

# PERIODONTAL DISEASE: SYSTEMIC CONSEQUENCES IN WIDER FOCUS

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**Categories :** [Vets](#)

**Date :** June 6, 2011

**Norman Johnston** discusses the importance tooth problems can have in the body, from cardiovascular issues to brain and nervous system difficulties

## Summary

The systemic effects of small animal dental disease is mainly associated with untreated and progressive periodontal disease. Organs affected include liver, kidneys, cardiovascular system and lungs. The effects of oral infection in ageing humans are well documented, and similar effects may have lessons for the veterinary profession. Timely and effective management of periodontal disease is a critical part of the practice approach to the health and well-being of patients. Although periodontal disease is the most common consideration, oral or dental pain also impacts adversely on cats and dogs. Neoplasia is also common, with six per cent of all tumours found in the mouth. Although oral infections are frequently the source of problems elsewhere in the body, the oral cavity can also be affected by conditions from other organs, such as renal failure and autoimmune diseases.

## Key words

periodontal disease, systemic effects, oral infection, oral pain, periodontal management

**DENTAL disease in cats and dogs has long been considered a major source of both local and systemic disease.**

For most purposes, the disease of greatest concern – with regards to systemic consequences – is periodontal disease (PD). PD is an infection that, over time, progressively attacks the attachments of individual teeth.

While being important locally in the mouth, it also causes distant organ disease. The seminal paper in this regard for veterinarians was published by DeBowes et al in 1996. This paper proved the link, in dogs, between PD and pathology of the kidneys, liver, spleen, heart muscle and lungs.

Over the past decade or so, the importance of untreated oral disease in elderly people has become of interest, not only to the dentist, but also the surgeon (Akar, 2011). Implant surgery in the elderly is increasingly common, with patients in their 70s, 80s and older routinely undergoing surgery. Prosthetic hips, knees and heart valves are now commonplace.

The importance of having the patient dentally fit before surgery is now well recognised to prevent failure of the implant, in addition to those patients undergoing elective cardiothoracic surgery.

Potent odontogenic infections lead to an increase in adverse outcomes, morbidity and even mortality (Yasny, 2010a; Yasny, 2010b).

Although the mouth is often the source of problems for the rest of the body, it should also be kept in mind that this can be a two-way street.

Chronic kidney disease, as one example, is responsible for the increasing severity of periodontal, periapical and mucosal lesions. Oral tumours also account for approximately six per cent of all cancers in dogs, and the mouth is the fourth most common site for tumours. In cats, it accounts for three per cent of all cancers. Malignant oral neoplasms can metastasise to distant sites – with severe consequences.

The oral cavity is also a common source of chronic pain that has a major debilitating effect on general well-being. Teeth damaged by trauma, with or without actual pulp exposure, are affected by endodontic disease. The resulting periapical lesions cause severe pain, often without any visible oral lesions.

Dental caries is also very common in some breeds (such as the Labrador retriever). Caries, with or without pulp exposure, also causes debilitating chronic pain. It is important the veterinarian is aware of the consequences of ignored and untreated damaged teeth, and the consequential pain associated with them.

The major problem for veterinarians is that most animal patients are highly stoical in the face of pain that would be considered highly significant in humans. The fact this pain is present and real is not in doubt.

Often, the only way to prove the pain is to treat the problem and note the immediate effect on the patient's demeanour having removed the noxious stimulus.

The fact many clients are sceptical of the need for treatment in such circumstances requires a high degree of confidence by the attending veterinarian in evaluating oral pathology and understanding its consequences. In these circumstances, the use of dental radiographs is very important.

It has often been said that the inability to communicate does not mean an absence of pain. This is true of both animals and humans, especially infants.

## **Periodontal disease**

Standard texts and journal articles have widely quoted incidence levels of PD in dogs of between 70 per cent and 92 per cent for more than 45 years since one of the earliest references on the subject in 1965.

