

Observations on Periodontal Changes After Tooth Extraction and Possible Influence of a Partial Tooth Replacement Therapy

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Take Home Message

Removal of a cheek tooth adversely influences the health of gingiva surrounding the remaining teeth in the corresponding arcade. Deterioration in gingival health might eventually lead to irreversible periodontal damage.

Introduction

Periodontal disease in horses is primarily a secondary problem related to the presence of congenital diastemata and/or displaced cheek teeth or due to combined age-related formation of diastemata and development of wear abnormalities.¹ Treatments described for horses with periodontal disease include dental balancing, removal of accentuated transverse ridges (ATR), diastema drilling, and subgingival pocket debridement and closure.²⁻⁵

Although generally accepted, tooth drift as a consequence of cheek tooth removal in the horse has been described only superficially.⁶⁻⁸ Tooth drift eventually results in widening of neighbouring interproximal spaces, and accumulation of food in the widened interproximal spaces (diastema formation) may lead to progressive periodontal breakdown. The relationship between dental drift and the development of periodontal disease has not been properly documented in horses. Our study describes the changes in periodontal health in ponies after extraction of a maxillary cheek tooth. The study also evaluates the influence of a partial tooth replacement therapy on periodontal changes post-extraction.

Materials and Methods

Five healthy ponies (mean age, 5.8 years; range, 5-7 years; mean body weight 328 kg; range, 270-389 kg) with a healthy dentition were selected for this study. The ponies were fed a balanced, soft diet devoid of long fiber nutrients from one week before surgery until one month after surgery, at which time the diet was gradually changed to hay and concentrates. The ponies were then maintained on hay and concentrates and allowed periodic pasture turnout for the rest of the study period. Prior to surgery, the dental arcades were floated to remove enamel overgrowths.

Both maxillary Triadan 08s (3rd cheek tooth) cheek teeth were removed from all 5 ponies while under general anaesthesia. After using radiographic guidance to determine the location of the apex of the 08, a U-shaped skin and muco-periosteal flap was created over the apex of the tooth and reflected dorsally to expose the maxillary bone overlying the apex of the teeth. The apex of the tooth was exposed by removing a rectangular section of maxilla using a bone chisel. The tooth was repelled into the oral cavity, and the alveolus was thoroughly curetted and lavaged with sterile physiological saline solution to remove dental or osseous fragments. The incision was closed in three layers using simple interrupted, monofilament resorbable sutures on each layer.

The ponies were repositioned and the contralateral tooth was removed in similar fashion. One randomly chosen alveolus of each pony was then filled *per os* with Bioplant[®] 24^a, an osseointegrative bone substitute, with the pony in dorsal recumbency. (Bioplant[®] 24^a is a synthetic alloplast consisting of a mixture of polymethylmethacrylate and polyhydroxyethylmethacrylate with a calcium hydroxide graft surface. It has a hollow, spherical architecture with one or more pores to allow bone ingrowth). The bone substitute was mixed with blood drawn from the bleeding alveolus and firmly condensed in the empty alveolus to a level 2 cm dorsal to the alveolar rim. To allow undisturbed healing of the alveolus, the alloplast was isolated from the oral cavity by packing the exposed portion of the alveolus with a polyvinylsiloxane plug.^b This plug was firmly retained by incorporating a custom-made, three-loop, orthodontic wire into the plug.^c The occlusal aspect of the contralateral alveolus was occluded with a simple polyvinylsiloxane plug without use of the retention wire as has been described.⁷

The ponies were evaluated after surgery and periodically for 2 years for signs of oral discomfort, such as anorexia, salivation, quidding, and weight-loss. At 1 month after surgery, any remaining alveolar plug was removed. The oral cavity was thoroughly examined at 6, 12, and 24 months after surgery using a full-mouth speculum and a rigid endoscope. Abnormalities of wear and changes in gingival health were recorded. A scoring system for periodontal disease, modified from Becker,⁹ was used (Table 1). Scores were recorded for the palatal and buccal aspects of the interproximal spaces between maxillary 06-07, 09-10 and 10-11 elements.

Statistical analysis was performed to assess the influence of tooth extraction on periodontal scores and to look for differences between control and Bioplant[®] 24-treated arcades. Comparisons were made using a repeated measures analysis in a linear mixed effect model. Calculations were performed using a statistical software package.^d P-values of <0.05 were considered to be statistically significant.

Results

None of the ponies displayed signs of oral discomfort during the follow-up period, and the dietary changes were well tolerated. A mean body weight increase of 30 ± 22.11 kg was recorded one year after surgery, and a mean body weight loss of 21.6 ± 23.23 kg was recorded during the second year after surgery.

