AN INNOVATIVE APPROACH TO FIGHTING PERIODONTAL DISEASE

SOFTMARES things happen that change your perspective, your viewpoints, on things that you regarded as commonplace or that were so familiar as to be almost ignored. This was the case, literally, with our recent purchase of a replacement operating microscope. The microscope has become a regular feature in our dental theatre and made me think again about plaque.

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causing palatal trauma in a 10-month-old Sapsaree dog. This involved the orthodontic correction of the maloccluded tooth using an elastic chain and inclined bite plane technique. At the same time, crown restoration was carried out on teeth with enamel hypoplasia. Journal of the American Animal Hospital Association 51 (1): 49-55.

Clinical effects of volatile sulphur compounds associated with oral malodour
Lisa Milella, Veterinary Dental Surgery, Byleaf, Surrey
Volatile sulphur compounds are the primary cause of oral malodour in humans and companion animals. There is extensive literature on the biological role of these compounds in human oral health but little research has been carried out on their effects in animals. The author reviews the current data on compounds such as hydrogen sulphide and methyl mercaptan in the human mouth. Although oral malodour is usually regarded as a cosmetic problem, she notes that there is an increasing body of evidence to suggest that even at low concentrations, volatile sulphur compounds are toxic to tissues and play a role in the pathogenesis of periodontitis. Journal of Veterinary Dentistry 32 (2): 99-102.

Iatrogenic traumatic brain injury during tooth extraction
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Road accidents are the most frequent cause of traumatic brain injury in dogs. Various other factors have been reported but incidents of brain trauma resulting from injuries during dental procedures appear to be rare. The author describes one such case in an eight-year-old female Yorkshire terrier with progressive neurological signs following a tooth extraction. A small skull fracture and a linear tract were detected on MRI imaging, consistent with slippage of the dental elevator during extraction of tooth 210. The patient was blind in the right eye with right hemiparesis but regained most of its normal neurological function within four months. Journal of the American Animal Hospital Association 51 (2): 114-118.

We are all familiar with “end stage” periodontal disease (Figures 1 and 1a, 2 and 2a). Our minds tend to focus on the technical aspects of extraction

Figure 1. Periodontal disease – 409.

Figure 1a. Radiograph of periodontal disease – 409.

Figure 2. Periodontal disease – 209.

Figure 2a. Radiograph of left maxillary arcade.

Figure 3. Calculus and plaque – 109.

Figure 4. Rinsed calculus – 109.

Figure 5. Close-up of “closed” gingival sulcus or pocket.

Figure 6. Using the air syringe to open the gingival sulcus.

On a freshly cleaned tooth surface, a layer of glycoproteins, the pellicle, will reform within a few hours. The pellicle derives from saliva and the serum transudate that forms crevicular fluid in the gap between the tooth and the gum. The gingival sulcus, or pocket, normally appears closed with the gingiva tight up against the tooth surface (Figure 5).

Gently using the air syringe opens up the gingival sulcus (Figure 6) and this technique can be very useful to examine for retained subgingival calculus during a scaling procedure.

The pellicle is a good thing: it provides surface protection and prevents desiccation of the tissues and lubrication. However, it also provides an attachment surface for bacteria. On the oral soft tissues, the constant turnover and shedding of the epithelial layers means that the bacterial population is controlled. However, on the hard tooth surfaces the pellicle is not disrupted, allowing bacterial populations to increase. This is the basis of the rationale for oral clearances as a treatment method for chronic gingivo-stomatitis in cats – helping to decrease the possibilities for retaining plaque.

The bacterial population within the pellicle increases and tissue cells and
Debris become incorporated within the substance; it then becomes known as the *Materia alba*. This has a disorganised structure and can be easily disrupted.

Adhesins are specific molecules on the surface of the primary bacterial colonisers that interact with proteins within the pellicle, holding the bacteria in place. A different group of bacteria form the secondary colonisers which bind onto, or co-aggregate with, the primary colonisers. This represents a change in the overall nature of the bacteria from Gram-positive aerobic to Gram-negative anaerobic.

The maturation of plaque creates a host-associated biofilm (Figure 7). Biofilms are fascinating — honestly they are! Biofilms are organised, often multi-layered structures containing heterogeneous micro-colonies of bacteria and an extracellular polymeric substance (EPS) matrix. This matrix is predominantly organic, with polysaccharides, proteins, glycoproteins and lipids, together with an inorganic calcium and phosphorous component. The highly hydrated EPS matrix provides protection for the bacteria by preventing desiccation and can even provide protection from antibiotics by directly binding onto them — preventing access to the bacteria themselves.

Within the biofilm micro-colonies the bacteria “talk” to each other and this can lead to both up-regulation and down-regulation of individual gene expression. This results in changes to bacterial metabolism and adaptation to any environmental changes.

In addition to this internal communication, the EPS matrix contains interstitial voids, allowing diffusion of water, nutrients, genetic and chemical factors. The different micro-colonies within the EPS matrix are then able to communicate between each other.

The combination of intra-species, inter-species and inter-kingdom communication using small diffusible signal molecules is known as quorum sensing. This can allow the whole population to undergo concerted actions.

One example of this is “swarming”. When a certain population density is reached, dedicated flagellated cells act in concert to spread a biofilm over a surface. It is as if quorum sensing allows the individual bacteria some freedom to interact with other bacteria within the biofilm micro-colony (Figure 8).

**Figure 7. Biofilm development.**

Bacterial metabolic production of ammonia, volatile sulphur and other toxic chemicals lead to tissue damage. A range of enzymes (from proteases, collagenases, keratinases, phospholipases, etc.) produced by bacteria directly damage the tissue. However, as important is the host response to the bacterial products and endotoxins. This results in release of cytokines, prostaglandins and tissue factors resulting in activation of host immune cells, inflammation and bone resorption. In essence all the elements of periodontal disease.

Focusing on the primary role of plaque biofilms in the development and progression of periodontal disease has led to innovative approaches to treatment and prevention. One such product is Sanos (Figure 8).

Sanos is a non-toxic, low viscosity barrier sealant which is designed to be applied sub-gingivally after a dental scale and polishing procedure. The teeth are thoroughly cleaned and polished with a non-fluoride paste, rinsed and then air-dried. Sanos is then painted into the gingival sulcus (Figure 9). The special applicator brush can be bent to allow easy access to all areas, including the labial lingual aspects.

Even after applying Sanos to the sub-lingual sulcus of all of the teeth, there is usually some left over to use as a final coat over the tooth-lingual junction (Figure 10).

The carrier solution quickly evaporates: this can be hastened (and the Sanos can be encouraged deep into the sulcus) by gently air-drying. As it dries it forms a white polymer film which acts in a number of different ways to stop plaque biofilm formation and can change from opaque white to clear translucent (Figure 11).

**Figure 8. Sanos.**

The Sanos polymer binds onto the gingiva and the tooth. The film encapsulates any remaining plaque biofilm, rendering it inert and immobile. The physical presence of the polymer blocks reinfection by preventing the sulcus.

The film interrupts the quorum sensing “conversations” between plaque bacterial micro-colonies, helping to prevent the co-operative behaviour and adaptations that are an integral part to the progression to tissue damage and disease. It also helps reduce the supply of nutrients required by the bacteria.

Finally, the hydrophilic nature of the polymer film encourages a higher oxygen concentration deep in the sulcus, making the environment more favourable for anaerobic pathogenic bacteria.

The product has achieved acceptance from the VOHC (Veterinary Oral Health Council) with blinded, split-mouth design studies that were published in a peer-reviewed article.


