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RESEARCH ARTICLE

A Retrospective Study on Periodontal Diseases in Companion Animals

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Abstract

The present study was conducted on 320 pet animals including 100 dogs, and 220 cats admitted to the clinic of the Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Zagazig University. A thorough oral and dental examination was performed for all animals. Radiographic imaging was conducted on animals that showed clinically progressive periodontitis and bony changes. Animals were classified into five scores according to their clinical dental examination and pocket depth. Animals with a score of 0, had healthy gingival tissue with normal pocket depth, a score (1) of those managed by dental scaling, and scores (2 and 3) of those treated by dental scaling and then non-surgical debridement. Open flap surgery was performed for more advanced cases; scores (4 and 5). Data were statistically analyzed using Chi-square and cramers v tests to investigate the relationship between age, diet, and sex to periodontal affection. Among the total number of admitted animals (N=320), 40.6 % (130 cases) showed periodontal diseases, 8.8% (28 cases) dogs and 31.9% (102 cases) cats. Affected males (24.4%) were higher than females (16.3%). Among the 130 animals with periodontal diseases, 142 affections were recorded. Age and diet showed high statistical significance ($P<0.001$). Sex showed to be statistically insignificant, ($P>0.05$). The cramers v test results for age and periodontal disease association showed a value of (0.490) and strong association between age and periodontal diseases.

Keywords: Alveolar bone resorption, Furcation Exposure, Gingivitis, Gingival Recession, periodontitis.

Introduction

Periodontium is the tooth-supporting structure includes the following structures: gingiva, periodontal ligament, cementum and alveolar bone [1]. Periodontal disease is the most encountered disease in dogs and cats [2]. Historically, it was believed that a rise in bacterial populations was the root cause of periodontal disease. On the premise of periodontal tissues, the nonspecific plaque theory was based. Actually, host response and bacterial virulence cooperate to govern the progression of periodontal disease. [1]. The host response frequently causes damage to the periodontal tissues. Gingivitis and periodontitis are the two subtypes of periodontal disease [3]. The condition known as gingivitis causes the gingiva to become red and swollen. Because the periodontal ligament, cementum, and alveolar bone are destroyed because of the inflammation of the tissues supporting the tooth, attachment loss eventually occurs. Although irreversible, periodontitis is frequently treatable [3,4]. Periodontitis: inflammation of periodontal tissue, has some local consequences such as the recession of gingiva and bone resorption [5]. A periodontal pocket and gingival recession may occur, or both because of the ongoing deterioration of these tissues caused by this infection. By correctly removing calculus and plaque, mild to moderate periodontal pockets can be diminished or even eliminated. Periodontal bone loss may never fully heal, though (without regenerative surgery) [3]. Additionally, the tooth becomes mobile and finally falls out because of ongoing

bone loss and attachment loss [6]. Systemically, periodontal disease affects cardiovascular, hepatic, and renal systems due to circulating organism. Diabetes has also been demonstrated to be a risk factor for periodontal disease. Periodontal abscesses and ulcers in the mucous membranes can form as the illness continues, both of which can be exceedingly painful. Early-stage periodontal disease is not associated with severe pain or discomfort. Plaque removal can be accomplished by mechanical (brushing, scaling, ultrasonic scaling, and dental chew) and chemical methods (chlorhexidine gluconate, and specific diet) [7-10]. As an animal gets older, periodontal disease becomes more common and severe, and early detection and treatment can often prevent more serious problems later in life [11]. The main goal of this study is to record, assess and statistically analyze the relationship and effect of some factors as age, diet and sex with the occurrence of periodontal disease in dogs and cats admitted to Surgery, Anesthesiology and Radiology department clinic of Faculty of Veterinary Medicine, Zagazig University.

Materials and Methods

Animals

This study was conducted on the clinical cases of dogs and cats (total no.=320, 100 dogs and 220 cats) admitted to the clinic of the Department of Surgery, Anesthesiology and Radiology, Faculty of Veterinary Medicine, Zagazig University for 18 months (from December 2020 to July 2022). Animals handling and surgical procedure were performed according to the Institutional Animal Care and Use Committee, Zagazig University under the approval number of ZU-IACUC/2/F/56/2022.

