

# **DENTAL DISEASE, PROPHYLACTIC TREATMENT, & CLIENT COMMUNICATION**

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## **Introduction**

Periodontal disease is a very common and serious disease of adult dogs and cats that has local and systemic impact. Understanding the pathophysiology of periodontal disease, particularly the relationship between dental substrates and disease progression is important to successful periodontal management. Maintaining oral health depends on professional periodontal management combined with appropriate, effective home care. Determining a periodontal management program that is effective as well as orally and systemically safe can be challenging and optimal results require consistent communication and education between the veterinarian, the technician, and the client.

## **Periodontal Anatomy and Tooth Function**

Different teeth provide different functions in dogs and cats. The incisor teeth are used for grasping and nibbling. The canine teeth are used for capturing and puncturing prey. The premolar and molar teeth are used for shearing, grinding and chewing. The carnassial teeth, designated as the upper fourth premolar and the lower first molar, are the teeth primarily used for chewing.

A normal, mature tooth has a crown and one to three roots. The junction of the crown and the root is termed the cemento-enamel junction (CEJ). The crown is the portion of the tooth above the CEJ and is covered by dense, smooth enamel. The root or roots are the portion of the tooth below the CEJ and serve to anchor the tooth in the alveolar bone as well as provide the neurovascular port (apical delta). A thin layer of cementum, a calcified structure in which the periodontal fibres are embedded, covers the root.

The dentin underlies the enamel and the cementum. There are three types of dentin: primary, secondary and tertiary. Primary dentin is present during formation of deciduous and permanent teeth. As the animal ages, primary dentin is replaced continuously by secondary dentin. Tertiary dentin is laid down as a reparative substance and is often present as a brown spot on the tip of the tooth. The pulp cavity contains blood and lymphatic vessels, nerves and odontoblasts supported in a connective tissue matrix.

The periodontium are the tissues that support and protect the tooth and include the gingiva, periodontal ligament, cementum and alveolar bone. The gingiva is an extension of the oral mucosa and consists of keratinized epithelial tissue that attaches to the alveolar process and extends to the neck of the tooth. The gingivae are divided into the attached gingiva and the free gingiva. Normal attached gingiva extends from the mucogingival line to the CEJ. Normal free gingiva surrounds the neck of the tooth without attachment. The coronal edge of the free gingiva is termed the marginal gingiva. The space between the free gingiva and the tooth surface is the gingival sulcus or crevice.

The periodontal ligament is composed of collagenous connective tissue fibres that attach the teeth to the alveolar bone. The periodontal ligament acts as a cushion, allowing slight movement of teeth during mastication to prevent trauma to teeth from occlusal and root-to-alveolar bone contact.

Thin, dense alveolar bone lines the tooth socket (lamina dura) and surrounds the root, providing attachment for the periodontal ligament and passage of blood and lymphatic vessels. Alveolar bone is surrounded and supported by trabecular and compact bone, which varies in

thickness depending on the anatomic location. The alveolar process is a relatively active tissue that responds to external forces and systemic influences by resorption and remodeling.

### **Dental Formulas**

Dogs and cats are diphyodont, erupting two dentitions termed deciduous (primary or baby) teeth and permanent teeth. Deciduous teeth begin erupting around three weeks of age in dogs and cats. Breed, environment, nutrition, hormones and season may influence eruption times.

Puppies have 28 teeth and adult dogs 42 teeth. Normal dental formulas for dogs are

Deciduous: 2(I<sub>3/3</sub>, C<sub>1/1</sub>, P<sub>3/3</sub>)

Permanent: 2(I<sub>3/3</sub>, C<sub>1/1</sub>, P<sub>4/4</sub>, M<sub>2/3</sub>)

Kittens have 26 teeth and adult cats 30 teeth. Normal dental formulas for cats are:

Deciduous: 2(I<sub>3/3</sub>, C<sub>1/1</sub>, P<sub>3/2</sub>)

Permanent: 2(I<sub>3/3</sub>, C<sub>1/1</sub>, P<sub>3/2</sub>, M<sub>1/1</sub>)

Dental formulas represent teeth that should normally be present in all dogs and cats. Anatomically, the maxillary first premolars and the mandibular first and second premolars are absent in cats. Thus, feline premolars are identified as the maxillary second, third and fourth, and the mandibular third and fourth. Individual dogs and cats may have abnormal numbers of teeth. Missing teeth may predispose to soft tissue trauma from occluding teeth and may reduce the effect of oral cleansing, particularly in the carnassial area. Extra teeth may lead to overcrowding which affects anatomical positioning and may increase plaque retention, decrease effectiveness of dietary cleansing and require more aggressive oral hygiene to maintain gingival health.

