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DISEASE IN WILDLIFE OR EXOTIC SPECIES

Dental Abnormalities in Eight Captive Giant Pandas (*Ailuropoda melanoleuca*) in China

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Summary

Dental data from eight adult giant pandas (*Ailuropoda melanoleuca*) (four females and four males) were collected at the Beijing Zoo from February 2009 to July 2010. Examination findings were recorded in dental charts. All the pandas had different degrees of tooth wear. Incisors, canines and second premolars had the most abnormalities. Five animals had caries; molars were the most affected. Chip fractures were found in seven teeth (incisor, canine and premolar) of five pandas; two had complicated fractures of their canines. Premolars and other teeth were missing in three pandas. Different degrees of dental plaque and calculus were found in all animals. Two pandas had mild gingivitis; the depth of periodontal pockets in all pandas was normal (0–2 mm). Five pandas had abnormal tooth mobility. Samples of dental plaque were collected for microbial culture. Two hundred and fifty-three bacterial strains belonging to 48 species of 23 genera were isolated. *Streptococcus*, *Moraxella*, *Peptostreptococcus* and *Porphyromonas* were the dominant genera. Further research with larger sample sizes of free-ranging and captive giant pandas will be required in order to demonstrate the absence of the premolar tooth, tooth fractures and the relatively low prevalence of periodontal disease in captive giant pandas.

Keywords: dental abnormalities; giant panda; oral microflora; periodontal abnormalities

Introduction

Dental diseases are very common among domestic and wild animals and may cause health problems such as anorexia, difficulty foraging, malnutrition and gastrointestinal, cardiovascular, renal and other systemic disorders (Wallach and Boever, 1983; Hungerford *et al*., 1999; Bellows, 2004; Holmstrom *et al*., 2004; Zhang, 2007; Stromquist *et al*., 2009). Without appropriate treatment, dental problems can be life threatening (Wallach & Boever, 1983; Hungerford *et al*., 1999; Zhang, 2007; Stromquist *et al*. 2009). In general, dental and periodontal diseases are associated with oral bacteria, incorrect food composition, bad chewing habits, poor oral hygiene and poor physical status (Wallach and Boever, 1983). Most studies of dental diseases have focused on companion and domestic animals. Studies of dental diseases in wild animal species are rare, especially in free-ranging and captive giant pandas (*Ailuropoda melanoleuca*) (Hu, 2001; Zhang, 2007; Stromquist *et al*., 2009).

A normal adult giant panda has 42 teeth, including incisor (I), canine (C), premolar (P) and molar (M) teeth. The dental formula of these animals is 2(I 3/3, C 1/1, P4/4, M2/3) (Beijing Zoo, 1986). The average lifespan of captive giant pandas is longer than wild giant pandas at approximately 25 years (Hu, 2001; Zhang, 2007). Greater longevity and highly refined diets contribute to the development of tooth abnormalities, periodontal diseases and other dental problems (Hu, 2001; Stromquist *et al*., 2009).

Previous dental studies of fossilized giant panda skulls have shown that giant pandas have a high prevalence of dental caries, tooth wear and tooth loss (Wang, 1961). Dental caries are mainly caused by oral microorganisms, which can adhere to, and grow on, the surface of a tooth. An aggressive immune response against these microorganisms will cause inflammation of the periodontal tissues and cause gingivitis or periodontitis (Savage *et al*., 2009). The oral microbial flora and microbiological

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activity pattern of giant pandas is largely unknown (Yang, 2008). The aim of the present study was to evaluate the dental and periodontal status and the oral microbial flora of captive giant pandas.

