Case Report

Dental diastemata and periodontal disease secondary to axially rotated maxillary cheek teeth in three horses

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Summary

Malerupted axially rotated maxillary cheek teeth (CT) were identified as the primary cause of diastemata and severe periodontitis in 3 horses. Diastema widening and periodontal debridement was performed initially in one case but did not resolve clinical signs. Subsequently, all 3 cases underwent extraction of the axially rotated teeth per os without complication. Follow-up indicated remission of periodontal defects and signs of oral pain. In these cases, maxillary CT had erupted in a manner that resulted in axial rotation of CT with undulating buccal and palatal surfaces aligned with the interproximal surfaces of adjacent normally orientated teeth. This resulted in poor interproximal compression and diastemata causing severe periodontitis. Axially rotated maxillary CT and the severe periodontitis that they precipitate, have not been previously described as a discrete dental disease entity.

Introduction

Each row of equine cheek teeth (CT) comprises of premolars and molars with their rostral and caudal (mesial and distal) interproximal surfaces in close contact. This enables them to function as a single masticatory unit (Dixon 2005) (Fig 1). Abnormal interproximal spaces between adjacent CT, referred to as diastemata, precipitate interproximal accumulation and impaction of food and subsequent periodontitis (Collins and Dixon 2005). This was the most painful oral disease diagnosed in a large case series of equine dental disease (Dixon et al. 1999). Abattoir surveys report prevalences of 52–60% in horses aged >15 years (Baker 1970; Wafa 1988). Proposedetiopathogenses for diastemata include congenital maleruption of the permanent dentition. The resulting lack of rostro-caudal angulation and convergence of CT causes reduced interproximal compression at the alveolar crest.

Case 1

History

A 13-year-old fell pony was referred with a history of discomfort with the bridle, dysmastication and halitosis. There was a transient improvement in clinical signs subsequent to rasping of dental overgrowths and administration of a course of oral trimethoprim/sulphadiazine by the referring veterinary surgeon.

Diagnostic findings

The pony’s body condition was reasonable. Oral examination and endoscopy revealed much food pocketing. Maxillary molars on the right (110) and left (210) were axially rotated by 45 and 90° respectively and were palatally displaced. Pronounced peripheral enamel ridges normally on the buccal aspects of maxillary CT were observed on the caudal aspects of the axially rotated...
teeth ([Fig 2]). Diastemata with periodontitis were evident caudal to the axially rotated teeth. Examination of these areas with a probe induced a pain reaction. Diastemata were also present in 2 other maxillary (106/7, 207/8) and 2 mandibular (406/7, 310/11) interproximal spaces with a lesser degree of periodontitis. Radiographs (lateral-oblique and dorsoventral projections of the CT apices and skull [Gibbs 2005] and lateral oblique projections of the erupted crowns [Barakzai and Dixon 2003] showed alveolar sclerosis around the apices of the axially rotated teeth and diastemata corresponding to oral findings.

Initial treatment

Sedation was achieved with detomodine (Domosedan, 0.01 mg/kg bw t i.v.)1 and morphine (Morphine Sulphate, 0.12 mg/kg bw t i.v.)2. Further increments of 6 μg/kg bw t of detomodine were administered as required to maintain sedation. Staged regional anaesthesia of both maxillary nerves as described by Tremaine (2007) was performed using 100 mg of prilocaine (Citanest)3.

All diastemata were widened using a motorised dental instrument (Powerfloat)4 with either conical or cylindrical carbide 2 mm ‘diastema’ burs5. Subsequently they were lavaged and debrided with pressurised water, sodium bicarbonate and nitrogen (Equine Dental System)5. Inter-proximal spaces were then bridged with poly-siloxane dental impression material6. Flunixin (Finadyne, 1.1 mg/kg bw t i.v.)7 and procaine penicillin (Depocillin, 10 mg/kg bw t i.v.)7 were administered perioperatively. Phenylbutazone (Equipalazone powder, 1.1 mg/kg b.i.d. per os)8 for 3 days and trimethoprim/ sulphadiazine (Equitrim granules, 30 mg/kg bw t b.i.d. per os)9 for 5–10 days were dispensed upon discharge from hospital the following day.

Further assessment and treatment

Dysmastication, halitosis and discomfort with the bridle subsided for several months after initial treatment. However, the pony was re-presented at the hospital 5 months after initial admission due to relapse of these clinical signs. Oral examination revealed increased severity of periodontal lesions caudal to the axially rotated teeth. Radiographs revealed more extensive sclerosis and periodontal changes around the apices of the axially rotated teeth. Due to the progression of clinical signs and severity of lesions, the axially rotated molars were both extracted per os (Tremaine 2004) with the same sedation, regional anaesthetic, analgesic and antibiotic protocol as above. Poly-siloxane dental impression material6 was placed in the coronal portions of the alveoli to prevent ascending contamination with food. Inflamed periodontium and peripheral caries ascending towards the apices were evident on both of the extracted axially rotated teeth ([Fig 3]). The pony was discharged one day post operatively with courses of phenylbutazone and trimethoprim/sulphadiazine. Impression material was removed from the granulating alveoli 3 weeks post operatively.

