Introduction
The domestic dog suffers from oral and dental problems similar to those seen in man. The most common oral disease is periodontal disease. The majority of dogs over 3 years of age have periodontal disease to an extent that warrants treatment.\(^1\) Several studies have investigated the relationship between food texture and oral health in the dog.\(^2\)\(^3\)

In a review of the literature on the subject, it was concluded that further research is needed to better define the relationship between dietary regimen and oral health in the dog and cat.\(^4\)

The domestic dog has been used extensively in research as a model for human periodontal disease.\(^5\)\(^6\)\(^7\)\(^8\) This study investigates the possibility of using the African wild dog (Lycaon pictus) as a model for the domestic dog on a "natural" diet. In this report, "African wild dog" indicates a non-domesticated, free-living specimen of Lycaon pictus, and "captive wild dog" indicates a specimen of Lycaon pictus that has been bred in captivity.

In a study that compared mandibulodental relationships, it was found that the African wild dog is more closely related to the domestic dog than previously thought.\(^9\) The dental formula is the same for both species and previous studies indicate that the African wild dog shows similarities with its domestic relative in the pattern of oral diseases seen.\(^10\)\(^11\) Dental lesions were typically found in the adult animal (>3 years), and the lesions found were more severe with increasing age.\(^11\) Traumatic dental injuries appear to be less common in the African wild dog than in wolves and hyenas.\(^12\)

The African wild dog (Lycaon pictus) was first described in 1820 and is a member of the order Carnivora, family Canidae. Their closest living relative is the South American bush dog (Speothos venaticus). The African wild dog weighs approximately 20-35 kg and lives in packs of 2-50 individuals. In these packs, there is generally only one reproductive pair, called the Alpha male and Alpha female. In some situations, a Beta female might also breed in the same season as the Alpha female. With two females lactating at the same time, there is increased cooperation between them in caring for their litter.

The litter sizes are far larger than most carnivores, ranging from 12 (typically) to 19 pups.\(^13\)

The cooperation seen in packs of African wild dogs is extensive. By means of regurgitation, they ensure that the nutritional needs of young, old or diseased pack members are met. Their life span is only about 5 years in the wild (Kruger National Park) as they are vulnerable to both predation (lions) and disease (especially canine distemper virus infection). The mortality rate among juveniles is high (20-50% in the first year).\(^14\)

Material and Methods
Thirty-seven (37) African wild dog skulls from the Kaffrarian and Transvaal museums and the Kruger National Park were examined. Most of the specimens date back to the early 20th century. Ages of the animals at the time of death were not available and permission to extract teeth from these valuable skulls to determine age by tooth sectioning was understandably not granted.

Each skull was inspected macroscopically and radiographically. Pathology was identified and recorded for each specimen. No statistical corrections were made for any teeth lost due to poor preservation techniques. The radiographs were taken of each specimen in rostral occlusal (maxilla and mandible), and oblique (maxilla) and lateral (mandible) views. These radiographs were used to assess the status of the tooth roots, periodontium, and alveolar bone. Data resulting from the macroscopic and radiographic evaluations were recorded on forms designed for this purpose.

Results
Of the 37 skulls examined, seven were juvenile animals with a mixed dentition and one skull originated from a zoo specimen. The juvenile skulls and zoo specimen skull were excluded from the examinations reported here. The remaining 29 skulls were pooled as results for "adults."

As in the domestic dog, the lower third molar is the tooth often absent in the African wild dog. A missing fourth maxillary premolar tooth (presumed to be congenitally absent since there was no radiographic evidence of an alveolus) was seen in one specimen (Fig. 1). A second specimen also had a missing premolar tooth (maxillary third), but since an alveolus was visible radiographically this was considered an acquired defect rather than a congenital absence (Fig. 2). One skull exhibited a malformed upper incisor tooth (Fig. 3).

One specimen had lesions resembling enamel hypoplasia on the maxillary left third incisor and canine teeth (Fig. 4).
Fig. 1 (A, B): Missing maxillary fourth premolar tooth, which was considered to be congenitally absent as there was no detectable alveolus radiographically.

Although no cephalometric studies were performed, the typical canine interlock pattern and the commonly seen overlap and rotation of maxillary premolar teeth (Fig. 5) could indicate a tendency towards maxillary brachygnathism (marked wear facets mesially and distally on the mandibular canine teeth, mesially on the maxillary canine teeth and distally on the maxillary third incisor teeth) (Fig. 6). Eight of the 29 (28%) specimens showed overlap and rotation of the maxillary premolar teeth. Two of the 29 (7%) also had overlap and rotation of the mandibular premolar teeth. No specimens had overlap and rotation of the mandibular premolar teeth only.

Twenty-four skulls (83%) showed signs of attrition of most teeth (Fig. 7). Fourteen of the 29 skulls (48%) had one or more fractured teeth, most of which were complicated.

Fig. 2 (A, B): Specimen with missing maxillary third premolar tooth. Since an alveolus is visible radiographically, this was considered to be an acquired defect.

Fig. 3 (A, B): Malformed maxillary third incisor tooth on the left side and an oronasal communication on the right side as a result of a complicated tooth fracture. The oronasal defect and the root remnant are obvious radiographically.