Two of the best studies (Hamp et al, 1984; Kortegaard et al, 2008) place the level at more than 80 per cent. Different diagnostic criteria are common in many of the seminal papers, mainly due to the lack of a generally accepted definition of periodontitis or PD.

It is also clear that breeds with certain risk factors will have higher levels of disease. These risk factors include:

- small size – less than 10kg in weight;
- crowded teeth, making good dental hygiene more difficult;
- dental malocclusions – particularly when teeth make abnormal contact with other teeth or contribute to crowding;
- brachycephalic head shapes, which contribute to both crowded teeth and dental malocclusions; and
- increasing age for all breeds, but it is worse for all of the above criteria.

Periodontal means “around the tooth”. The definition of PD is clinical attachment loss. Gum disease is an often used lay term that can mean simple gingivitis or PD.

Clinical attachment loss is loss of the tooth's attachment to the supporting structures, and involves loss of attachment to both the soft tissues (gingiva) and bone.

It can be measured by a probe and seen on a radiograph. Periodontal probes provide a guide to

the existence of a pocket and, in addition, a measurement of depth. This is only half the equation required for accurate prognosis, diagnosis and treatment.

A radiograph provides vital information as to how much attachment remains. This second half of the equation provides a clear course of action.

As a rough guide, attachment loss of 50 per cent or more is an indication to remove the affected tooth. Advanced periodontal surgery and grafting may be possible, but for most animal patients, the scrupulous postoperative hygiene necessary is difficult to achieve.

One of the best studies uses 98 dogs (Kortegaard et al, 2008), and summarises the author's finding as follows: "The prevalence of clinical attachment loss (CAL) greater than 1.0mm was 20 per cent in one-year-old dogs, increasing to 84 per cent in dogs aged more than three years. The prevalence increases with age, but is already high at the age of two years."

## **Systemic consequences**

DeBowes et al (1996) studied 45 dogs, ranging in age from five to 14 years, for PD scores and pathological changes after euthanasia. Statistically significant relationships were found between myocardial degeneration, kidney disease (both glomerular and interstitial) and liver parenchymal disease.

In addition, a relationship between PD and fibrosed mitral heart valves is supported by a cause-and-effect relationship, with the same bacteria being found in both the gingival sulcus and the diseased heart valves.

How does this occur? White blood cells and other inflammatory mediators migrate from the periodontal tissues into the blood and lymph streams due to increased vascular permeability.

This combination of bacteria (mostly gram-negative anaerobes) and inflammatory mediators is particularly potent. The surface area of the subgingival tissues alone has been estimated to be the size of an adult hand.

### **• Liver and kidney effects**

The liver and kidneys filter the blood, and bacteraemia from the oral cavity allows bacteria to settle in these organs.

The bacteria appear to have an affinity for endothelium. Immune complexes form, which further stimulate the production of other bioactive mediators. Organ damage to both parenchyma and kidney tubules follows. Over time, organ function suffers progressively. It is from this effect that PD gets its moniker of "the silent killer".

## • **Cardiopulmonary effects**

PD has been linked to significant changes in the heart, lungs and circulation (DeBowes et al, 1996). Changes in the atrioventricular valves have subsequently been proven in two more studies (Pavlica et al, 2008; Glickman et al, 2009). The latter study showed the risk of endocarditis was six times higher for dogs with stage three PD (25 per cent to 50 per cent clinical attachment loss) compared to those with no PD. Numerous studies in humans have linked ischaemic heart disease and myocardial infarction to oral bacteraemia.

A recent human study of 12,000 people also showed a direct relationship between the frequency of toothbrushing and increased incidence of cardiovascular events (De Oliviera et al, 2010). Those who brushed their teeth less than twice daily had a 70 per cent increase in their risk of heart disease.

While exact parallels between humans and dogs cannot be proved, recent history does show that the effects of PD in dogs appear to be similar to those in humans.

