Periodontal lesions in slaughtered cattle in the West of Scotland

A. C. Borsanelli, L. Viora, D. F. Lappin, D. Bennett, G. King, I. S. Dutra, M. P. Riggio

A. C. Borsanelli, DVM,

I. S. Dutra, DVM, PhD,

Universidade Estadual Paulista Julio de Mesquita Filho, Faculty of Veterinary Medicine, Araçatuba, Department of Animal Health and Production, Sao Paulo, Brazil

L. Viora, MVB Dip., ECHBM, MRCVS

D. Bennett, BSc (Hons), BVetMed (Hons), MRCVS, PhD, DSAO, FHEA, DVM

G. King, BVMS, Cert VC, MRCVS

School of Veterinary Medicine, University of Glasgow, Bearsden Road, Glasgow G61 1GH, United Kingdom

D. F. Lappin, BSc (Hons), PhD,

M. P. Riggio, BSc (Hons), PhD,

Oral Sciences Research Group, Dental School, University of Glasgow, 378 Sauchiehall Street, Glasgow G2 3JZ, United Kingdom

E-mail for correspondence: marcello.riggio@glasgow.ac.uk

Periodontitis is a multifactorial infection elicited by a complex of bacterial species that interact with host tissues and cells causing the release of a broad array of inflammatory cytokines, chemokines, and mediators, some of which lead to destruction of the periodontal structures, including the tooth supporting tissues, alveolar bone, and periodontal ligament (Holt and Ebersole 2005). Although cattle are of worldwide economic importance in the dairy and beef industries, their dentition has not been investigated as thoroughly as that of other species. Cattle are diphyodont and hypsodont and their permanent dentition has 32 teeth. The permanent incisors erupt sequentially between 1.5 and 4 years of age. All permanent premolars and the second and third molars erupt between 1 and 3 years of age (Page and Schroeder 1982).

The importance of bovine periodontal disease has largely been overlooked by veterinarians and scientists. In Brazil, periodontal disease affects cattle kept in areas where grazing has been recently formed or reformed in the Atlantic Forest, Cerrado, Pantanal and Amazon biomes (Döbereiner and others 2000). The disease is characterised by a purulent, progressive periodontitis, with periodontal pocket formation, development of a chronic periostitis ossificans and in some cases systemic illness. The tooth roots become exposed with eventual loss of teeth (Döbereiner and others 1974). Reported studies in the UK are scarce. Of 501 heads of cows examined in a slaughterhouse, only 15 (3%) had periodontal lesions (Ingham 2001). However, an investigation recently conducted at the University of Edinburgh, UK, revealed several dental problems in the mouths of 11 culled dairy cows, which included periodontitis (displaced and loose teeth), mainly involving the cheek teeth (Dr. Susan Kempson, personal communication). Although the sample size in this study was small, it was concluded that loosening of the teeth was a result of end stage periodontitis and undoubtedly a cause of significant pain and suffering to the animals concerned.

The aim of the current study was to conduct a preliminary evaluation of the presence of periodontal lesions in slaughtered cattle in a local abattoir from September to November 2015. Two-hundred complete heads were examined and the criteria for diagnosing periodontitis were the presence of gingival recession (i.e. the tooth root was visible at the gum margin) and the existence of periodontal pockets (the distance from the gingival margin to the base of the periodontal pocket as measured with a graduated universal periodontal probe) greater than 5 mm in depth. The probe was inserted to the base of the periodontal pocket, applying a light force and moved gently around the tooth surface and pocket depth measurement obtained.

Of the 200 heads, 24 (12%) were considered to have periodontal lesions. The overall age range was 18 to 197 months (mean age 90.4 months). Lesions were found predominantly in beef cattle (17 animals) whose mean age (85.2 months) was lower than for the seven affected dairy cattle (mean age 102.9 months). Although the clinical attachment level of the gingival margin was not recorded precisely, the cement enamel to periodontal pocket base distance was seen to greatly exceed 5mm. Furthermore, the deep pockets did not appear to be accompanied by gingival hyperplasia.

Table 1 shows the prevalence of periodontal lesions in incisors and cheek teeth. The number of periodontal pockets ranged from 2 to 9 lesions per animal. Periodontal pockets were more prevalent between mandibular third premolar and first molar (58.3%), at maxillary third premolar (50%), between maxillary third premolar and first molar (45.8%), at first incisor (41.7%) and at maxillary first molar (37.5%). Representative periodontal lesions observed at dental sites are shown in Figure 1.

Bovine periodontitis occurs under specific epidemiological conditions and is associated with the presence of anaerobic bacterial microflora (Döbereiner and others 2000, Borsanelli and others 2015a, Borsanelli and others 2015b), as previously

reported in ovine (Frisken and others 1989, Ismael and others 1989, McCourtie and others 1990, Riggio and others 2013) and equine periodontitis (Kennedy and others 2016). In the present study, we observed the predominance of lesions in the masticatory teeth, with older animals having a greater frequency of periodontitis lesions. In humans, the concept of increasing periodontitis incidence as an inevitable consequence of aging has been questioned and this increase in incidence probably more truly represents the cumulative effect of prolonged exposure to real risk factors (Papapanou and others 1991). Although the sample size of this study is limited and there are no criteria for epidemiological surveys of this nature in animals, the results show the need to consider the impact of periodontal disease on productivity and animal welfare. Performing epidemiological surveys in slaughterhouses may provide a tool that will result in observations that are indicative of the actual prevalence of periodontal disease in herds. This may alter the common perception that dental disease is of little consequence in the ruminant population. It is likely that bovine periodontitis will impact significantly on the welfare of affected animals, since it can be a chronic painful condition leading to difficulty in feeding with consequential loss of body condition and weight, increased susceptibility to disease and decreased productivity. Oral pain may only have subtle effects on the behavior of cattle, and thus dental disease is easily ignored or missed.

