Turkish Journal of Veterinary & Animal Sciences

Volume 27 | Number 2 Article 10

1-1-2003

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Turk J Vet Anim Sci
27 (2003) 349-357

Research Article

Diagnostic Approach to the Prevalence of Feline Periodontal Disease

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Received: 24.08.2001

Abstract: Periodontal disease in cats was investigated with respect to clinical, radiological and microbiological evaluations. Each tooth group was evaluated according to plaque index, gingival index, sulcus bleeding index, calculus index, periodontal disease index, furcation exposure index, feline odontoclastic resorptive lesions (FORL) and tooth mobility. The prevalence of the disease was evaluated statistically. Upper and lower premolars were affected by periodontal disease at a higher rate than others. Tooth loss was often observed in incisives, premolars and canines concurrently. Sub and/or supragingival calculus accumulations occurred in lower incisive, upper canine and upper premolar teeth, in increasing order. FORL was observed in 69 teeth of the 54 cats evaluated. In the microbiological evaluation of oral flora, the aerobic bacteria observed were Neisseria sp., Alpha hemolytic streptococcus, *S. epidermis*, non-hemolytic streptococcus, *S. aureus* and *E. coli*, while the anaerobic bacteria observed were Bacteroides sp., Porphyromonase sp., Gram (-) bacillus, and Gram (-) coccus.

Key Words: Periodontal disease, cat, diagnosis, prevalence

Kedilerin Periodontal Hastalık Prevalansına Diagnostik Yaklaşım

Özet: Kedilerin periodontal hastalığı klinik, radyolojik ve mikrobiyolojik yönden araştırıldı. Her diş grubu plak indeksi, gingival indeks, sulkus kanama indeksi, periodontal hastalık indeksi, furkasyon ekspojur indeksi, kedi kariesi, ve diş mobilitesine göre değerlendirildi. Hastalığın prevalansı istatistiksel yönden araştırıldı. Üst ve alt premolar dişlerin diğerlerine oranla daha fazla peridontal hastalıktan etkilendiği anlaşıldı. Diş kaybı sırasıyla insisiv, premolar ve kanin dişlerde daha fazla görüldü. Sub ve/veya supragingival kalkulus sırasıyla alt insisiv, üst kanin, ve üst premolar dişlerde daha yüksek derecede belirlendi. Değerlendirilen 54 kedinin 69 dişinde kedi kariesi saptandı. Mikrobiyolojik değerlendirmede kedi ağız florasında aerob bakteri olarak Neisseria sp., Alpha hemolitic streptococcus, *S. epidermis*, non-hemolitic streptococcus, *S. aureus* ve *E. coli*, anaerob bakteri olarak da Bacteroides sp., Porphyromonase sp., Gram (-) basiller, Gram (-) kok'lar saptandı.

Anahtar Sözcükler: Periodontal hastalık, kedi, tanı, prevalans

Introduction

Periodontitis, a common cause of tooth loss in dogs and cats, is an inflammatory response of the periodontium to bacteria, which can be a result of systemic disorders like endocarditis and nephritis (1-3). Feline periodontal disease can be a severely debilitating condition that progresses from gingivitis to periodontitis and ultimately to tooth loss. Severely affected cats show a reluctance to take food and water and intensive care should be taken (4,5).

Teeth are affected to different degrees by periodontal disease because of their size and functions, species and regions of the mouth (6). Numerous studies have been done on periodontal disease in dogs with large parameters (7-10). A few investigations have aimed to determine the prevalence of feline periodontal disease in respect of which tooth was affected to what level. However, studies based on the bacteriological and radiological evaluation of feline periodontal disease are limited in number and in content (2,11). Both the smaller structure of feline teeth and the presence of feline odontoclastic resorptive lesions (FORL) make diagnosis and treatment more difficult than in dogs (2,12).

The estimation of the prevalence of feline periodontal disease in respect to the tooth groups, and maxillar/mandibular teeth was the aim of the present study. Clinical and radiological examination were used to determine which teeth were affected and to what extent. Feline oral aerobic and anaerobic flora were investigated and correlated with bacteriological and clinical findings.

Materials and Methods

Fifty-four cats of different breeds, ages, and sexes, presented to the Department of Surgery, Faculty of Veterinary Medicine, Ankara University were included in the study between September 1998 and August 2000. The age range of the cats is presented in Table 1.

Table1. The age range of the cats.