### **Initial Oral Examination**

Examination of the skull and oral cavity should be a regular part of every physical examination. An extra oral examination should be done before opening the mouth to inspect the skull and facial areas for any abnormalities, such as muscle atrophy, swelling, draining tracts and ocular or nasal discharge. Extra oral examination should also include inspection for facial symmetry, palpation of the temporomandibular joints, regional lymph nodes and salivary glands and thorough inspection of the skin and lips. Extra oral abnormalities related to oral dysfunction may include mucopurulent discharge from the eyes or nostrils, soft or hard swellings, crepitus, salivation and an inability to open or close the mouth.

After the extra oral examination, the lips should be gently parted or retracted to allow inspection of the oral mucosa. Patients experiencing severe oral pain may not tolerate even a cursory oral examination without sedation. The facial surfaces of the teeth and gingivae should be examined for substrate accumulation, inflammation, trauma and capillary refill time. Tooth position and occlusion should be evaluated and all oral tissues should be inspected.

### **Comprehensive Oral Examination**

A definitive oral examination must be done with the patient heavily sedated or anesthetized, and is often done immediately before periodontal therapy. The general examination should be used as a starting point in client communication with the understanding that the definitive oral examination may uncover other lesions that require treatment.

The examination should begin with a thorough inspection of all oral tissues. An overall assessment of oral health should consider the amount and location of substrate accumulation.

Substrate location and accumulation provide valuable information about the frequency and effectiveness of dental homecare. The remainder of the periodontal indices (e.g., probe depth, attachment loss, furcation exposure, and tooth mobility) are usually charted after prophylaxis or periodontal therapy to ensure accurate assessment after removal of sub gingival debris that may impede measurement. Each tooth and its associated periodontium should be evaluated using a dental explorer-probe to examine the tooth for defects, lesions or both. The same instrument should be used to evaluate periodontal health by measuring the extent of gingival inflammation, attachment loss and alveolar bone loss. Any abnormalities in tooth or periodontal structures should be noted on the dental chart. Detailed dental charting allows for disease assessment and provides a record for future reference. The results should become part of the patient's permanent medical record.

### **Radiographic Examination**

Oral radiography may be indicated to identify lesions that cannot be detected visually or manually, and to determine the extent of pathology. Root fractures, periapical abscesses, alveolar bone loss, acute resorption lesions and anatomic anomalies are difficult to assess without radiography. Additionally, oral radiographs are useful in selecting a definitive treatment plan and assessing the outcome of a dental procedure.

### **Laboratory Studies**

A complete blood count, serum biochemistry profile, bacterial culture, virus isolation, cytologic examination and biopsy may add useful information. Other diagnostic tests such as urinalyses and cardiac examinations may complement a standard panel as part of a preanesthetic profile. Patients with suspected renal or cardiac disease may be compromised by bacteraemia associated with dental manipulations.

### **Pathophysiology of Periodontal Disease**

Periodontal disease is a very common and serious disease of adult dogs and cats. Understanding the pathophysiology of periodontal disease, particularly the relationship between dental substrates and disease progression is important to successful periodontal management. Periodontal disease is an infection caused by bacteria in the biofilm (dental plaque) that forms on oral surfaces. Left untreated, periodontal disease leads to oral pain, dysfunction and tooth loss. These changes often lead to behaviour changes such as changes in eating habits to general behavioural changes such as reluctance to grooming and socialization or signs of 'depression'. There is an association between the severity of periodontal disease and pathologic changes in other organ systems. Systemic effects result from both bacteraemia and by chronic systemic release of inflammatory mediators and bacterial degradation byproducts.

Periodontal disease commonly refers to gingivitis and periodontitis. Gingivitis is reversible and can be appropriately treated and largely prevented with thorough plaque removal and effective supragingival plaque control. Periodontitis is more severe and primarily irreversible, and may require advanced therapy and meticulous plaque control to prevent progression of the disease. Gingivitis may progress to periodontitis and although the course is unpredictable and heavily dependent on individual animal variability it is known that gingival inflammation is the first step in the development of more severe periodontitis.<sup>1</sup>

Bacterial plaque is the most important substrate in the development of periodontal disease. Bacterial colonization occurs almost immediately after a dental prophylaxis. Supragingival dental plaque forms above and along the free gingival margin; subgingival dental plaque is formed entirely within the gingival sulcus. Growth and maturation of supragingival plaque are necessary for subsequent colonization of subgingival surfaces by dental plaque.

Plaque accumulation along the gingival margin induces inflammation in adjacent gingival tissues. Without plaque removal or control, gingivitis progresses in severity inducing local changes allowing subsequent bacterial colonization of subgingival sites. Inflammatory mediators damage the integrity of the gingival margin and sulcular epithelium, allowing further infiltration of bacteria. The immune response of the host attempts to localize the invasion of the periodontal tissues; the result may be further destruction of local tissues due to cytokines released from inflammatory cells.

