HARRAN ÜNİVERSİTESİ VETERİNER FAKÜLTESİ DERGİSİ

Retrospective Evaluation of Dental and Gingival Health in 150 Dogs

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Abstract: The aim of this study was to calculate the prevalence of gingivitis, calculus, and traumatic dentoalveolar injury as a result of dental and gingival examinations of 150 dogs brought to Burdur Mehmet Akif Ersoy University Animal Hospital due to various health problems. In this study, dogs were examined by inspection without anaesthesia or invasive techniques. As a result of the examination, calculus (87.2%), gingivitis (60.7%) and traumatic dentoalveolar injuries (51.3%) were found in the majority of patients at rates higher than the reported prevalence values. It was emphasised that if existing diseases are not treated, the general health of the patient may be adversely and irreversibly affected.

Keywords: Calculus, Dog, Gingivitis, Oral examination, Traumatic dentoalveolar injuries.

150 Köpekte Retrospektif İnspektif Diş ve Gingiva Sağlığı Değerlendirilmesi

Özet: Bu çalışmada Burdur Mehmet Akif Ersoy Üniversitesi Hayvan Hastanesine çeşitli sağlık problemlerinden dolayı getirilen 150 köpeğin inspektif olarak diş ve gingiva yönünden gerçekleştirilen muayeneleri sonucunda gingivitis, kalkulus ve travmatik dentoalveoler yaralanma prevalanslarının hesaplanması amaçlanmıştır. Bu çalışmada, köpekler anestesi ve invazif teknikler kullanılmadan, inspeksiyon ile muayene edilmiştir. Muayene sonucunda hastaların çoğunluğunda, bildirilen prevalans değerlerinden daha yüksek oranlarda kalkulus (%87.2), gingivitis (%60.7) ve travmatik dentoalveoler yaralanmalar (%51.3) ile karşılaşılmıştır. Mevcut hastalıkların tedavi edilmediği takdirde ise hastanın genel sağlığının olumsuz ve geri dönülemez bir şekilde etkilenebileceği vurgulanmıştır.

Anahtar Kelimeler: Gingivitis, Kalkulus, Köpek, Oral muayene, Travmatik dentoalveoler yaralanmalar.

Introduction

Dentistry is one of the most overlooked and undervalued veterinary medicine services yet one of the most profitable (Lengyel, 2018). Practical assessments of oral health include gingival examination, calculus examination, and detection of traumatic dentoalveolar injuries (TDI) (Asproni et al., 2022; Soukup et al., 2015).

Traumatic dentoalveolar injuries include injuries to the supporting structures of the tooth, such as the tooth, alveolar bone, or periodontal ligament, caused by a direct force (Bilyard and Juriga, 2021; Soukup et al., 2015). TDIs can occur in situations such as vehicle accidents, blunt force trauma, falls, or masticatory activities. However, despite the suspected high prevalence, studies of TDI in animals have been historically neglected and studies of the epidemiology of TDI in dogs are limited; therefore, further research in this area is warranted (Capik et al., 2000; Mulherin et al., 2013; Soukup et al., 2015). When the pulp is exposed, it is referred to as a complex fracture and is associated with caries erosion. In such cases, the spread of pathogenic bacteria into the pulp canal or periapical region can lead to abscess formation. Complex fractures can result in pain, pulpitis, and pulpal necrosis (Soukup, 2018). If the infection progresses to the apical end of the root canal, it can lead to osteomyelitis and loss of surrounding bone (Holmstrom, 2019).

Malocclusion is defined as the misalignment of teeth in the dental arches when the mouth is closed (Bellows, 2022). Malocclusion can be caused by skeletal malocclusion, which is seen as an inconsistency in the length and/or width of the jaw; dental malposition, which refers to the abnormal placement of the teeth relative to each other or their position in the mouth; or a combination of both (Milella, 2015). Occlusion evaluation included assessment of cranial morphology, symmetry, and jaw length during the examination. The position of the teeth was then assessed by lifting the labium. The teeth were then checked for trauma and the oral soft tissues were checked for abnormalities (Southerden, 2017). Examination of the canines and premolars provides a good guide for assessing the occlusion and also helps to determine whether the malocclusion is due to skeletal or dental causes (Milella, 2015).