Age Range	Number of Cats
≤ 3 years old	15
> 3 years old ≤ 6 years old	20
> 6 years old ≤ 9 years old	12
> 9 years old ≤ 12 years old	7

All cats were examined under general anesthesia with atropin sulphate (Atropin- 0.02 mg/kg, sc), Xylazin hydrochloride (Rompun-Bayer, 1 mg/kg, im) and ketamin hydrochlorure (Ketalar-Parke Davis, 15 mg/kg, im). Dental calculus was harvested from premolars with the highest amount of calculus accumulation for the purpose of microbiological examination. Plaque index, calculus index, periodontal disease index, gingival index, sulcus bleeding index, furcation exposure index, FORL, and tooth mobility were examined clinically (5).

Radiological examinations: Ninety-five moderately and severely affected teeth were evaluated radiologically to determine the range of destroyed bone tissue in order to make a prognosis. All the teeth with FORL were also examined radiologically to detect the limits of the lesion and to decide on either treatment or tooth extraction.

Microbiological examinations: Dental calculus samples were collected in tubes containing 5 ml saline and mixed for 10 s by a Fisher Vortex Genice (Scientific Industries Inc. Bohemia, NY). After excluding supernatant fluid, 0.5-1 ml suspensions were evaluated. For aerobic bacterial examinations, a sample of this suspension was inoculated onto 5% ovine blood agar, and eosine methylene blue (EMB). For anaerobic bacterial examinations, the samples were inoculated onto anaerobic blood agar, kanamycine-vancomycine agar and Bacteroides bile esculin agar (13). Gram staining was carried out on the samples. Aerobic plates were incubated at 35 ºC for 5 days and anaerobic plates were incubated at 35 ºC in anaerobic jars for 7 days. The first evaluations of the aerobic and anaerobic plates were performed after 48 h. Reincubations were done in plates where reproduction was not detected. For anaerobic bacteria, aerotolerance tests were applied at the first step. Obligatory anaerobic bacteria were identified by using Gram-stain morphology, colony appearance, and sensitivity reaction to kanamycine-vancomycine and colistin.

Statistical Analysis: Clinical values were evaluated with the Chi-square test. The relationship between the indexes was evaluated with phi and Cramer's V tests.

Results

Twenty-two of the 54 cats evaluated were male and the rest were female; their ages ranged from 2 to 14 years old (mean 6). According to the breed, the cats were divided into Persian (1), Turkish Angora cat (4), Siamese (3), and mongrel groups (46). According to the history taken from the cat owners, the cats had previously had nephritis-cystitis (5), enteritis (1), hypersensitivity (1), upper respiratory disease (1) and paraplegia due to spinal trauma (1). It was determined that eight cats were fed with commercially available dry food and 46 cats were fed with kitchen food.

For this study we evaluted 457 incisive, 203 canine, 470 premolar and 183 molar teeth; 191 incisive, 13 canine, 70 premolar and 33 molar teeth losses were determined at the first examination.

Tooth loss for the upper premolar (UP) was higher than for the lower premolar (LP) ($p < 0.01$), but there was no positive correlation between upper and lower teeth according to tooth loss in other tooth groups. Incisive loss was significantly higher than the other types, but the difference between upper and lower teeth was not significant ($p > 0.05$). In the evaluated animals, 29.48% incisive, 6.02% canine, 12.96% premolar and 15.28% molar losses were detected at the mean age of 6 years.

The plaque index had a higher degree in the upper incisive (UI), upper canine (UC) and UP than the lowers (Figure 1), but the lower molars (LM) had a higher degree than the uppers ($p < 0.01$). Calculus was settled supragingivally in 12 incisives, 17 canines, 45 premolars, and 13 molars and either sub and supragingivally in 26 canines, 137 premolars, and 36 molars (Figure 2). According to evaluation of the calculus accumulated teeth; lower incisive (LI), UC and UP had higher degrees ($p < 0.01$).