This study suggests that periodontitis may be a cause of hidden financial loss to farmers and a reason for culling animals. From a veterinary perspective, examination of the teeth of cattle is an essential part of any clinical investigation, whether to estimate age or as a possible cause of low productivity. Functional teeth are essential for cattle health and optimisation of productivity. Dental disease should always be considered with clinical signs such as weight loss or poor weight gain, salivation or

dropping of cud and impaction of food in the cheek.

It was not possible to determine why the cattle in the study were sent for slaughter; some were prime cattle and others were cull animals that were failing to perform. This is the first study to demonstrate that periodontitis is not uncommon in slaughtered cattle in the West of Scotland and is clearly an overlooked problem of cattle to date.

TABLE 1. Location of periodontitis lesions in 24 cattle slaughtered in the West of Scotland

	Teeth	Maxillary lesions N	Bilateral Lesions N	Mandibular lesions N	Bilateral lesions N
Incisors	First incisor	--	--	10	8
	Second incisor	--	--	8	5
	Third incisor	--	--	5	2
	Fourth incisor	--	--	1	1
Premolars and molars*	PM1	0	0	0	0
	PM1/PM2	1	0	2	0
	PM2	4	0	4	1
	PM2/PM3	4	0	5	1
	PM3	12	4	2	0
	PM3/M1	11	3	14	7
	M1	9	3	3	1
	M1/M2	6	2	3	0
	M2	4	2	2	0
	M2/M3	1	0	0	0
	M3	0	0	0	0

*PM1, first premolar; PM2, second premolar; PM3, third premolar; M1, first molar; M2, second molar; M3, third molar.

Number of periodontal pockets per animal: 2 lesions (4 animals); 3 lesions (4 animals); 4 lesions (5 animals); 5 lesions (2 animals); 6 lesions (5 animals); 7 lesions (3 animals); 9 lesions (1 animal).

References

BORSANELLI, A. C., GAETTI-JARDIM JR, E., DÖBEREINER, J. & DUTRA, I. S. (2015) *Treponema denticola* in microflora of bovine periodontitis. *Pesquisa Veterinária Brasileira* **35**, 237–240.

BORSANELLI, A. C., GAETTI-JARDIM JR, E., SCHWEITZER, C. M., DÖBEREINER, J. & DUTRA, I. S. (2015) Presence of *Porphyromonas* and *Prevotella* species in the oral microflora of cattle with periodontitis. *Pesquisa Veterinária Brasileira* **35**, 829–834.

ISMAIEL, M. O., GREENMAN, J., MORGAN, K., GLOVER, M. G., REES, A. S. & SCULLY, C. (1989) Periodontitis in sheep: a model for human periodontal disease. *Journal of Periodontology* **60**, 279–284.

DÖBEREINER, J., INADA, T. & TOKARNIA, C.H. (1974) “Cara inchada”, doença peridentária em bovinos. *Pesquisa Agropecuária Brasileira* **9,** 63–85.

DÖBEREINER, J., DUTRA, I. S., ROSA, I. V. & BLOBEL, H. (2000) “Cara inchada” of cattle, an infectious, apparently soil antibiotics-dependent periodontitis in Brazil. Pesquisa Veterinária Brasileira **20**, 47–64.

FRISKEN, K. W., LAWS, A. J., TAGG, J. R. & ORR, M. B. (1989) Environmental influences on the progression of clinical and microbiological parameters of sheep periodontal disease. *Research in Veterinary Science* **46**, 147–152.

HOLT, S. C. & EBERSOLE, J. L. (2005) *Porphyromonas gingivalis, Treponema denticola* and *Tannerella forsythia*: the ‘red complex’, a prototype polybacterial pathogenic consortium in periodontitis. *Periodontology 2000* **38**, 72–122.

INGHAM, B. (2001) Abbatoir survey of dental defects in cull cows. *Veterinary Record* **148**, 739–742.

KENNEDY, R., LAPPIN, D. F., DIXON, P. M., BUIJS, M. J., ZAURA, E., CRIELAARD, W., O’DONNELL, L., BENNETT, D., BRANDT, B. W. & RIGGIO, M. P. (2016) The

microbiome associated with equine periodontitis and oral health. *Veterinary Research* **47**, 49.

MCCOURTIE, J., POXTON, I. R., BROWN, R., WHITTAKER, C. R., SPENCE, J. A. & AITCHISON, G. U. (1990) A longitudinal study of the cultivable subgingival anaerobic bacteria isolated from sheep during the development of broken mouth periodontitis. *Journal of Medical Microbiology* **31**, 275–283.

PAGE, R. C. & SCHROEDER, H. E. (1982). Periodontitis in other mammalian animals. In: Periodontitis in Man and Other Animals: A Comparative Review. pp 58–221.

PAPAPANOU, P. N., LINDHE, J., STERRETT, J. D. & ENEROTH, L. (1991) Considerations on the contribution of ageing to loss of periodontal tissue support. *Journal of Clinical Periodontology* **18,** 611–615.

RIGGIO, P.M., JONSSON, N. & BENNETT, D. (2013) Culture-independent identification of bacteria associated with ovine 'broken mouth' periodontitis. *Veterinary Microbiology* **166,** 664–669.

Figure legend

Figure 1. A: Presence of gingival recession with root exposure and periodontal pockets deeper than 10 mm between the third premolar and the first molar left maxilla of a 2-year-old Aberdeen Angus. B: Presence of gingival recession with exposure of furca and periodontal pockets deeper than 10 mm in the second molar left maxilla of a 11-year-old Holstein Friesian.