In malocclusion class 1, if the tooth is in an abnormallingual position, it can lead to ulceration and perforation of the palatum durum (Holmstrom, 2019). In malocclusion class 2, if left untreated, this malocclusion can lead to oronasal fistula formation in severe cases (Southerden, 2017). In Class 3 malocclusion, misalignment of the maxillary and mandibular premolars can be seen. This can cause trauma to the teeth, to wear and tear. In Class 4 malocclusion, irregular occlusion results in the mandibular canine teeth striking the maxillary palatum, gingiva, or labium. This can lead to periodontal disease, oronasal fistulae, traumatic pulpitis, and severe pain and infection, depending on the location of trauma. Traumatic pulpitis can lead to endodontic diseases or abscesses (Niemiec, 2010). Linguoversion of the mandibular canines causes obstruction of the crown tips by the palatal mucosa (Niemiec et al., 2017).

Periodontal disease is one of the most common diseases in veterinary clinical practice, affecting 80% of dogs over two years of age (Barbosa et al., 2023). The clinical inflammatory state of the periodontal tissues can be divided into two categories: gingivitis and periodontitis. Gingivitis is characterised by erythematous and swollen gingiva (Asproni et al., 2022). Periodontitis is a severe form of periodontal disease in which the periodontium is affected. Gingivitis occurs before periodontitis, but does not always lead to periodontitis (Reiter, 2018).

Periodontal disease begins with the accumulation of plaque on the tooth surface (Holcombe and Wallis, 2020). Within seconds of brushing, the dental pellicle begins to accumulate and within hours, gram-positive bacteria colonise the pellicle and begin to form a plaque biofilm. With the addition of bacterial by-products, plaque changes colour from ivory to yellow and greyish. Halitosis is caused by volatile sulfur compounds produced by oral bacteria. Mineralisation of the plaque biofilm leads to the formation of tartar. (Dodd & Lobprise, 2019). The color of the calcified part of the tooth crown can vary from dark yellow to dark brown (Lobprise 2021). Dental calculus causes irreversible damage to the tissues that support the teeth, such as the gingiva, alveolar bone, cementum, and periodontal ligament and also, as tartar progresses, tooth mobility and loss occur (Chain et al., 2020).

Chronic periodontitis can cause osteomyelitis of the maxilla or mandible. Tooth dislocation may occur due to periodontal disease, and the tooth may extrude from the alveolus (Niemiec et al., 2017). In geriatric and small-breed dogs, this can lead to iatrogenic fractures during tooth extraction. As the disease progresses, an oronasal fistula formation can also be observed (Marretta and McFadden, 2013). Bacteria involved in periodontal disease can migrate to other parts of the body with bacteremia and cause endocarditis, nephritis, and hepatitis by colonising the relevant sites (Bourguignon et al., 2012).

The aim of this study was to demonstrate that, in dogs examined retrospectively, the lack of control over dental and gingival health results in higher disease rates than the reported prevalence by other studies, and that the current situation may worsen as oral pathologies progress and reach irreversible points.

