated odontoclasts. These cells were identified at the border of regular cementum and dentin lying in typical resorption lacunae (Howship’s lacunae). In areas where tooth resorption had ceased, cementoblast-like cells were found. These cells mediated the production of new calcified tissue, which was referred to as irregular cementum. The excessive apposition of irregular cementum causes the feature of hypercementotic enlargements of the tooth.
Accordingly the term EOTRH (Equine Odontoclastic Tooth Resorption and Hypercementosis) was proposed to describe the syndrome.

Discussion

The histological findings suggest a chronological sequence of tooth resorption which is followed by a reparative mechanism in terms of apposition of irregular cementum. This chronology of the cellular events is not synchronized along the entire tooth. Thus, sides of active resorption and sides of massive production of irregular cementum are in close vicinity to each other. The balance between simultaneous tooth resorption and apposition of irregular cementum defines the appearance of an affected tooth, and may favour a more resorptive type of EOTRH or a more hypercementotic type of EOTRH.

EOTRH shares many features with similar dental syndromes described in humans (multiple idiopathic root resorption, MIRR) and cats (feline odontoclastic root resorption, FORL). However, studies on these diseases have shown that the predominant pathological factor is tooth resorption which is followed by moderate production of reparative, cementum-like tissue as soon as the sustaining stimulus for tooth resorption has vanished. The dimensions of newly formed cementum-like tissue described in the horse exceed those described in other species by far. In contrast to MIRR and FORL, there is evidence that the periodontal ligament of the horse is capable of reattaching to particular areas of the repaired tooth surface. This observation underlines the high capacity of the equine periodontal ligament for remodelling and regeneration.

Experimental studies in rat and mouse models have shown that high pressure forces within the periodontal ligament cause micronecroses and subsequently induces the activation of clastic cells. These results lead to an etiological hypothesis of EORTH which proposes mechanical stresses within the periodontal ligament as the initiating factor of odontoclastic resorption.

Alternative etiological explanations, including ischemic necrosis, genetic linkage, systemic disorders such as Cushing’s syndrome, hypervitaminosis A, hypocalcaemia or hyperparathyroidism and idiopathic diseases, should be kept in consideration when performing further studies. Also a multifactorial genesis, including severe periodontal infections with particular pathogens, cannot be excluded.

References