Materials and Methods

Study Animals and Immobilization

From February 2009 to July 2010 dental data and samples of dental plaque were collected from eight adult giant pandas (four males and four females) housed at the Beijing Zoo. Five of these animals were under anaesthesia for physical examination, semen collection or artificial insemination. Immobilization was by remote drug delivery system (Dan-Inject blowpipe systems; Model 125 Zoo; DAN-INJECT, Børkop, Denmark) with 3 ml darts and 2.0 × 40 mm barbed needles filled with ketamine (4–6 mg/kg, intramuscularly). The total duration of anaesthesia was approximately 45 min. The time allowed for dental examination and dental plaque sample collection was 15 min. With the help of caretakers, three tame giant pandas were examined awake on three to five occasions over a 1-week period (about 5 min on each occasion) with mouth gags and dental mirrors. Samples of dental plaque were collected with the help of their keepers. Pre-examination training was also given to familiarize the animals with the examination routine. Dental radiology was performed on two animals (numbers 3 and 7; Table 1) within 4 h of their death, as part of a necropsy examination.

Dental Examination

All dental examinations and plaque sample collections were performed by YJ. Findings were recorded on a dental examination chart modified for giant pandas (Fig. 1). Seven indices were evaluated, based on an overall average impression of the mouth, including: plaque index (PI), calculus index (CI), gingival index (GI), periodontal index (PDI), mobility index (MI), furcation involvement (F) and tooth wear (TW). Periodontal pocket depth and furcation involvement was evaluated for each tooth with a dental explorer probe (Jorvet-937cn-EXPLORER/PROBE 23/12; Jorgensen Laboratories Inc., Loveland, Colorado, USA) (Bellows, 2004; Holmstrom *et al.*, 2004) and the deepest single site was recorded. Tooth fractures, caries and missing teeth were noted. Dental caries were defined as a discoloured area of the tooth surface into which a dental explorer could be inserted and which offered slight resistance when removed (Stromquist *et al.*, 2009). Fig. 1 shows the items inspected and the grading scales used. The tooth numbering system used in this study is the modified Triadan system (Floyd, 1991).

Collection of Dental Plaque

Teeth were divided into four quadrants: left and right mandibular dental arcade, and left and right maxillary dental arcade. Dental plaque was scraped from the surface of the worst effected tooth and the gingival sulcus with a sterilized dental curette (Jorvet-937gn-COLUMBIA 4r-4l; Jorgensen Laboratories). Samples were diluted and oscillated in 5 ml 0.9% saline and stored in an anaerobic collection tube (BD Vacutainer™ Brand Anaerobic Specimen Collector; Becton Dickinson, Franklin Lakes, New Jersey, USA). The diluted samples were then streaked onto

Table 1
Results of dental examinations

No	*Age (years)*	*Gender*	*Existing health problems*	*PI*	*CI*	*GI*	*PDI*	*MI*	*TW*	*Pocket depth*	*Tooth fracture*	*Tooth missing*
1	3	M	None	1	1	0	0	0	1	<1 mm	None	308
2	10	F	None	2	1	0	0	0	1	1 mm	303 (chip), 406 (chip)	None
3	11	M	Haemorrhagic enteritis, death	2	1	0	0	1	1	1–2 mm	307 (chip)	None
4	12	F	None	1	1	0	0	0	1	<1 mm	103 (chip)	None
5	15	M	None	3	1	1	1	1	2	2 mm	None	305, 405
6	17	F	Corneal ulceration and cataract in right eye	2	2	1	1	1	2	1–2 mm	None	305
7	18	F	Hydropericardium, congestive heart failure, death	2	2	0	0	1	3	1–2 mm	104, 404 (chip)	None
8	21	M	Arrhythmia, chronic renal failure	1	2	0	0	1	3	1 mm	304 (chip), 404 (chip), 104	None
Prevalence of abnormalities:												
Affected tooth/total tooth (%)				–	–	–	–	–	–	–	2.71	1.2
Affected animals/total animals (%)				100	100	25	25	62.5	100	–	62.5	37.5

No, animal number; M, male; F, female; PI, plaque index; CI, calculus index; GI, gingival index; PDI, periodontal index; MI, mobility index; TW, tooth wear; tooth numbering system used is the modified Triadan system (Floyd, 1991).