Follow-up

The owner reported no evidence of previous clinical signs of dental pain 11 months post operatively.
Case 2

History

A 13-year-old Thoroughbred cross gelding was referred with a right maxillary swelling of 8 months' duration, transient nasal discharge and head-shy behaviour of 3 months' duration.

Diagnostic findings

Oral examination and endoscopy revealed 4 maxillary premolars (Triadan positions 106, 108, 207 and 208) to be axially rotated by 90° (Fig 4). There was buccal displacement of 108, 208 was loose, and 107 and 108 were dysplastic (with abnormal occlusal features including incomplete infundibular enamel and abnormal relative positioning of the secondary dentine overlying the pulp horns [Fig 5]). Diastemata were present and deep periodontal pocketing was identified using a periodontal probe caudal to 2 of the axially rotated teeth (108 and 208) (Fig 6). Investigation of these areas induced a pain reaction. Mandibular teeth opposing the dysplastic and axially rotated teeth were super-erupted. Buccal and lingual trauma subsequent to sharp enamel points on teeth was evident.

Radiographs revealed alveolar sclerosis and periapical lysis apical to Triadan 07–09 maxillary CT. An irregular periodontal space caudal to 108 was also evident radiographically, corresponding to the deepest

Fig 3: Extracted rotated maxillary cheek tooth (210) from Case 1 (preserved with 10% formalin). Deep food impaction undulating surface (normally buccal) that was on the caudal interproximal aspect of this tooth led to ascending peripheral caries (white arrow). Much inflamed periodontium remains adhered to the reserve crown and apex (black arrow).

Fig 4: Intra-oral photograph of Case 2: HP = Hard palate, T = Tongue, BM = buccal mucosa being retracted. Tooth 208 is visible in the dental mirror at right angles to the tooth caudal to it. There is a diastema (arrow) on the caudal aspect of the tooth, where the undulating ridges that normally face buccally are also evident. In contrast to the abnormal anatomy of the dysplastic teeth, this tooth had normal occlusal anatomy but it is orientated at 90° to its usual positioning.

Fig 5: The occlusal surface of the dysplastic cheek-tooth 108 extracted from Case 2. Before extraction, this tooth was positioned abnormally with its buccal surface facing caudally in contact with the rostral aspect of 109, which resulted in poor appositional contact and food entrapment. A: The caudal palatal pulp horn and overlying secondary dentine is absent. This aspect of the tooth has intact peripheral cementum and peridontium suggesting that the absence of the pulp horn and overlying dentine is developmental rather than acquired. B: The peripheral cement, enamel, caudal buccal pulp horn and associated dentine are absent on this aspect of the tooth as a result of dental fracture secondary to advanced caries adjacent to the extensive periodontal pocket caudal to the tooth, which revealed an uneven surface of primary dentine and some infundibular enamel. C: There is an absence of dentine between the 2 infundibula. The caudal infundibulum has incomplete enamel.
periodontal pocketing identified previously upon oral examination (Fig 7). Metallic markers indicated the facial swelling was dorso-lateral to the apex of 108.

**Treatment**

The super-erupted mandibular CT opposite the diastemata and enamel points were reduced using a motorised rotating diamond tipped burr (Flexifloat). Impacted food was cleared from the diastemata using dental picks and pressurised water. The loose axially rotated tooth (208) and also 108, which was associated with severe periodontitis and facial swelling, were extracted per os using techniques described in Case 1. (That is, the same drug dosages per kg were used as were the staged maxillary nerve block technique described by Tremaine [2007] and the per os extraction technique described by Tremaine [2004]).

**Follow-up**

Four months post operatively, the owner reported the horse to have improved acceptance of the bridle and absence of head-shy behaviour. The right maxillary swelling subsided. There was healthy mucosa at the sites of previous periodontitis.

**Case 3**

**History**

An 8-year-old Irish Draught cross gelding was referred due to periodontal pocketing noted during a routine dental examination.

Follow-up

Four months post operatively, the owner reported the horse to have improved acceptance of the bridle and absence of head-shy behaviour. The right maxillary swelling subsided. There was healthy mucosa at the sites of previous periodontitis.