Materials and Methods

The number of patients in the study consisted of 150 dogs brought to Burdur Mehmet Akif Ersoy University Animal Hospital for various health problems between January-June 2023. The teeth and gingiva were examined by only inspection in order to examine without anaesthesia and scored for gingival index, calculus index and visual traumatic dentoalveolar injury. TDIs were classified as complicated, uncomplicated, or luxated TDIs based on the classification used by Soukup et al. (2015) (Figure 1) (Figure 2). To obtain diagnostic radiographs of the canine dentition, patients must
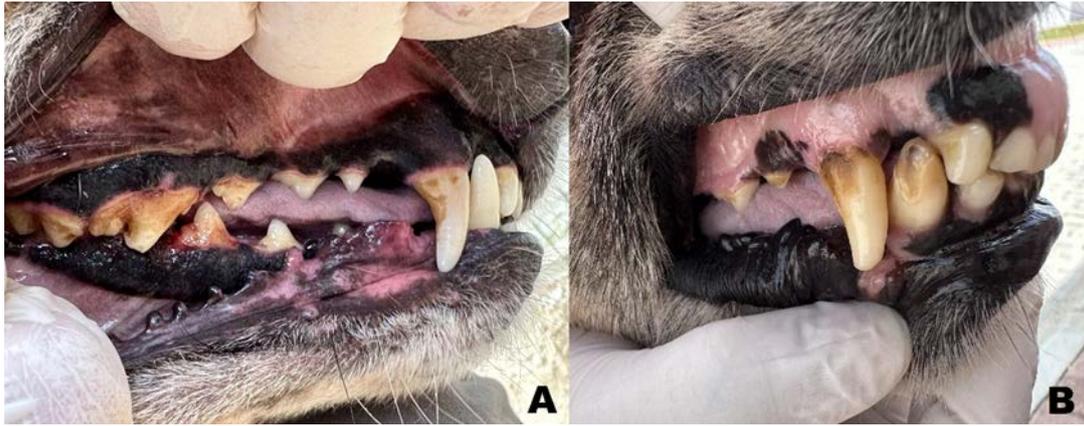
Figure 1. (A) Calculus 3.degree with 3.degree gingival index, also there is a uncomplicated fracture at 4.premolar tooth (108). (B) Complicated fracture at mandibular canine tooth (404).

Figure 2. (A) Lateral view of the teeth of a 4-year-old female dog with a gingival index of 2 and a calculus index of 2. In addition to gingival inflammation, the calculus covers 1/3-2/3 of the buccal tooth surface with minimal subgingival deposition. (B) Complicated fractured canine in a 3-year-old female dog.

be under general anesthesia (Bannon,2013). Owing to this fact, this study recorded data that could only be seen by inspection. (Figure 1) (Figure 2).

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Malocclusion: The angle classification system we used has been adapted from human dentistry to categorise veterinary dental occlusion by Bellows (2022) for felines. Class 0 represents a normal occlusion (Bellows, 2022). Class 1 shows a normal jaw relationship and the abnormal positioning of one or more teeth. Class 2 malocclusion are skeletal malocclusion in which the mandible is relatively shorter and usually narrower than the maxilla, so the teeth do not close normally (Southerden, 2017). It is considered to be an inherited trait unless it is the result of trauma (Dodd and Lobprise, 2019). Class 3 is a skeletal malocclusion with a long mandible or short maxilla. Class 4 is a special classification of mandibular and maxillary asymmetry, in

which class 0 or 2 is seen in one mandible and class 3 in the other maxilla (Bellows, 2022).

Gingival Index: Gingivitis scoring we used in this study, also known as the gingival index, has been used to assess gingival health (Niemiec, 2010). A gingival index score of zero meant that there was no inflammation of the gingiva. In grade one, the gingiva showed mild inflammation and slight changes in texture and colour. In the second degree, moderate inflammation, redness, oedema, hypertrophy and bleeding occur when pressure is applied to the gingiva. In the third degree, severe redness and hypertrophy of the gingiva is observed and spontaneous bleeding may occur when pressure is applied (Löe and Silness, 1963).