Oral and dental examination

Animals were physically examined (assessment of cardiovascular, respiratory systems and temperature). Oral and dental clinical examinations were performed following a standardized protocol of examination (Figure 1) [12]. The tooth surface and gingiva were assessed using a dental explorer and Williams's periodontal probe. Bones of the mandible, maxilla and teeth roots were assessed using radiographic imaging for those suffered from advanced periodontitis. A modified scoring system of Kyllar [13] was used to assess gingival and periodontal tissue health (Table 1).

Control and anesthesia

Dogs and cats were sedated using Xylaject *(Xylazine HCL 2%, ADWIA, Egypt),* at an intramuscular, dose of (1 mg per Kg BW) [14].

Propofol *(Propofol 1%, Fresenius Kabi Global, Egypt)* at an intravenous, dose of (4mg per Kg BW) was used to induce and maintain general anesthesia for radiographic examination and case management.

The lateral oblique position of the head with an open mouth was used to obtain radiographic images. Animals were managed in lateral recumbency for surgical interference (Figure 2).

Management of affected cases

Animals with a score (1) were managed only by supra gingival plaque removal using an ultrasonic scaler *(Woodpecker Co, China)* [5, 15]. Scores (2 and 3) were managed through dental scaling at first then closed periodontal therapy was performed [5]. A subgingival curette was introduced under the gingival margin to remove the subgingival plaque layer with no reflection of the gingiva [15]. Scores (4 and 5) were treated by gingival flap surgery [16]. A dental scaling was performed 2 weeks before surgery. An incision was made using a surgical blade (#15) of the gingival layer. An envelope flap was elevated using a periosteal elevator to expose the bones of mandible or maxilla. A subgingival curette was introduced to perform a debridement of subgingival plaque Any detached tooth was extracted when detected. The reflected gingival flap was sutured in an interrupted manner using a polyglactin 910 (Vicryl, ETHICON Co., Egypt) with appropriate size (2/0 usp for dogs and 3/0 usp for cats).

Post-operative care

Chlorhexidine (0.125%) (Hexitol, ADCO, Egypt) oral antiseptic. Antibiotics, Amoxicillin-Clavulanic acid (Augmentin, GSK, UK) with a dose of (22mg/kg B, W per-os) and anti-inflammatory, Meloxicam (Mobitil, MUP, Egypt) with a dose of (0.2mg/kg intramuscular) administration for three consecutive days.

Data recording and analysis

The data was recorded in a designed survey sheet. Lesions along with some other factors such as age, sex, and type of diet were recorded. Animals were simultaneously affected with more than one affection at the same time, classified into four groups according to age. Group I (less than 6 months), II (Above 6 months up to 1 year), III (Above 1 up to 4 years) and IV (Above 4 years old).

Data were statistically analyzed with Chi-square and Cramers V tests using SPSS (version 28) computer software.

Figure 1: Extraoral picture of type I gingivitis characterized by line of erythematous inflammation **(A, Black arrow)** in an adult cat. Picture of gingivitis type II characterized by bleeding upon probing **(B, orange arrow)** in a senile tomcat. Type III gingivitis' extraoral appearance, which is marked by spontaneous bleeding **(C, blue arrows)** and the picture of caudal stomatitis in an adult baladi cat **(D, green arrow).**

Figure 2: Radiographic image in a lateral oblique position of an adult dog post-extraction of canine tooth due to retained root abscess.

Table1. A modified scoring system of Kyllar [13] for assessment of periodontal tissue.

Score	clinical picture	pocket depth
0	Healthy tissue with no abnormalities	0.5 mm for cats
	No bleeding while probing	1 mm for dogs
1	Gingivitis with slight inflammation	0.5 mm for cats
	No Bleeding while probing	1 mm for dogs
2	Gingivitis with inflammation and swelling	< 1mm for cats
	Bleeding induced by probing	< 2 mm for dogs
3	Gingivitis with severe inflammation and oedema	>2 mm for cats
	Spontaneous bleeding	>3 mm for dogs
	Early Periodontitis (Gingival recession and bone resorption may exist)	
4	Moderate Periodontitis	>2.5 mm for cats
	Gingival recession	>5 mm for dogs
	Furcation exposure	
	Bone resorption	
5	Severe Periodontitis	>3 mm for cats
	Gingival recession	>5 mm for dogs
	Furcation exposure	
	Bone resorption	

Results

Among the total cases of pet animals (N=320); dogs (100) and (220) cats were examined in the department clinic. 40.7 % (130 case) showed different scores of periodontal diseases, 8.8% (28 case) dogs and 31.9% (102 case) cats (Table 3). Among the 130 animals with periodontal diseases, 142 affections were recorded (Table 2).