Table 1. Periodontal scoring system used to evaluate interproximal gingival health.

Periodontal score	Clinical presentation
0	No food entrapment in the interproximal space Normal healthy gingiva
1	Food entrapment in the interproximal space Normal healthy gingiva
2	Food entrapment in the interproximal space Local gingivitis (hyperemia/edema)
3	Food entrapment in the interproximal space Periodontal pocket Erosion of gingival margin < 5mm
4	Food entrapment in the interproximal space Gingival retraction > 5mm
5	Gross periodontal pocketing Lysis of alveolar bone Loosening of bone support

Progressive tooth drift in both maxillary arcades induced wear pattern changes in both mandibular arcades. This change included focal overgrowths on the rostral aspect of the 06 tooth, the caudal aspect of the 11 tooth, and caudal half of the 08 tooth. The frequency of cheek lesions caused by enamel overgrowths on the buccal side of the maxillary arcades increased with time in all ponies.

Progressive changes that could cause periodontal disease were observed in both maxillary arcades. These changes were first characterized by widening of the interproximal spaces between 06-07 and 09-10, leading to food entrapment, gingival swelling, and later in the follow-up period, subgingival pocketing.

Mean time-dependent periodontal scores are illustrated in Table 2. The overall recorded periodontal scores significantly increased with time ($p < 0.01$). Bioplant[®] 24-treated arcades, did not differ significantly from control arcades in the severity of periodontal changes. During the first year of the follow-up, periodontal changes were noted more frequently in the premolar area but during the second year, periodontal scores in the premolar area improved, while scores in the molar region worsened. The buccal aspect of interproximal sites tended to have higher periodontal scores at the end of the study period compared to the palatal aspect of the interproximal sites.

Table 2. Mean (\pm sd) periodontal scores in Bioplant[®] 24-treated and control arcades at 6, 12, and 24 months after removal of maxillary P4 (Triadan 08) cheek teeth in 5 ponies.

	6 months	12 months	24 months	Total
Bioplant [®] 24	0.43 (\pm 0.70)	0.73 (\pm 0.95)	0.97 (\pm 0.80)	0.71 (\pm 0.46)
Control	0.17 (\pm 0.27)	0.50 (\pm 0.61)	0.86 (\pm 0.96)	0.51 (\pm 0.41)
Total	0.30 (\pm 0.31)	0.62 (\pm 0.35)	0.91 (\pm 0.45)	0.61 (\pm 0.44)

Discussion

The periodontal changes we recorded were not associated with significant clinical symptoms of periodontal disease, which explains the absence of signs of oral discomfort in the study ponies. Grade 2 and 3 periodontal disease may cause excessive salivation and sensitivity to cold water, but these symptoms often remain unrecognised.¹⁰ Discrete changes in the quality of the mastication process may have decreased the efficiency of nutrient resorption in the digestive tract and may have accounted for changes in body weight. Numerous other factors, however, may have influenced the body weight changes observed in this study including changes in the quality of pasture greens, intestinal parasitism, and different energy demands dictated by changing weather conditions. Investigations of fecal particle size, as recently described,¹¹ might have allowed us to detect changes in feed digestibility caused by extraction of the P4s.

Because periodontal disease is a slowly progressing disease, evaluation of the periodontium over longer periods of follow-up may be necessary to determine the full extent of periodontal damage related to post-extraction tooth drift. Periodontal scores in the maxillary premolar area improved with time, demonstrating that acquired periodontal damage might be reversible. Similarly, transient periodontal disease is also seen in young horses at the time of eruption of the permanent dentition.¹²

The partial tooth replacement therapy did not improve gingival health, but in fact caused higher periodontal disease scores in comparison with control arcades. Incorporation of the bone substitute, however, significantly slowed down the rate of tooth drift during the second year.¹³ Reduction in rate of drift might have limited widening of acquired diastemata secondary to tooth drift, which may have contributed to food accumulation and subsequent periodontal damage.

Mean periodontal scores at buccal aspect of the interproximal sites may have been higher than the scores at the lingual aspect of the interproximal spaces because food lodged at the lingual aspect of the interproximal spaces can be dislodged with the tongue.

We conclude that removing a cheek tooth adversely influences gingival and periodontal health in the corresponding dental arcade. Long periods of follow-up may be necessary to determine the full extent of periodontal damage related to post-extraction tooth drift.

References and Footnotes

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^a Bioplant[®] 24, Synthetic Bone[™], Kerr Corporations, Orange, CA, USA.

^b President Putty, Coltène/Whaledent, Switzerland.

^c Dentaurem Remanium[®], Pforzheim, Germany.

^d S-Plus 7.0, Cambridge, USA.