Calculus Scoring: In calculus scoring we used, at grade zero shows no calculus is seen on the tooth surface, at grade one shows the supragingival calculus covering <1/3 of the buccal tooth surface. In the second degree, a moderate calculus is seen, covering 1/3-2/3 of the buccal tooth surface with minimal subgingival deposition (Fig. 2.A). In the third

degree, there is a subgingival accumulation of calculus covering more than 2/3 of the buccal tooth surface (Greene and Vermillion, 1964).
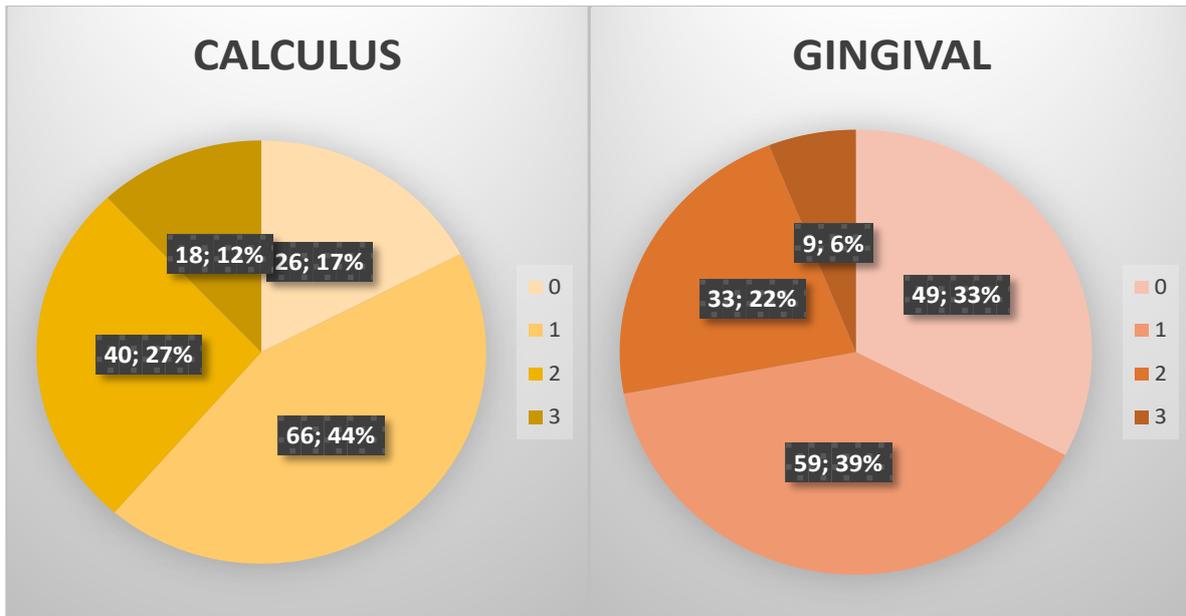
Results

Gingival Index: The number of dogs with a gingival index of 1 was 59 (39.3%), 33 (22%) with a gingival index of 2 and 9 (6%) with a gingival index of 3. After examination of 150 dogs, 49 (32.6%) dogs had gingival index 0. According to the data obtained, gingivitis was found in 101 (60.7%)

Calculus Index: Calculus index was scored as 1 in 66 (44%), 2 in 40 (26.6%) and 3 in 18 (12%) of 150 dogs in addition, 26 (17.3%) dogs had calculus index 0. According to the data obtained, calculus in 124 (87.2%) of the 150 dogs examined (Table 1).

Table 1. The gingival and calculus indices and percentages of 150 dogs examined by the inspection method are shown in the figure.
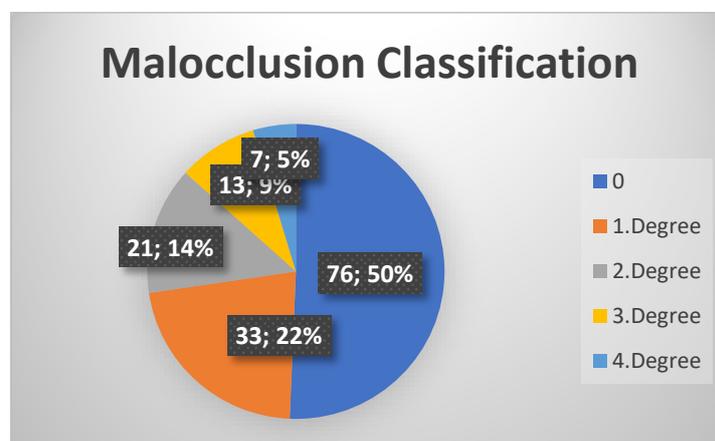

The numbers indicate the calculus degrees on the left and the gingival index degrees in the right.
0 represents, 0 degrees, 1 represents 1. degrees, 2 represents 2. degrees, and 3 represents 3. degrees.