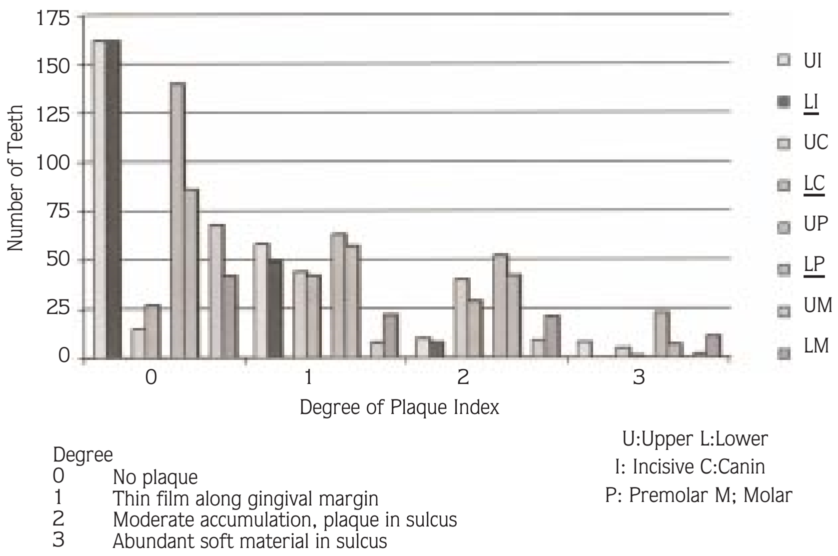


Figure 1. Plaque index; while upper incisive, canines and premolars were affected more than lowers, LM was affected more than UM.

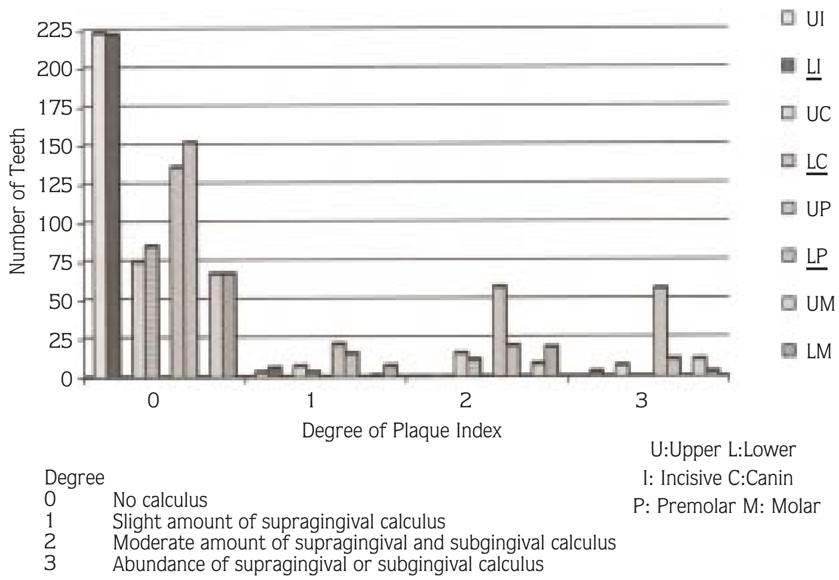
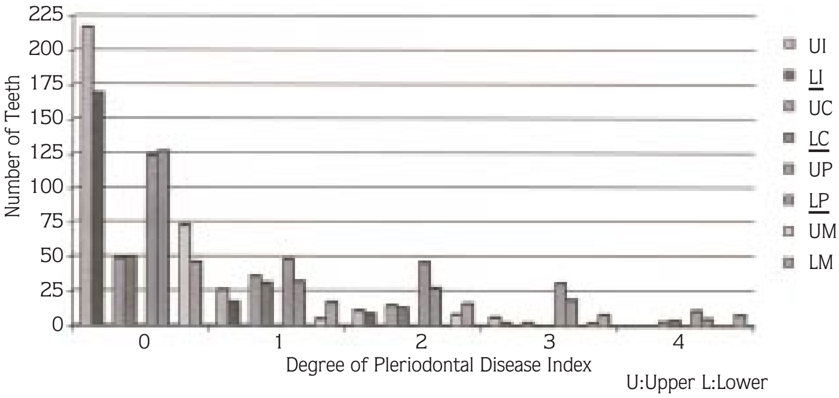


Figure 2. Calculus index; UC and UP had more calculus than lowers.

In the periodontal disease index, the buccal or labial surface of the tooth was more affected than the lingual surface. UI and UP were affected to a higher degree than the lowers; however, LM was affected to a higher degree than the uppers ($p < 0.01$). The proportional dispersion of affected teeth in different degrees of periodontal disease was 54.65% in canines, 53.67% in premolars, 39.26% in molars and 17.83% in incisives (Figure 3). Sulcus bleeding and gingival index findings were in correlation with the periodontal disease index (Figures 4 and 5).