Clinical and oral findings

Body condition was good. Oral examination and endoscopy revealed that there were 7 rather than 6 left maxillary CT. The second CT (207) in the quadrant was axially rotated by 90° and had deep periodontal pocketing and gingivitis rostral and caudal to it. The horse exhibited a pain reaction upon investigation of this area. Radiographs corroborated the oral findings of the supernumerary tooth and diastemata. Alveolar sclerosis and periodontal changes were evident around the axially rotated tooth (Fig 8).
Treatment

Due to the presence of severe lesions around the axially rotated tooth, and the likelihood of progression of the periodontitis, the axially rotated tooth was extracted per os as described above.

Follow-up

The owners reported that the horse was comfortable and not showing any evidence of oral discomfort 7 months postoperatively. The 3 cases described above are summarised in Table 1.

Discussion

With the advent of improved equipment and techniques for equine oral examination such as oral endoscopy (Tremaine 2005; Simhofer et al. 2008), diagnosis of equine periodontitis and its precipitatory lesions is becoming more common. In the past, CT repulsion or euthanasia were sometimes carried out in horses with advanced periodontitis (Dixon et al. 1999). However, with earlier identification, better understanding of the disease and better equipment, successful treatment is being reported in a higher proportion of horses (Dixon et al. 2008). In this series, diastema widening with removal of impacted food and subsequent periodontal abrasion was initially performed in Case 1, as there were multiple periodontal lesions with mild gingivitis and a milder pain response compared to the other 2 cases. Furthermore, this horse had already improved with rasping of dental overgrowths and antibiotics. However periodontitis associated with the axially rotated teeth progressed, and exodontia was elected aspiring to achieve long-term remission. In Case 2, one of the teeth extracted was already digitally loose and the other was associated with facial swelling, signifying ascending periodontitis with apical disease and indicating exodontia. In Case 3, exodontia was selected on the basis of severe periodontitis associated with one axially rotated tooth and poor response to conservative treatments in Case 1.

Unlike diastemata between normally oriented teeth, these 3 cases had pronounced enamel ridges extending from crown to apex on the interproximal aspects of axially rotated teeth, impeding good interproximal cemental contact, which enabled food impaction. Long-term cessation of periodontitis with conservative treatment would probably have failed due to ongoing eruption of undulating enamel ridges adjacent to the interproximal space. These enamel ridges are normally sited on the buccal aspect, with the flatter rostral and caudal surfaces providing good interproximal cemental contact, which does not allow food impaction between the teeth. Similarly, in a series reviewing treatment of oromaxillary fistulae due to ascending periodontitis, a case with rotated maxillary CT was refractory to conservative treatment despite good responses in other cases in the series with diastemata unconnected to axially rotated CT (Hawkes et al. 2008). In an earlier report, a horse was subjected to euthanasia due to severe periodontitis due to bilateral axially rotated maxillary 09s (Dixon et al. 1999).

Diagnosis of rotational maleruption was made by noting that the occlusal features of the teeth were in a different orientation to their neighbours. Radiography alone provided insufficient information to diagnose the rotation but was useful for assessing ascension of periodontitis and apical disease.

In this series, Cases 1 and 2 had multiple axially rotated teeth, with Case 2 also having dysplastic teeth and Case 1 having additional dental displacements. Case 3 had a
supernumerary tooth in the same quadrant as the axially rotated tooth. This suggests disorders with multiple tooth buds prior to eruption, which may be similar to the case in man, where a genetic cause with hereditary transmission is reported for axially rotated maxillary teeth (Escobar et al. 1976). In the cases reported here, misalignment of the permanent dental cysts probably occurred early in the dentogenesis before eruption of fully formed teeth since in hypsodonts, marked rotation of the erupted tooth appears mechanically unlikely due to their elongated reserve crowns.

In conclusion, axially rotated maxillary CT should be recognised as a potential cause of severe periodontitis. They can be identified due to their altered occlusal orientation using a dental mirror or endoscope. Despite the altered orientation of the teeth, per os extraction of the axially rotated teeth was performed without complications. This proved successful in achieving remission of clinical signs. The presence of undulating ridges extending for the length of the interproximal surfaces of axially rotated teeth result in poor interproximal contact and mean treatment such as diastema widening, periodontal debridement and bridging are unlikely to achieve long-term remission of periodontitis.

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Manufacturers’ addresses

1Pfizer Limited, Sandwich, Kent, UK.
2Martindale Pharmaceuticals, Romford, Essex, UK.
3Astra Zenica, Luton, Bedfordshire, UK.
4D and B enterprises Inc, Calgary, Canada.
5Pacific Equine Dental Institute, El Dorado Hills, California, USA.
63M, St Paul, Minnesota, USA.
7Intervet/Schering-Plough Animal Health, Milton Keynes, UK.
8Arnolds Veterinary Products Ltd, Shrewsbury, Shropshire, UK.
9Boheringer Ingelheim, Bracknell, Berkshire, UK.
10Veterinary Dental Products, Elmwood, Wisconsin, USA.

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