Malocclusion Classification: As a result of the examinations, 33 (22%) dogs had grade 1 malocclusion, 21 (%14) dogs had grade 2. 13 (8%) dogs had grade 3 malocclusion and 7 dogs had grade 4 malocclusion. A total of 53 dogs were found to have malocclusions, of which 33 (43.4%) were 1st degree malocclusions, 21 (27.6%) were 2nd, 13 (%17.1) were 3rd and 7 (9.2%) were 4th degree malocclusions. In addition, 76 (%50.6) dogs had an occlusion classification 0. (Table 2).

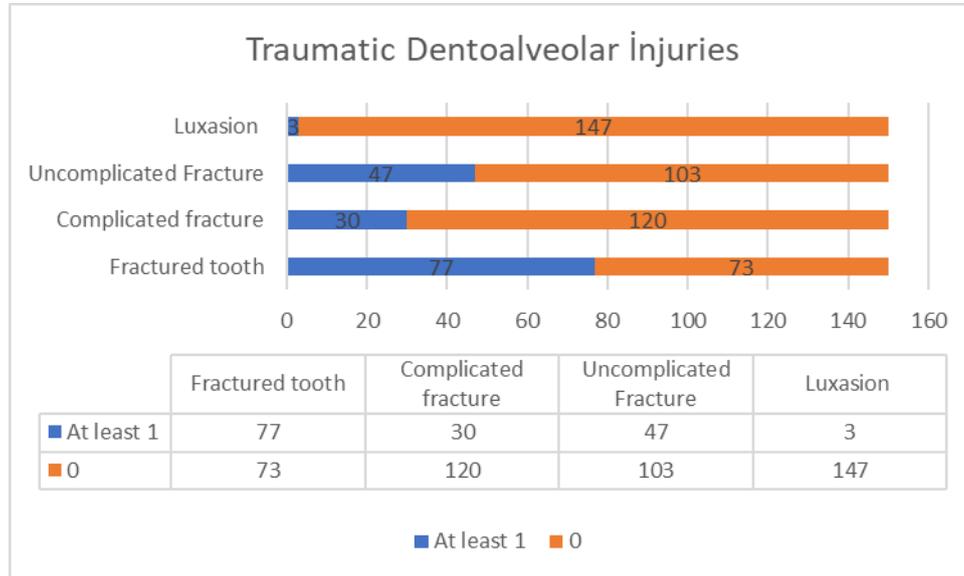**Table 2.** Pie chart of malocclusion classification of dogs.

The maloclusion types of 150 dogs examined on the left are shown in the pie chart.
On the right is the color description of the charts slices.

Traumatic Dentoalveolar Injury: As a result of the prospective visual examination, 77 (51.3%) of 150 dogs had at least 1 tooth fracture and 30 (38.9%) of these dogs had complex fractures. In total, 30 of 150 dogs (20%) had at least 1 complicated fracture. Dogs with only uncomplicated

fractures accounted for 61% of the dogs with at least one fracture and represented 47 (31.3%) of the total 150 dogs studied. In addition, 3 (2%) of the 150 dogs were found to have tooth dislocation due to trauma (Table 3).

Table 3. Examination results of dogs in terms of TDI.

	Fractured tooth	Complicated fracture	Uncomplicated Fracture	Luxasion
■ At least 1	77	30	47	3
■ 0	73	120	103	147

The graph above shows the percentage distribution and number of 150 dogs with traumatic dentoalveolar injuries.