Furcation exposure was seen in 105 premolars and 38 molars in 32 of the 54 cats to different degrees (Figure 6). Six of the 32 cats were fed with commercial diets. UP and LM was affected to a higher degree than LP and upper molars (UM).

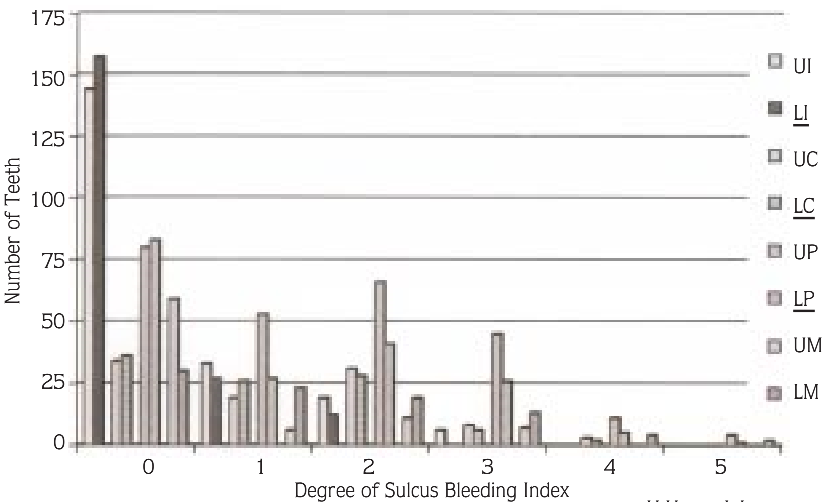
FORL was detected in 24 of the 54 cats, and its dispersion was 45 premolars (22 LP, 23 UP), 22 LM and 2 LC. The degrees of FORL and affected teeth are listed in Table 2. Three of the 69 teeth with FORL had a lesion on the lingual surface and the rest had one on the buccal surface (Figure 7).



U:Upper L:Lower
I: Incisive C:Canin
P: Premolar M: Molar

Degree	Attachment Loss %	Probing Depth mm	Cat
0	Normal	0	< 0.5
1	Gingivitis	0	< 0.5
2	Early	< 25	< 0.1
3	Moderate	< 50	< 2.0
4	Severe	> 50	> 2.0

Figure 3. Periodontal disease index; UI, UC, and LM had a higher degree of periodontal disease.



U:Upper L:Lower
I: Incisive C:Canine
P: Premolar M: Molar

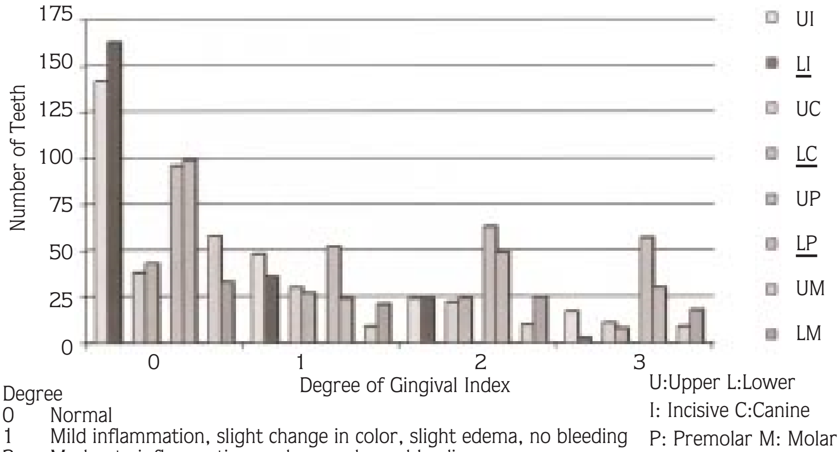
Degree	
0	Healthy appearance no bleeding
1	Apparently healthy, slight bleeding from sulcus when probing
2	Bleeding on probing, color change, no swelling or edema
3	Bleeding on probing, change in color, slight edema
4	Bleeding on probing, change in color, obvious edema
5	Bleeding on probing, spontaneous bleeding

Figure 4. Sulcus bleeding index.