Fig. 4: Specimen with lesions resembling enamel hypoplasia on the maxillary third incisor and canine teeth.
fractures (pulp exposed in the fracture line). Six
skulls (21%) showed evidence of endodontic pathol-
ogy as seen by well demarcated radiolucent areas
around the apex of the root (Fig. 8). All of these
periapical lesions were associated with pulpal ex-
posure as a result of tooth crown or root fracture. One
skull also had an oronasal communication as a con-
sequence of a complicated incisor tooth root fracture
(Fig. 3).
Periodontitis lesions were diagnosed based on
more prominent vascular foramina and slightly
rougher texture of the alveolar bone crest, bone loss
(Fig. 9) and tooth instability.15 Twelve of the 29
(41%) specimens had evidence of periodontitis of
one or more teeth based on these criteria. Calculus
deposits were evident on only two specimens; these
were mild deposits on most teeth.
A dark brown cavity resembling a caries defect was
identified with a dental explorer on the occlusal sur-
face of the right maxillary first molar tooth in one
specimen. Verification was not possible as we were
not permitted to extract the tooth for further inves-
tigation.

Discussion
This preliminary survey of the oral and dental sta-
tus of the African wild dog indicates that the wild
dog is affected by conditions similar to those seen in
the domestic dog (periodontal disease, fractured
teeth). The infrequent observation of calculus (2 of
the 29 skulls) could be attributed to the preparation
of the skulls, which were boiled in acidic solution
(which would dissolve the calculus).
As already mentioned, the African wild dog is very
susceptible to canine distemper. The two teeth in
one specimen which had lesions consistent with
camellia hypoplasia were probably associated with
localized trauma or infection rather than a sequel of
canine distemper, as a generalized distribution of the
lesions would be expected to result from distem-
per.16 The African wild dog’s main source of food con-
sists of small- to medium-sized antelope such as
impala (Aepyceros melampus) and they require a
powerful bite to catch their prey and tear it apart.
It is speculated that the relatively short upper jaw,
resulting in attrition of canine teeth and rotation of
the maxillary premolar teeth, is an adaptation that
makes the animal more successful in its environment.
The short maxilla will allow for a more powerful bite
than is possible in a mesaticephalic or dolicocephalic
animal. This may also result in fewer traumatic tooth
injuries than are seen in the longer-nosed wolves.12
It is possible that the price paid is increased plaque
accumulation due to the overlap and rotation of the
premolar teeth. This may predispose the African
wild dog to periodontitis in situations where they
live longer. Further studies with living animals are
required to investigate this hypothesis.
Our study shows a higher prevalence per animal of
tooth fractures (48%) compared to a previous study
(18%) on African wild dogs.12 However, in the pre-
vous study, a tooth was considered to be fractured
only where significant wear was present. Most of the
fractured teeth that we examined had only slight to
moderate wear. The fact that some of these teeth
presented with endodontic lesions (visible on radi-
ographs) must indicate that significant or severe wear
as an indicator of a tooth fracture is probably too
conservative a criterion in this species. African wild
dogs often die at a young age and will not have
severely worn teeth. Another study, evaluating
prevalence of dental problems macroscopically,
found a low prevalence of dental problems (17%).11
In domestic dogs and cats, combining macroscopic
and radiographic inspection of the oral cavity detects
more pathology.17
Wild carnivores are believed to be less affected by
oral disease than their domestic counterparts, mainly due to their diet. This has led to a recommendation that the domestic dog should be fed a diet consisting mainly of raw meaty bones, and the domestic cat a diet containing lightly boiled chicken wings, as a means of preventing or reducing oral diseases and any possible systemic consequences. The evidence to support such a recommendation is lacking. This study and several others have shown that oral and dental diseases are prevalent in wild carnivores or those fed a more “natural” diet.

The spectrum of oral disease seen in wild canids and felids is very similar to that of the domesticated carnivores, including periodontal disease, traumatic tooth injuries with pulp exposure, and endodontic complications. Predators with a higher bone content in their diet have a higher prevalence of tooth fractures. These findings suggest that the natural diet of the wild carnivore does not protect the animal from oral and dental diseases.

This study did not compare findings in free-living wild dogs to captive-bred animals, as no captive-bred animal skulls were included. The present study was limited to skulls boiled in acidic solutions, so evaluations of soft tissue and dental deposits were not possible.

The African wild dog is a species threatened by extinction. Examination of free-living and captive animals would allow us to identify common oral and dental problems and plan for interceptive handling. If there is a difference in prevalence of disease between free-living and captive-bred wild dogs, it would be useful to identify the possible causes. Such research could make a significant contribution to the successful management of healthy captive wild animals.

Acknowledgements

We wish to acknowledge the support and advice received from Dr. Gus Mills, Senior Scientist at the Kruger National Park.

References


Author Information

From the Dept. of Surgery (Dental Clinic), Onderstepoort Vet Faculty, University of Pretoria, Private Bag X4, Onderstepoort PO BOX 1010, South Africa. (Steenkamp) and 17 Burnt House Lane, Pilley Near Lymington, Hampshire, SO41 5QN, United Kingdom (Gorrel).

Fig. 8: Endodontic pathology associated with the root remnants of a maxillary third premolar tooth.

Fig. 9: Periodontitis (prominent vascular foramina and slightly rougher texture of the crestal alveolar bone, bone loss, and tooth instability) affecting the maxillary fourth premolar tooth.