Discussion and Conclusions

In this study, dogs presented to Burdur Mehmet Akif Ersoy University Animal Hospital for variety reasons were examined. Most of the dogs examined had calculus and gingivitis, 51.3% had TDI, and 35% had occlusal disorder.

In general, TDIs have been reported to affect 26.2% of dogs (Soukup et al., 2015). In contrast, according to our study, 77 dogs (51.3%) had at least one TDI. Treatment of uncomplicated tooth fractures includes closure of all exposed dentin tubules as soon as possible. Annual radiographs are recommended to monitor changes in tooth colour, periapical disease and enlarged root canals (Juriga and Bilyard, 2021). In accordance with this information, the owners of patients with pathology were informed of the treatment. According to the data obtained in this study, 20% of the patients examined had complicated fractures. It was found that complicated fractures lead to pain, pulpitis and pulp necrosis over time (Soukup, 2018). It has been reported that due to exposure of the pulp, a coronal fracture or caries erosion can allow pathogenic bacteria to enter the pulp canal in a short period of time or cause a periapical abscess within the canal or with the spread of infection, and it has been stated that the progression of infection to the apical end of the root canal can lead to osteomyelitis and loss of surrounding bone (Marretta and McFadden, 2013). The owners of the dogs with complicated fractures were informed about the treatment and advised to follow the treatment path as soon as possible.

It has been emphasised that dislocation injuries result in pulp necrosis, that teeth are susceptible to root resorption or infection if left untreated, and that all teeth with dislocation injuries should be re-evaluated with follow-up radiographs between 6 and 12 months, in addition to the time between the accident and treatment which may be critical for a positive outcome (Bilyard and Juriga, 2021; Startup, 2010). In our study, it was observed that 2% of the dogs examined had dislocated teeth (Figure 3.B). Patients with dislocations were started to be treated with the consent of their owners.

Berman et al. (2023) reported the presence of malocclusion 1 variant in 65% which is nearly 20% higher than this study. Their study has similar number for malocclusion 2 with 30%. When it comes to malocclusion 3 there is a significant difference of almost 20%, the number of dogs we saw malocclusion 3 is less than theirs. Their number for Malocclusion 4 is 5.6% while our number is 9.2% (Figure 3.A).

According to Holcombe and Wallis (2020), an average prevalence of 9.3-18.2% has been reported for periodontal disease in canine populations. A much higher prevalence of 44-100% has been reported in detailed examinations of anaesthetized dogs (Holcombe and Wallis, 2020). The gingival index of the dogs examined was 60.7% and calculus was found in 87.2% in our study, which are the main reason of the periodontal disease.

