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## Correspondence

# The role of human dentists in the oral health care of conservation animals: A comparison of cases among three zoos in Taiwan



## KEYWORDS

Human dentists;  
Human dentistry;  
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Dental treatment;  
Conservation animals

Dental medicine has historically benefited from animal model research. It is clear that many modern procedures and medicines would not exist without the help of animal experiments. Interestingly, as human dentistry developed directly from this assistance, veterinary dentistry also developed indirectly. This is becoming increasingly important as we strive to improve our understanding of the apparent oral similarities and differences between animals and humans.<sup>1</sup> In addition to our pets, as society places greater emphasis on conservation animals, we realize that these improvements directly benefit the field of wildlife conservation. Not only is it advisable to monitor current progress in the field, but it is also worth exploring the interaction of veterinary dentistry with human dentistry. In this article, we searched and analyzed press release of dental treatment for conservation animals in three zoos in Taiwan and reported the different medical models for dental treatment of conservation animals.

In this analysis, the press release of Taipei Zoo, Hsinchu Zoo, and Shoushan Zoo in Taiwan from their websites was used to search for cases related to dental treatment for conservation animals. Only 14 medical events of dental treatment for 8 different kinds of conservation animals from 2011 to 2023 were extracted. The characteristics of the different medical models for dental treatment of

conservation animals acquired from press release of the three zoos in Taiwan are shown in [Table 1](#). The conservation animals received dental treatment were western lowland gorilla ( $n = 2$ ), giant panda ( $n = 2$ ), pony ( $n = 1$ ), white handed gibbon ( $n = 1$ ), African lion ( $n = 1$ ), and Formosan black bear ( $n = 1$ ). Among 14 medical events, the life stage of the treated conservation animals spanned from baby stage to elderly stage. The reasons for medical treatment were routine oral or dental examination ( $n = 9$ ) and known dental problems including tooth crown fracture ( $n = 4$ ) and tooth decay ( $n = 1$ ). Among 4 cases of tooth crown fracture, the canine was the most common tooth, followed by the incisor. The tooth crown fracture usually caused pulp exposure or gingival fistula of the affected tooth. The treatment for the tooth with crown fracture was usually root canal treatment to preserve the affected tooth for a metal crown fabrication. A new technology of vital pulp therapy for human dentistry and subsequent metal crown fabrication were applied in case B, which might be the world's first case of dental treatment for the giant panda. To the best of our knowledge, this is the first analysis of human dentists involved in the oral health care of conservation animals in Taiwan. We summarized three medical models for the dental treatment of conservation animals as follows: 1) Collaboration of zoo veterinarians and Wildlife

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**Table 1** Characteristics of the different medical models for dental treatment of conservation animals acquired from the press release of three zoos in Taiwan.

Zoo (foundation time)	Case	Animal name (species)	Event time	Life stage	Reason for medical treatment	Treatment modality	Medical model personnel
Taipei Zoo (1914)	Case A	Western lowland gorilla	2011	Elderly	Cardiac function assessment and tooth decay treatment	Under general anesthesia, heart examination and dental fillings for carious tooth were performed at the same time.	Collaboration of zoo veterinarians, cardiologists, and dentists
	Case B	Giant panda	2013	Young adult	Oral examination	Under general anesthesia, a health check and oral examination were carried out. A dentition stone cast making was also performed.	Collaboration of zoo veterinarians, physicians, dentists, and giant panda experts
			2018	Adult	Crown fracture of the left maxillary canine with pulp exposure	Under general anesthesia, emergency dental examination and vital pulp therapy including removal of local inflamed pulp tissue and mineral trioxide aggregate (MTA) pulpotomy were performed. Then, a metal crown was fabricated and cemented on the fractured canine.	Collaboration of zoo veterinarians and Wildlife Health Care and Medical Team including veterinarians, anesthesiologists, and dentists
			2020	Adult	Oral examination	The 3-dimension full-mouth scan was performed to prepare for future dental care.	Collaboration of zoo veterinarians and Wildlife Health Care and Medical Team including veterinarians, professors of veterinary medicine, anesthesiologists, physicians, and dentists
			2022	Adult	Oral examination	Under general anesthesia, a health check including the follow-up of the metal crown of the left maxillary canine was carried out.	Collaboration of zoo veterinarians and Wildlife Health Care and Medical Team including veterinarians, professors of veterinary medicine, anesthesiologists, and dentist
	Case C	Giant panda	2014	Baby	Dental examination	A dental checkup was performed without general anesthesia.	Zoo veterinarians