Dental calculus is mineralized plaque. Calculus is a hard substrate formed by the interactions of salivary and crevicular calcium and phosphate salts with existing plaque. Calculus accumulates supra- and subgingivally and calculus deposits thicken with time. It has been demonstrated that calculus control in the absence of plaque control is cosmetic; however calculus provides a roughened surface that enhances bacterial attachment and plaque development and chronically irritates gingival tissues. Undisturbed calculus is always covered by vital dental plaque.

### **Periodontal Therapy**

The periodontal procedures required will vary depending on patient status. For example, is an adult dog with complete dentition, 42 separate decisions are possible depending on the pathology and extent of disease affecting each tooth and its surrounding periodontium. Treatment is aimed at correcting existing loss of attachment or extraction of the tooth. Dental scaling and polishing is a preventive procedure, removing the cause of the disease and allowing tissues to recover.

### **Dental Homecare**

Periodontal disease is a common, chronic infection in dogs and cats. Prevention of periodontal disease in pets requires identification and elimination of exacerbating factors, professional examination and care on a regular basis, and must include an effective dental home care program.

If examination reveals a healthy mouth, the appropriate home care regimen to maintain oral health should be recommended. If examination reveals periodontal disease, appropriate periodontal therapy followed by an effective home care regimen to prevent recurrence should be recommended. It is unreasonable to expect a pet's mouth to stay healthy without appropriate plaque and tartar control between veterinary visits.

Periodontal therapy and home care recommendations depend on the both the degree of oral pathology and the extent of owner compliance. To make an effective home care recommendation, veterinarians and technicians should evaluate the pet's oral pathology to frame the necessary degree of plaque control, be knowledgeable of products that provide proven, effective plaque control, understand the client's willingness and ability to provide oral hygiene and assess the pet's response to oral applications or manipulations.

There are numerous veterinary exclusive and over-the-counter products available for pet dental care and the effectiveness as well as the evidence supporting claimed efficacy is highly variable. Dental hygiene products are typically divided into the following categories; 1) mechanical plaque and calculus control, 2) chemical calculus control, 3) anti-microbial therapy and 4) barrier agents.

Mechanical plaque and tartar control refers to any means that physically disrupts the accumulation of or removes existing plaque and calculus. Commonly used methods include tooth brushing, dietary cleansing and chew aids. The most effective means of mechanical plaque and calculus control when applied correctly and consistently is tooth brushing. There are several designs of pet toothbrushes available and the softness of the bristles combined with the handle and head design make these very desirable for use in pets. It is important to fit the appropriate head size and shape to the pets' mouth to allow for safe and effective oral cleansing. Application of flavoured dentifrices, gels or powders to the brush head may increase palatability and acceptability to the pet. Options to the use of a toothbrush include finger cots, gauze applicators and oral swabs.

Mechanical plaque control can also be provided through dietary cleansing. It is common for veterinarians to recommend a dry dog food as part of an oral care routine. Typical dry pet foods may provide some cleansing benefit particularly in comparison to moist sticky foods; however, the dental cleansing provided is far from optimal. There are dental foods available through veterinarians that effectively reduce plaque and calculus accumulation and gingival inflammation.<sup>4</sup> Advantages of feeding a dental diet include effectiveness, increased compliance, pet acceptance and optimal nutrition. Dental foods should be assessed for dental efficacy as well as nutrient compatibility appropriate for the animal's life stage and health status.

Dietary snack foods have long claimed dental benefits for dogs and cats. Unfortunately most of these claims are unsubstantiated and should be regarded with skepticism. Rawhide chews and other edible treats have demonstrated oral benefits. The disadvantages of these products may include pet acceptance, potential for gastrointestinal side-effects, cost and dietary influences such as caloric excess and nutrient imbalances.

There are numerous chew toys available that claim oral benefits. Most of these claims are unsubstantiated and inappropriate use may cause gingival abrasions, fractured teeth and gastrointestinal disturbances.

Chemical agents used for calculus control refer primarily to polyphosphate compounds such as hexametaphosphate and pyrophosphate. These agents act as calcium chelators, binding calcium and decreasing mineralization of plaque into calculus. It has been demonstrated that the addition of hexametaphosphate to the surface of baked biscuit treats, rawhide chews and dry foods results in reduced calculus accumulation. Polyphosphates have no known direct effect on oral micro flora populations or plaque accumulation and an effective plaque control regimen should always be the primary recommendation for prevention or post-therapeutic care of periodontal disease.