In conclusion, according to the data obtained by evaluating the gingivitis index, the calculus index and the traumatic dentoalveolar injuries, it was concluded that
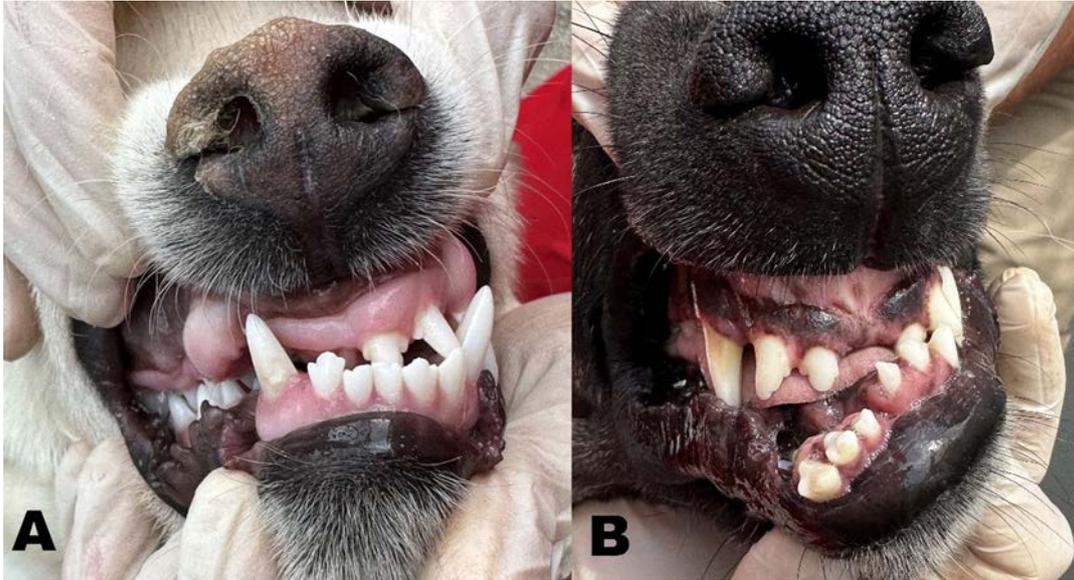
Figure 3. (A) Rostral view of a dog with a grade 4 malocclusion. In addition to mandibular and maxillary asymmetry, a grade 3 malocclusion is also noted. (B) Rostral view of a dog with lateral luxation. Teeth 401, 402 and 403 are dislocated, breaking the alveolar bone.

dental and gingival examinations in dogs should be performed regularly by the veterinarians in Turkey. The numbers this study found are generally higher compare to other studies around the world. The necessary information and advice should be given to the dog owners to protect the oral health of their dogs, the course of the current situation may be negatively affected if the detected diseases are not followed up and if they are not treated, they may develop into irreversible situations that may affect the life of the patients.

Conflict of Interest

The authors have stated that there is no real, potential or perceived conflict of interest for this article.

Ethical Approval

This work is not subject to HADYEK authorization under Article 8 (k) of the "Regulation on the Practice and Basics of Animal Experiment Ethics Boards"

Similarity Rate

We state that the similarity rate of the article is 11% as stated in the report uploaded to the system.

Author Contributions

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Data Collection and / or Processing: MAK, FCO
Analysis and Interpretation: MAK, FCO
Literature Review: MAK, FCO
Writing the Article: ÖŞŞ

References

Asproni P, Cozzi A, Fonseca MJ, Lafont-Lecuelle C, de Oliveira J, Pageat P, Palmeira I, 2022: Dental Pain in Cats: A Prospective 6-Month Study. *J Vet Dent,* 39(4), 369-375.

Barbosa, E, Hauptli L, Pires PGS, Moraes P, 2023: Strategies to improve the home care of periodontal disease in dogs: A systematic review. *Res Vet Sci*, 154, 8-14.

Barnvos D, Harvey C, Serfilippi L, 2015: Effect of frequency of brushing teeth on plaque and calculus accumulation, and gingivitis in dogs. *J Vet Dent,* 32(1), 16-21.

Bellows J, 2022: Occlusal Disorders In: Feline Dentistry, Bellows J (Ed), 410-432, John Wiley and Sons, USA.

Berman M, Scanlan AJF, Soltero-Rivera M, 2023: Prevalence of Dental and Skeletal Malocclusions in Mesaticephalic and Dolichocephalic Dogs-a Retrospective Study (2015-2018). *J Vet Dent, 40*(2), 143-153.

Bilyard K, Juriga S, 2021: Working Dog Dentistry. Veterinary Clinics. *J Small Anim Pract,* 51(4), 779-802.

Bourguignon E, Daibert APF, Moreira MAS, Pieri FA, 2012: Periodontal Disease in Dogs In: A Bird's-Eye View of Veterinary Medicine, Perez-Marin CC (Ed), 119-140, InTech, Croatia.

Capik I, Ledecký V, Ševčík A, 2000: Tooth fracture evaluation and endodontic treatment in dogs. *Acta Vet Brno,* 69(2), 115-122.