*(continued on next page)*

Table 1 (continued)

Zoo (foundation time)	Case	Animal name (species)	Event time	Life stage	Reason for medical treatment	Treatment modality	Medical model personnel
			2015	Child	Dental examination	A dental checkup was performed without general anesthesia.	Collaboration of zoo veterinarians and dentists
			2020	Young adult	Oral examination	Under general anesthesia, a health check and oral examination were carried out. The construction of a dentition model and 3-dimension full-mouth scan were performed to prepare for future dental care. No tooth decay was found.	Collaboration of zoo veterinarians and Wildlife Health Care and Medical Team including veterinarians, professors of veterinary medicine, anesthesiologists, physicians, and dentists
			2021	Young adult	Crown fracture of the left mandibular incisor resulting in pulp exposure	Under general anesthesia, a health check and dental treatment were carried out. The root canal treatment of the fractured incisor was performed to preserve the tooth root for continued observation.	Collaboration of zoo veterinarians and Wildlife Health Care and Medical Team including anesthesiologists and dentists
	Case D	Western lowland gorilla	2016	Young adult	Oral examination	Under general anesthesia, a health check including oral examination was carried out. A slight periodontal disease and tooth decay were found and treated.	Collaboration of zoo veterinarians, professors of veterinary medicine, and dentists
Hsinchu Zoo (1936)	Case E	Two ponies	2023	Adult	Dental examination	Occlusion adjustment was performed to avoid malocclusion caused by attrition of teeth.	External veterinarians
Shoushan Zoo (1978)	Case F	White handed gibbon	2019	Elderly	Crown fracture of the right maxillary canine with gingival fistula and severe attrition of other three canine teeth	Under general anesthesia, the root canal treatment and metal crown fabrication were performed for four canine teeth.	Veterinarians with specialties of dentistry and surgery from an animal hospital
	Case G	Two African lions	2022	Adult	Dental examination	Under general anesthesia, the full-mouth scaling was performed. One of them, medication was used to relieve toothache caused by the root resorption.	Veterinarians with specialties of dentistry and surgery from an animal hospital
	Case H	Formosan black bear	2023	Adult	Crown fracture of bilateral maxillary canine teeth with pulp exposure and bleeding	Under general anesthesia, the root canal treatment and metal crown fabrication were performed.	Veterinarians with specialties of dentistry and surgery from an animal hospital

Health Care and Medical Team including veterinarians, anesthesiologists, physicians, and dentists in Taipei Zoo; 2) Veterinarians with specialties of dentistry and surgery from an animal hospital in Shoushan Zoo; and 3) External veterinarians in Hsinchu Zoo. Among them, human dentists play an important role in the medical models for the dental treatment of conservation animals in Taipei Zoo.

Since the world's first dental school (the Baltimore College of Dental Surgery) was established in 1840, human dentistry and veterinary dentistry have moved towards two completely separate knowledge systems.<sup>2</sup> However, veterinary dentistry had a long period of small advances since the Renaissance.<sup>3</sup> In 1762, the first veterinary dental school established in Lvon, France was proved to be the most important first step in the recent development and explosion of veterinary dental knowledge.<sup>4</sup> Currently, veterinary dentistry is recognized as a specialty by the American Veterinary Medical Association.<sup>5</sup> Although veterinary dentistry has a long history and the development of human dentistry in the past is based on it, the explosive growth of modern human dentistry knowledge should directly benefit the veterinary dentistry. We believe that the human dentistry and veterinary dentistry should not be completely separated, on the contrary, they need to have more common development fields and further collaboration. The medical model of collaboration of veterinarians and dentists for the oral health care of conservation animals is a good demonstration.

### Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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### References

1. Easley K. Veterinary dentistry: its origin and recent history. *J Hist Dent* 1999;47:83–5.
2. Robinson JB. The Baltimore College of dental surgery and the Baltimore College of dental surgery, dental school, University of Md. *J Md State Dent Assoc* 1975;18:98–101.

3. Harvey C. The history of veterinary dentistry part one: from the earliest record to the end of the 18th century. *J Vet Dent* 1994; 11:135–9.
4. Eisenmenger EZK. *Veterinary dentistry*. Philadelphia: Lea and Febiger, 1985.
5. Emily P, Penman S. *Handbook of small animal dentistry*. New York: Pergamon, 1990.

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