According to mobility, incisive teeth were affected more severely than others, and the lower incisives were less affected than the uppers ($p < 0.05$) (Figure 8). In seven of 34 cats microbiologically examined, anaerobic bacteria did not reproduce. The results of detected bacteria are introduced in Table 3. Radiological evaluation of the teeth affected by periodontal disease seemed essential, especially in determining the degree of bone tissue destruction.

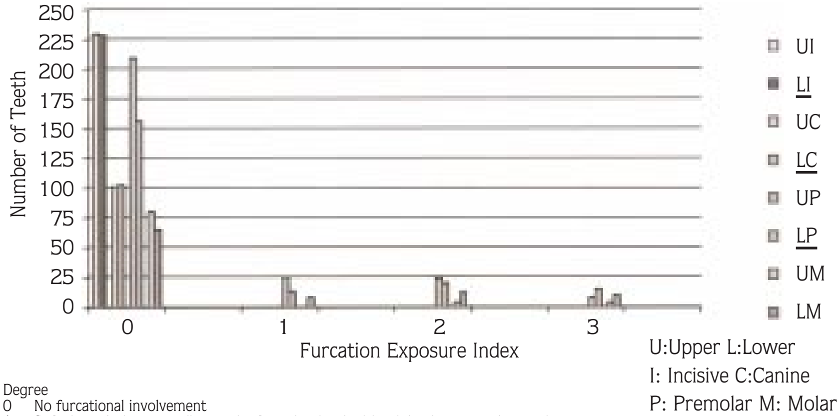
Discussion

Shorthair, Somali, Abyssinian and other pure breed cats are predisposed to periodontal disease (2,5).



Degree
0 Normal
1 Mild inflammation, slight change in color, slight edema, no bleeding
2 Moderate inflammation, redness, edema, bleeding
3 Severe inflammation

Figure 5. Gingival index.



Degree
0 No furcational involvement
1 Soft tissue lesion extending to the furcation level with minimal osseous destruction
2 Soft tissue lesion combined with bone loss that permits a probe to enter the furcation from one aspect but not to pass completely
3 Lesions with extensive osseous destruction that permits through and thorough passage of the probe

Figure 6. Furcation exposure index; in the UP and LM had a higher degree of furcation exposure.

FORL	1st degree	2nd degree	3rd degree	4th degree	5th degree
Incisive					
Canine		2 teeth			
Premolar	6 teeth	10 teeth	17 teeth	7 teeth	5 teeth
Molar	3 teeth	6 teeth	9 teeth	3 teeth	1 tooth

Table 2. The teeth affected by different degrees of FORL.

Mongrel cats have been found to be the most affected breed despite the limited number of cases included in the study. According to our results the cats that did not receive proper home dental care were predisposed to periodontal disease. The necessity of home dental care has been reported and stated by many authors for the prevention of periodontal disease in both dogs and cats (1,6,14). Almost all of the owners were not aware or lacked knowledge of dental care for cats which consists of tooth brushing, appropriate diet and a periodic dental check. These results indicate that cat owners should be educated on this subject because it is thought that feline dental home care is different from that of dogs due to neurological temperament. It can be checked by oral examination during routine visits to veterinary clinics, and treatments require anesthesia.

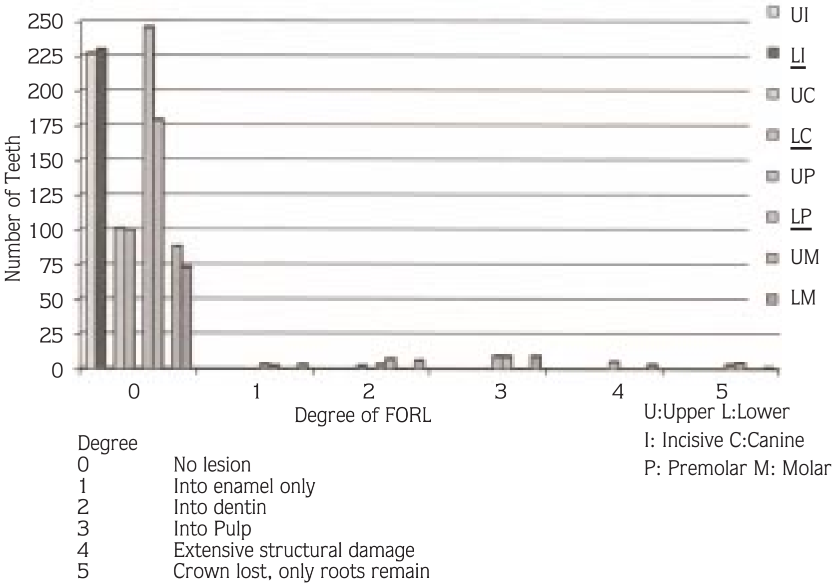


Figure 7. Caries index; Forl was detected in the UP, LP, and LM groups more than other tooth groups.