Group II (Above 6 months up to 1 year), Group III (Above 1 up to 4 years) and Group IV (Above 4 years old). Group I (less than 6 months) did not illustrated in this table because no animal was found to be affected with periodontal doseases in this age group.

The affections were found to be higher in group III (Above 1 year up to 4 years old) with 81 cases (57%), followd by Group II (up to 1 year old) with 37 cases (26.1%) , then group IV (above 4 years old) with 24 cases (16.9) of the total recorded disorders presented to the department clinic . Gingivitis, gingival recession, furcation expousue, Gingivo stomatitis and Bone resorption constitutes 82.4%,6.4%, 3.5%, 2.1%, 5.6% out of the total recorded periodonitis affections (n=142), respectively.

Periodontal affections were recorded in 78 males (37.14%) and 52 females (47.3%) out of the total animals. The frequency distribution of periodontal affections in the examined male dogs versus female dogs was (15 cases, 18.99% versus 13 cases, 61.9%). On the other hand, 63 male cats (48.1%) had periodontal affections compared to 39 female cats (43.8%) (Table 3).

Animals on soft food diet were the most affected among total affected cases recorded by 97 cases (48 %), then comes after that, the group of animals on a mixed diet (soft and hard) food) with 27 cases (36.49%) and the last group of animals had dental disorders were on a dry or hard diet by 6 cases only (13.64 %) (Table 4).

The prevalence of age groups were performed and the results showed that , animals of group V (above 4years old , 78.13%) were the most affected group, then comes after that group III (from 1 to 4 years old, 56.7%), then group II (above 6 months to 1 year old). Group I did not illustrate any periodontal affcetions (Table 5).

There was a significant relationship between the two factors (Ages and Diet) and periodontal diseae , $X2(3 ,N=320) = 76.876$, $P <0.001$., $(2, N=320)= 18.392$, $P <0.001$ respectivley while, sex was statistically insignificant $P > 0.05$ (Table 6)

Referring to data in (table 5), a Cramer's V test was performed between age and

periodontal disease with a value of (0.490), signifigant p value (<0.001) and degrees of freedom = 2, indicates a strong association between periodontal diseases and age.

Table2. The frequency distribution of 142 recorded periodontal affections among the different age groups examined.

Disorder/Age	Group II	Group III	Group IV	Total
Gingivitis	31 (26.5%)	71 (60.7%)	15 (12.8%)	117 (82.4%)
Gingival recession	3 (33.3%)	3 (33.3%)	3 (33.3%)	9 (6.4.%)
Furcation Exposure	2 (40%)	2 (40%)	1 (20%)	5 (3.5%)
Gingivo stomatits	0	2 (66.7%)	1 (33.3%)	3 (2.1%)
Bone resorption	1 (12.5%)	3 (37.5%)	4 (50%)	8 (5.6%)
Total	37 (26.1%)	81 (57%)	24 (16.9%)	142 (100%)

Table 3. The frequency distribution of periodontal affections in the examined dogs and cat in relation to gender.

Gender	Result of physical examination in								
	All examined animals			Examined dogs			Examined cats		
	Total	Normal	Affected	Total	Normal	Affected	Total	Normal	Affected
Male	210	132 (62.9%)	78 (37.14%)	79	64 (81%)	15 (18.99%)	131	68 (51.9%)	63 (48.1%)
Female	110	58 (52.7%)	52 (47.3%)	21	8 (38.1%)	13 (61.9%)	89	50 (56.2%)	39 (43.8%)
Total	320	190 (59.38%)	130 (40.6%)	100	72 (72%)	28 (28%)	220	118 (53.6%)	102 (46.4%)

Table 4. The frequency and prevalence of affected animal's diet type.