Chain CP, Lehr W, Pignone VN, Pinto CFD, Trevizan L, 2020: Evaluation of teeth injuries in Beagle dogs caused by autoclaved beef bones used as a chewing item to remove dental calculus. *PLoS One,* 15(2), 1-15.

Daculsi G, Hamel L, Le Brech C, Le Nihouannen JC, 1996: Epidemiologic study of canine teeth fractures in military dogs. *J Vet Dent,* 5(1), 10-18.

Dodd JRB, Lobprise HB, 2019: Oral anatomy and physiology In: Wiggs's veterinary dentistry principles and practice, Lobprise HB, Dodd JRB (Eds), 1-24, John Wiley and Sons, USA.

Gawor J, Niemiec BA, 2014: Oral pathology in dog and cat: overview of selected problems. *Vet nurs*, 5(1), 10-18.

Greene, JG, Vermillion JR, 1964: The simplified oral hygiene index. *J Am Dent Assoc*, 68(1), 7-13.

Hetzel S, Paul A, Soukup J, 2015: Classification and Epidemiology of Traumatic Dentoalveolar Injuries in Dogs and Cats: 959

Injuries in 660 Patient Visits (2004-2012). *J Vet Dent,* 32(1), 6–14.

Holcombe LJ, Wallis C, 2020: A review of the frequency and impact of periodontal disease in dogs. *J Small Anim Pract,* 61(9), 529-540.

Holmstrom SE, 2019: The Oral Examination and Disease Recognition In: Veterinary Dentistry A Team Approach, Holmstrom SE (Ed), 21-72, Elsevier Health Sciences, Missouri.

Lengyel K, 2018: Why'Dental'Is a Dirty Word. *J Am Vet Med Assoc, 3*(4).

Lobprise HB, 2021: Intraoral Radiology and Advanced Imaging In: Blackwell's five-minute veterinary consult clinical companion small animal dentistry, Lobprise HB (Ed), 21-46, John Wiley and Sons, Texas.

Löe H, Silness J, 1963: Periodontal disease in pregnancy I. Prevalence and severity. *Acta Odontol Scand,* 21(6), 533-551.

Marretta SM, McFadden T, 2013: Consequences of untreated periodontal disease in dogs and cats. *J Vet Dent,* 30(4), 266-275.

Milella L, 2015: Occlusion and malocclusion in the cat: What's normal, what's not and when's the best time to intervene? *J Feline Med Surg,* 17(1), 5-20.

Mulherin BL, Snyder CJ, Soukup JW, 2013: Prevalence and nature of dentoalveolar injuries among patients with maxillofacial fractures. *J Small Anim Pract,* 54(1), 9-14.

Niemiec BA, 2017: Advanced and Future Options For Oral and Maxillofacial Imaging In: Practical Veterinary Dental Radiography, Niemiec BA (Ed), 347-358, CRC Press, New York.

Niemiec BA, 2010: Pathology in the pediatric patient In: A colour handbook of small animal dental and oral maxillofacial disease, Niemiec BA (Ed), 89-126, Manson Publishing Ltd, London.

Niemiec BA, 2010: Problems with the gingiva In: A colour handbook of small animal dental and oral maxillofacial disease, Niemiec BA (Ed), 159-181, Manson Publishing Ltd, London.

Reiter AM, 2018: Commonly encountered dental and oral pathologies In: BSAVA manual of canine and feline dentistry and oral surgery, Gracis M, Reiter AM (Eds), 89-118, British Small Animal Veterinary Association, Aberystwyth.

Southerden P, 2017: Malocclusion in dogs and cats. *Vet nurs*, 8(4), 207-214.

Startup S, 2010: Wire-composite splint for luxation of the maxillary canine tooth. *J Vet Dent,* 27(3), 198-202.

Soukup J, 2019: Traumatic Dentoalveolar Injuries In: Wiggs's veterinary dentistry principles and practice, Lobprise HB, Dodd JRB (Eds), 109-130, John Wiley and Sons, USA.