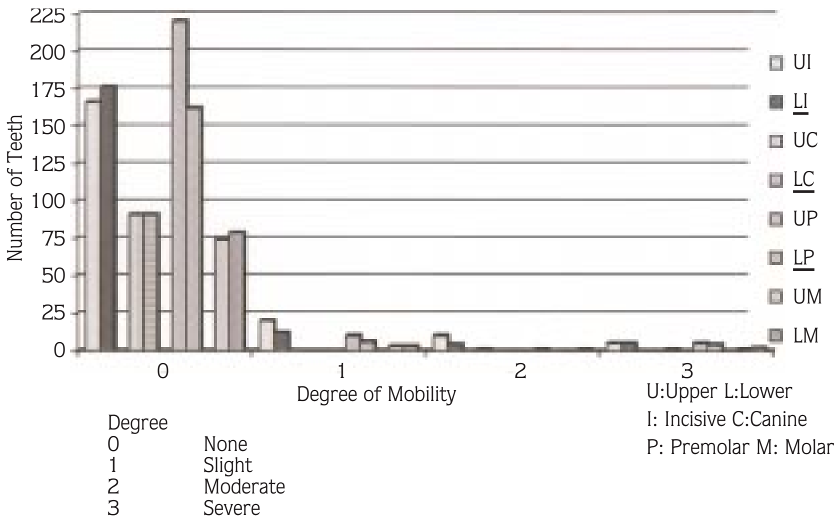


Figure 8. Mobility index; LI had higher degrees of mobility than UI, and either LI or UI had a higher degree of mobility than the others.

The relationship of periodontal disease with concomitant systemic disease like Feline Leukemia Virus (FeLV), Feline Immunodeficiency Virus (FIV), Feline Calicivirus (FCV) and uremia has been reported (1,5,6,15). Eight cases had histories of systemic disease and the owners reported that they had not checked for oral discomfort. It could not be determined whether systemic disease results from or causes periodontal disease. The interaction of periodontal disease and diet is well known. Both the physical peculiarity and chemical composition of the diet are important factors in periodontal disorders. Cranium differentiation as a result of evolution was suggested as a likely cause of periodontal disease (5,6). The results of our study were supported by previous studies, but the presence of periodontal disease in cats fed with commercially available dry food suggest that this situation might be attributed to the lack of masticator habits.

The earliest tooth loss was seen in the incisive group and generally this loss happened in the second year in cats. Early tooth loss can be seen in adult cats (2). Tooth loss and mean age are listed in the results according to tooth group. As one case had a long-term history of oral

Table 3. Bacteria reproduced by the dental calculus of the cats.