Type of diet	Soft food	Mixed Diet	Dry food	Total
Total examined no.	202	74	44	320
No. of normal animals	105 (55.3%)	47 (27.7%)	38 (20%)	190
No. affected animals	97 (48.%)	27 (36.49%)	6 (13.64%)	130

Table 5. The association of age with the occurrence of periodontal diseases in dogs and cats.

	Age	Results of examination		Total
		Normal	Affected	
Groups	**Less than 6 months (Group I)**	65 (100%)	0	65
	Above 6 months to 1 year (Group II)	66 (64%)	37 (35.9%)	103
	Above 1 year to 4 years (Group III)	52 (43.3%)	68 (56.7%)	120
	Above 4 years (Group IV)	7 (21.9%)	25 (78.13%)	32
Total		190 (59.4%)	130 (40.6%)	320

Table 6. Statistical significance of age, sex, and diet as a risk factors corresponding to the occurrence of periodontal diseases.

Factor	Chi-square value (X^2)	df^x	*P* value
Age	76. 876	3	<0.001
Sex	3.071	1	0.080
Diet	18.392	2	<0.001

X= degree of freedom (df).

Discussion

Periodontal disease is considered to be the most commonly encountered disorder, among the total animals exposed to dental examination, this study showed that 40.6% (130 cases) was found to have periodontal diseases with different scores which agreed with, Neimiec [2]. In periodontal disease, gingivitis and periodontitis are two disorders that are identified, which agrees with our results [17,27]. Although it is understood that periodontitis does not usually develop from gingivitis, the risk of getting the condition rises with age and this agrees with our study, results of creamer v test indicated a significant (P <0.001) and strong association (value of 0.490, df = 2) of age and periodontal disease occurrence . Higher prervalence of affection was found to be in group IV (above 4 years old) (78.13% , 25/32 affected animals) . These results could be explained by the fact that gingivitis is an early stage of Periodontal disease, with a higher frequency in older animals. In this investigation, gingivitis was discovered higher prevalence, which agreed with Thengchaisri *et al*. [27] and Reichart *et al*. [28].

This study results showed that Crowded or miss-aligned teeth and crown fractures are predisposing factors for occurrence of periodontal disease as they contribute to the accumulation of bacterial biofilm leading to the accumulation of plaque layers, which by time leads to the formation of subgingival plaque and dental calculus which agrees with O′ Neill et al. [4]. Additionally, all cases of periodontal disease in this study were determined to be linked to either plaque (a yellowish biofilm produced by bacteria on the teeth) or dental calculus calculus (salivary minerals mineralized on soft plaque), both of which are bacterial biofilms that cause active gingival inflammation and progression into other periodontal tissues. These findings were in agreement with Niemiec, [2] and Hennet, [18]. The subgingival plaque's microorganisms secrete both toxins and metabolic waste products. The bacteria also create cytotoxins and bacterial endotoxins, both of which have the ability to independently infiltrate tissues and cause inflammation of the gingival and periodontal tissues. Gingivitis is the initial result of this inflammation, which harms the gingival tissues [5,6].

These enzymes will be released into the sulcus, causing the already vulnerable gingival and periodontal tissues to swell even more. Actually, the virulence of the bacteria and the host response collaborate to govern the progression of periodontal disease. The tissues of the periodontium are commonly harmed by the host response [19,20]. Additionally, the most under-treated issue in animal health is periodontal disease. Uncontrolled periodontal disease causes a number of grave local and systemic effects [29]. One of the main local sequence is bone resorption which lead to pathologic fractures and detached teeth , prognosis for pathologic fractures due to advanced periodontal disease is uncertain for a number of reasons, our study revealed that there was a prevalence of 5.6 % (8 cases) of bone resorption, this study findings agreed with Reichart *et al*. [28].