Finally, endocardiosis and myocardial fibrosis occurs with greater frequency in old dogs, and it has been suggested that aged dogs with PD have a higher incidence and greater severity of cardiac problems compared to those with healthy teeth (Hamlin, 1990).

## • **Brain and nervous system**

Strokes (ischaemic cerebral infarction) in humans are often preceded by a systemic infection. In addition, those individuals with such an infection suffer more significant neurological defects during an attack.

Poor dental health is considered to contribute to strokes in the same way it contributes to myocardial infarction, with an increase in thrombotic events, blood viscosity and C-reactive proteins (Mealey, 1999). Although the incidence of strokes in animals is not accurately known, it certainly does occur. Since dental disease is mostly preventable, steps to initiate management in a dental hygiene programme appropriate to the patient's size, age and breed are simple to undertake and will improve the general health of the patient immeasurably.

## • **Other adverse health effects**

Human literature abounds with PD's other systemic effects.

These include diabetes mellitus, malignancies, problems in pregnancy and conception, low birth weight and neonate viability, chronic inflammatory conditions (such as arthritis and chronic obstructive pulmonary disease) and early mortality.

## PD management

PD's systemic effects in dogs and cats are serious and mostly preventable by a properly constructed and implemented practice oral health policy.

Understanding the correct time to intervene is important and often left too late. The clear message is that gingivitis without attachment loss (stage one PD) is reversible. PD with any attachment loss (stage two and above) is not reversible in most cases, and the progressive nature of PD ultimately leads to tooth loss. The nature of most dog and cat teeth, with long and/or multiple roots, means that without timely veterinary intervention, an infected tooth may long outstay its welcome in the mouth, thus leaching bacteria and toxins into the blood and lymph.

Frequent professional examinations – at least annually – are an important step to ensuring dental disease is treated early and often. Since the development of dental plaque takes only hours, it is sensible to introduce clients to methods of plaque disclosing they can use at home.

If they can see where the plaque is, and how much is present, they are more likely to brush effectively. For the same reason, disclosing plaque should take place in the consulting room at every dental check or routine examination. Plaque disclosing is cheap and easy to do. Since the primary enemy in PD is plaque, it makes sense to know your enemy before you start the good fight.

Domestic dogs generally have no access to the materials that would naturally clean teeth of the biofilm of dental plaque that initiates gingivitis and, ultimately, causes PD. For this reason, providing professional scaling and polishing as frequently as is necessary to prevent irreversible changes is important. If this level of frequency is annual or biannual, then this must be impressed on the owner.

Toothbrushing is an effective method of home maintenance when used with the correct frequency – preferably daily. It is very difficult to motivate many owners to provide daily toothbrushing for their pets beyond the short term (Miller et al, 1994; Gorrel et al, 1996). Most cease to brush three to six months after a professional scale and polish, with around 53 per cent of owners still brushing effectively at six months.

As brushing less than every other day does not maintain clinically healthy gingival, the addition of a dental hygiene chew or proven effective dental diet can provide an added health benefit when not toothbrushing frequently enough. It can provide owners with a useful adjunct to home care (Gorrel et al, 1996). For this reason, it is often necessary to advise the use of an effective adjunctive method of plaque removal, such as dental chews of the correct size, texture and formulation (Brown et al, 2005). Practitioners must be aware that the pet market is awash with unproven dental remedies that often have little or no effect.

## Summary

- PD is an inflammatory response by the teeth's supporting structures, known as the periodontium. These structures are the gingiva, cementum, periodontal ligament and the alveolar bone.
- It is the number one cause of dental disease and early tooth loss in dogs and cats, with a minimum incidence level in adults of 70 per cent.
- PD consists of stages of progressive attachment loss, seen in cyclic periods of active destruction (periodontitis) and dormancy.
- PD is an infection that can be caused by a wide range of bacteria.
- PD has serious consequences for the health of internal organs, such as the heart, liver and kidneys.
- Only half the client owners of dogs continue to provide the minimum effective frequency of tooth brushing beyond six months from professional scaling and polishing.

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