Cat	Aerobic	Anaerobic
1	Neisseria sp., Staph. aereus, S. epidermidis	Fusobacterium sp
2	Neisseria sp., S. epidermidis	Gram (-) bacillus
3	Neisseria sp, S. epidermidis, Beta hemolytic streptococcus	-
4	Neisseria sp., S. epidermidis, Nonhemolytic streptococcus	Gram (+) coc, Bacteroides fragilis
5	Neisseria sp., Nonhemolytic streptococcus	Bacteroides fragilis
6	Alfa hemolytic streptococcus, Neisseria sp,	Gram (-) coc
7	E. coli	-
8	Neisseria sp, S. Epidermidis	Bacteroides sp, Gram (+) coc
9	S. epidermidis, Nonhemolytic streptococcus	Gram (-) coc,
10	S.epidermidis, Neisseria sp.	Lactobacillus sp.
11	E. coli, S. aereus, Proteus sp., Alpha hemolytic gram (+) streptococcus	-
12	Neisseria sp., S. Epidermidis	Bacteroides sp., Fusobacterium sp., Gram (+) coc
13	Neisseria sp., Gram (-) coccobacillus	Porphyromonase sp., Gram (-) bacillus
14	Enterobacter sp.	Gram (-) bacillus, Gram (-) coc
15	E. coli, Alpha hemolytic streptococcuscus	Porphyromonase sp. Actinomyches Sp., Gram (-) coc
16	Pseudomonase aeroginosa	Porphyromonase sp.
17	Neisseria sp., E. coli, S. Epidermidis	-
18	S.aereus, Neisseria sp., E. Coli, Beta hemolytic streptococcus	-
19	S. epidermidis, Neisseria sp., E. Coli	Gram (-) bacillus
20	S. aereus, Neisseria sp., Nonhemolytic streptococcus	Porphyromonase sp.
21	Neisseria sp., S. Aereus	Bacteroides sp.
22	Neisseria sp., S. epidermidis, Nonhemolytic streptococcus	Bacteroides sp.
23	Coliphorm, Neisseria sp	Bacteroides sp.
24	Neisseria sp., Alpha hemolytic streptococcus	-
25	Neisseria sp. S. Epidermidis	Bacteroides sp.
26	Neisseria sp., S. Epidermidis	-
27	Neisseria sp., S. Epidermidis	Bacteroides sp.
28	Neisseria sp., S. Epidermidis	Gram (+) bacillus
29	Neisseria sp., Alpha hemolytic streptococcus	Gram (-) bacillus
30	Neisseria sp., S. epidermidis	Gram (-) coc
31	Neisseria sp.	Bacteroides sp.
32	Neisseria sp., S. epidermidis	Veillonella sp. Porphyromonase sp.
33	Neisseria sp., S. epidermidis, E. coli	Bacteroides fragilis
34	Neisseria sp.	Porphyromonase sp.

discomfort, it was considered that the results of tooth loss could be a periodontal problem. UPs were affected to a higher degree than LPs, but it was interpreted that this was due to the higher number of UPs.

Dental plaques accumulate first on the premolar and molar teeth. Dental calculus is seen generally on the buccal surface, and sometimes on the lingual surface of the UP and LM (2,16). UI, UC, UP and LM teeth had more dental calculus than the rest. Dental calculus was situated either sub- or supragingivally but generally it accumulated on the buccal surface of the maxillar and lingual surface of the mandibular teeth. The fourth UP tooth is where the most dental calculus accumulated in cats (2,17,18). Either sub- or supragingival dental calculus was observed in premolars more frequently. According to the periodontal index findings, the buccal surfaces of the teeth were affected more seriously than the lingual surface.

In the present study, multi-rooted teeth with the furcation exposure, which are directly correlated with the existence of periodontal disease with either horizontal or vertical bone loss were observed in 105 premolar (49 UP, 56 LP) and 38 molar teeth. Furcation exposure was 22.34% in premolar and 20.77% in molar teeth of all examined in our study group.

Anaerobic Gram (-) bacteria are detected in subgingival plaque after microbiological examination of a cat. In progressive cases, increased Bacteroides spp. and *Peptostreptococcus anaerobius* were observed. Porphyromonase spp. and Actinomyces spp. were isolated from cats with periodontal disease and healthy cats, but Peptostreptococcus is isolated only in patients (4-6,19). Due to the absence of the studies about feline dental calculus microbiology, comparative results could not be obtained. Neisseria and *S. epidermis* were the main aerobic, while Bacteroides spp., Porphyromonase spp and Gram (-) bacillus were the main anaerobic bacteria isolated.

When alveolar bone loss occurs, tooth mobility will be increased and generally the extraction of this kind of tooth is easy (17,20,21). Our research results supported those of previous studies and we observed that increased tooth mobility seems parallel to the existence of periodontal disease, except for the incisives.

Although FORL can occur in every tooth, it is generally observed in premolars and molars and the incidence of the disease varies from 20% to 67%. The lesion is mostly situated on the buccal surface, but is rarely seen on the lingual surface of the tooth (2,12). FORL was observed in 9.57% of premolars, 12.02% of molars and 0.98% of canines of all those examined in our group. The dispersion of FORL was 65.22% in premolars, 31.88% in molars and 2.90% in canines of 68 FORL teeth. During the treatment of cat periodontal disorders, FORL, which was found to a noticeable degree (44.44%) in the present study, should be taken into account for the long-term survival of teeth

In conclusion, the prevalence of periodontal disease in respect to the tooth groups will be helpful in the patho-physiology of the disease and as reference values for new studies. Anaerobic bacteria should be given attention during treatment. Further studies should be performed with a larger number of subjects to determine the prevalence of feline periodontal disease.

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