Animal diet has a major role in the initiation and progression of periodontal disease. Data analysis showed high statistical significance ($p < 0.001$) between diet and periodontal disease. Soft food diet leads to plaque formation (anaerobic bacterial biofilm with slimy material) [24]. Animals on soft food diet were (total number= 202, 97 cases found to be affcetd with a prevalence of 48 %) of the total affected animals. The type of diet constituents can also affect periodontal disease occurrence, these findings agreed with Gawor *et al*. [25]. Not only type of diet but also feed ingredients as proteins, minerals and vitamins deficiencies (especially Vitamin. A, B) cause degenerative changes in periodontium, marginal gingivitis, gingival hyperplasia and significant alveolar bone resorption[26] Gingivitis, gingival hypoplasia, crevicular epithelium development, and alveolar resorption can all be brought on by a vitamin A deficiency. For the epithelium to remain healthy, vitamin A is essential. Vitamin B complex deficiency is associated with

decreased resistance to bacterial assaults, and folic acid in particular is crucial for maintaining the health of periodontal tissues. Recent research suggests that a folic acid deficiency affects the periodontal tissue's ability to react to bacterial irritants [25,26].

Animals were given scores to classify and order the progression of the periodontal disease, and based on those scores treatment was initiated. Periodontal therapy was used to debride plaque and reduce gingival inflammatory response [15]. Non-surgical debridement (closed periodontal therapy) for animals with a score of 2, after Niemiec [2]. Open surgical periodontal therapy was performed in animals with advanced cases (scores 3 and 4) after Neimiec, [21] Following a thorough dental cleaning and in cases of periodontitis, antibiotic therapy is advised for cats and dogs.

Age has a strong statistical significance (P 0.001), according to data statistical analysis. Age had an effect on the likelihood of developing periodontal disease; the cramer v test revealed significant significance (P 0.001) and a strong connection (value = 0.490, df=2) that periodontal disease increases with age, which agree with Harvey *et al*. [22] and Garanayak et al. [23].

Analysis of this component revealed no statistical significance between periodontal disease and sex among the total affected animals, but the proportion of affected females was higher (47.3%, 52/110 affected cases) than affected males (37.14%, 78/210 affected cases) as found by Whyte *et al*. [17].

Conclusion

Age and diet showed to have high statistical significance meaning they had a major role in disease occurrence and progression while sex has no satistical significance. Data analysis also showed that there was an increase in periodontal disease with older ages.

Conflict of interest

There no conflict of interest.

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الملخص العربي

دراسة مرجعية علي أمراض اللثة فالحيوانات الأليفة

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أجريت هذه الدراسة على عدد 320 من الكلاب والقطط من الحالات الواردة إلي عيادة قسم الجراحة والتخدير والاشعة بكلية الطب البيطري، جامعة الزقازيق. بعد إجراء كشف للفم والاسنان. تم إجراء الأشعة السينية للحيوانات ثم تقييم للحيوانات التي تعاني من التهابات اللثة المتقدم وتغيرات في عظام الفك بعد الفحص الإكلينيكي وتقسيمها إلى خمس أقسام طبقا لكشف الأسنان الإكلينيكي وعمق جيب اللثة الي حالات قيمت بدرجة (صفر) وهي لا تعاني من أي أمراض في اللثة وعمق جيب اللثة طبيعي. بينما الحيوانات التي قيمت درجة (1) تم التعامل معها عن طريق تنظيف الأسنان الخارجي فقط، بينما درجة (2 و3) تم التعامل المبدئ معها عن طريق تنظيف الأسنان ثم إستخدام الكحت. أجريت جراحات اللثة للحالات الأكثر تقدما، التي قيمت بدرجات (4 و5). تم تحليل البينات المجمعة إحصائيا بإستخدام تحليل مربع كاي واختبار كرامر لتقصي العلاقة بين العمر، النظام الغذائي والجنس إلى أمراض اللثة. من خلال النتائج إتضح أن من بين الحالات الواردة للقسم وعددها 320 , (40,7%) كانوا يعانون من امراض اللثة، 8,8% (28 حالة) كلاب و31,9% (102 حالة) قطط. الذكور المصابة (24,4%) كانوا بنسبة أكثر من الاناث. من بين بين 130 حيوانًا مصابًا بأمراض اللثة، تم تسجيل 142 إصابة. العمر والنظام الغذائي يؤثران إحصائيا على أمراض اللثة بينما الجنس لايؤثر (أ أكبر من 0,05). كما أظهرت نتيجة اختبار كرامر أظهر ارتباط إيجابي (0,490) بين العمر وأمراض اللثة (درجة الحرية 2). وله تأثير إحصائي (أ اقل من 0,001).