Anti-microbial agents are available for use in veterinary dentistry either topically or systemically. Chlorhexidine is a very effective plaque antimicrobial agent. It has broad-spectrum activity and binds to oral tissues providing some residual antibacterial activity. Clindamycin is an antibiotic that works by inhibiting bacterial protein synthesis. Clindamycin has been shown to control dental plaque accumulation and oral malodor when used in conjunction with a prophylactic procedure. Fluoride has been reported to decrease tooth

hypersensitivity and inhibit bacterial growth and metabolism, and is often applied following professional prophylaxis or therapy. Fluoride is potentially toxic and should not be used indiscriminately. Other products available that have reported anti-plaque activity include zinc ascorbate and zinc chlorhexidine solutions. Zinc has been demonstrated to exhibit some antiplaque properties and zinc and vitamin C have been associated with wound healing. Enzyme systems containing glucose oxidase and lactoperoxidase combine with oxygen and water in saliva to form hypothiocyanite which has been shown to have antibacterial activity.

One of the newer categories of plaque and calculus control in pets is the use of a barrier method, or dental sealant. Following a dental prophylaxis, an odourless, tasteless invisible barrier sealant is applied by the veterinarian along the gingival margins of the buccal surface of the dental arcade and is then continued by the animal owner at home on a weekly basis. The inert polymer forms a physical bond to the tooth enamel and creates a barrier that repels attachment of bacterial plaque.

Many oral hygiene aids have varying degrees or claim varying degrees of plaque and calculus control. Caution should be utilized when extrapolating results to individual patients. It is important for the healthcare team to evaluate the evidence that supports the product efficacy and the product effectiveness. Products that demonstrate efficacy under ideal conditions, for example in a research colony setting, may demonstrate variable effectiveness in the home environment. For example, effectiveness of a dental treat may vary if the client feeds less than the number of treats tested to deliver the claimed efficacy. An understanding of the product, the evidence that supports the product claims, and the expected client application will support a successful outcome.<sup>5</sup>

### **Client Education and Compliance**

Periodontal management begins with educating the client on the pathophysiology of periodontal disease, the treatment plan and the degree of at home plaque control appropriate for maintenance of oral health in their pet. Most clients are aware of the importance of oral hygiene for themselves and this awareness can be utilized to discuss the importance of oral hygiene for their pets. Demonstrating the degree of oral disease present in the client's pet also effectively stresses the importance of oral care. Discussing oral health as part of systemic health and detailing the client about potential infection to other organ systems can reinforce the importance of oral hygiene.

Owner compliance is critical to determining the type of periodontal therapy applied as well as the home care recommendations. Owner compliance is a function of both owner commitment and capability. Some clients may lack the commitment necessary to provide effective plaque control to their pet and some pets may not tolerate oral manipulation. It may take consistent training and handling over time to accustom a pet to an oral hygiene routine. The client should be instructed in techniques to condition their pet to accept oral manipulations and applications of oral hygiene tools or materials. Other factors affecting owner compliance is the lack of ability of the client to apply effective oral hygiene due to lifestyle demands or lack of manual dexterity. It may be necessary for the pet to be brought to the clinic for routine plaque control by a staff member although this may be inconvenient for some clients. The healthcare team should combine their knowledge of the pet's oral condition and degree of periodontal therapy with an understanding of the level of owner and pet compliance when recommending appropriate home care. Long term success depends on the degree of plaque control the client is capable of providing between professional visits.

Regardless of the type of dental home care recommended, plaque control will only be successful if applied effectively by the client and accepted by the pet. Healthcare team members should be informed about the benefits and the disadvantages of oral hygiene products. Home care goals include control of supragingival plaque consistent with maintenance of periodontal health, prevention of disease progression and maintenance of oral health between professional visits. Idealistic oral hygiene procedures may not be realistic for every case and appropriate home care should be customized to fit the degree of oral pathology and the level of owner compliance.

## References

1. Harvey CE. Management of periodontal disease: understanding the options. *Vet Clin Small Anim* 2005;31:819-836.
2. Logan EI, Wiggs RB, Zetner K, et al. Dental disease. In: Hand MS, Thatcher CD, Remillard RL, Roudebush P. eds. *Small Animal Clinical Nutrition*, 4<sup>th</sup> ed. 2000:475-492.
3. Burns KM. Oral health in pets: home care and dietary considerations. *Veterinary Technician* 2006:224-233.
4. Logan EI, Finney O, Hefferren JJ. Effects of a dental food on plaque accumulation and gingival health in dogs. *J Vet Dent* 2002;19:15-18.
5. Roudebush P, Logan EI, Hale FA. Evidence-based veterinary dentistry: a systematic review of homecare for prevention of periodontal disease in dogs and cats. *J Vet Dent* 2005;22(1):6-15.