Chapter 13: Periodontal Disease

Periodontal disease refers to any pathological state in the periodontium. It is a progressive and relentless, usually non-regenerative and incurable disease. If treated properly, periodontal disease can be managed but we are better to think of prevention rather than of cure.

Prevention and treatment depend on a thorough understanding of the relationship between the etiologic factors and the pathogenesis of the disease.

In very simple terms, periodontal disease is a bacterial infection. The bacteria reside in a complex slime on the tooth surface known as *plaque*.

Plaque

In most cases, local factors such as bacterial plaque play the primary role with regard to the etiology of the inflammation and associated tissue destruction. Systemic factors such as hormonal changes play the secondary role in that they exaggerate the tissue response to the local factors. Bacterial plaque is the initiating factor. It is a complex, tenaciously attached soft deposit of organized stature, composed of microorganisms, epithelial cells, leukocytes, macrophages, intermicrobial matrix (salivary proteins) and water. In mature dental plaque, there may be hundreds of different species of microorganism.

Plaque is a *biofilm*. It is estimated that 99% of the bacteria on the planet reside in *biofilms*. Biofilms form on any wet surface such as in plumbing, lakes and rivers, boat hulls, swimming pools, water coolers, dental-station water lines and in the oral cavity.

Dental plaque is deposited on a thin bacteria-free film called the *acquired pellicle* (a glycoprotein from saliva which will form on a clean tooth surface within minutes). As plaque grows, it goes through a complex maturation where proliferation and addition of bacteria and bacterial by-products increase. Plaque can be deposited on a clean tooth within three hours.

Early on, when the plaque film is thin, there is good oxygen tension throughout, favouring aerobic organisms. As the layer matures and grows thicker, the oxygen tension on the tooth surface decreases, favouring the growth of anaerobic bacteria. A mature plaque film, then is stratified, with aerobes near the outer surface, anaerobes in the deeper layers and protozoa milling about in various layers.

The matrix of dental plaque is a jelly-like substance produced by the bacteria and from salivary proteins. Within the matrix there are channels that allow passage of nutrients and waste products. There is a symbiotic relationship between the inhabitants of plaque whereby one organism produces nutrients or protective factors to benefit other organisms. The matrix also offers a great deal of protection for the organisms. Bacteria in a biofilm are estimated to be 1500 times more resistant to chemical antimicrobial agents (antibiotics and antiseptics). Therefore, controlling dental plaque by chemical means alone without causing serious damage to the oral cavity and the patient is (currently) impossible.

The good news is that immature dental plaque can be easily disrupted mechanically. Mildly abrasive diets, chew toys and tooth brushing can all be very effective in plaque control. However, nothing is 100% effective. I brush my own teeth 2-3 times a day and floss daily, yet every time I see my hygienist, she always finds some work to do in my mouth.

Eitology of Periodontal Disease

How plaque actually leads to periodontal disease is complex and not yet fully understood. Etiology depends on large concentrations of many types of bacteria and their products in a localized area of the gingival sulcus. This upsets the normal healthy flora and the bacteria-host relationship resulting in disease. Host resistance is afforded by normal defense mechanisms such as intact epithelium, keratinization of outer surface of gingiva (the sulcus is not keratinized), crevicular (sulcar) fluids containing antibodies and compliment factors, antibacterial and self-cleaning effects of saliva, self-cleaning during mastication and by the tongue.

Lowered resistance results in accentuated gingival changes and more rapid bone loss.

Initially, the supra-gingival bacteria are non-motile, aerobic, gram-positive rods and cocci. These irritate the gingiva and proliferate allowing sub-gingival plaque to form, resulting in inflammation within the gingival sulcus. As supra- and sub-gingival plaque continues to accumulate, the flora changes to more tissue-

destructive, motile, anaerobic, gram-negative rods and filamentous organisms. These bacteria and the leukocytes sent to fight them produce tissue toxic endo- and exotoxins, collagenases and proteases and waste products such as ammonia and hydrogen sulfide. The periodontium is increasingly destroyed resulting in tooth mobility and eventual exfoliation.

There are many factors which predispose an animal to periodontal disease; here are a few.

Heredity: Likely the most important factor in the development of periodontal disease is the level of in-born resistance. Some animals develop virtually no periodontal disease despite total dental neglect, while others have constant problems in the face of aggressive preventative and therapeutic programs.

Materia alba: a soft deposit of micro-organisms, white cells, salivary proteins and food particles which adheres to the teeth and contains no organized microbial structure.

Food debris: retained and impacted food creates a favourable environment for plaque accumulation and is a direct mechanical irritant to the tissues. When teeth are crowded together, food and bacteria can get trapped between them.

Food consistency: soft, sticky foods cling to the teeth, providing more substrate for plaque accumulation and carbohydrates provide food for bacterial growth and substrates for the synthesis of extracellular polysaccharides (glucans).

Calcified deposits: As plaque becomes mineralized into calculus, it acts as a holding mechanism for non-mineralized plaque. Calculus itself does not cause periodontal disease, but its presence does make the control of periodontal disease much more difficult.

Caries: this pathological destruction of tooth structure provides a favourable environment for the accumulation and retention of soft deposits.

Oral hygiene: lack of home-care allows plaque and calculus to accumulate unchallenged.

Deficient dental treatment: simply scaling the crowns while leaving plaque below the gum line allows periodontal disease to progress without delay.

Missing teeth: When important teeth are missing on one side of the mouth, the animal will chew on the other side. There will be less self-cleansing on the side that is not being used for chewing and so there will be more plaque and calculus accumulation on that side.

Malocclusion: abnormal occlusal forces can cause mobility and loosening of the periodontium. Crowding, rotations, tipping and other malpositions can reduce the self-cleansing during mastication and can lead to areas of increased food and debris entrapment, which leads to more plaque accumulation.

Vices: chewing on sticks and bones may force foreign bodies (splinters) below the gum line

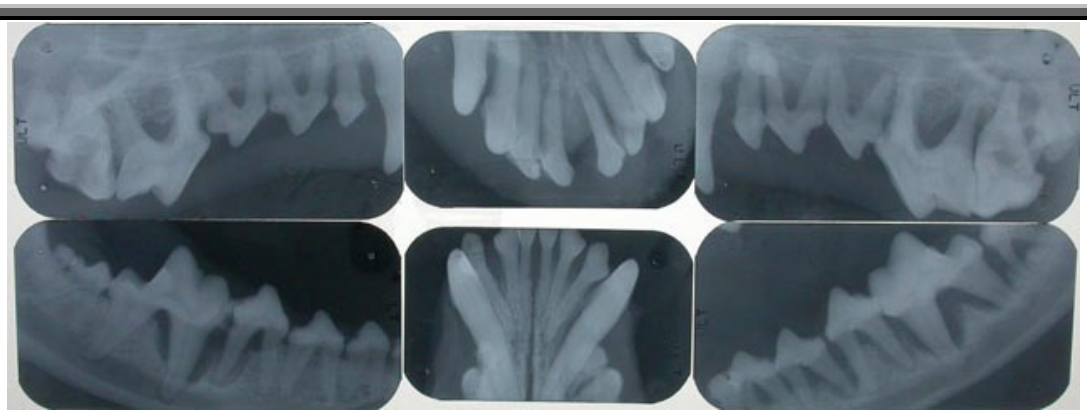

Figure #13.1. These radiographs are from a five-year old poodle. There was end-stage periodontal disease of nearly every tooth and treatment involved whole-mouth extraction. This patient had virtually no natural resistance to periodontal disease and so was best served by being made edentulous. Yet other dogs may be twice as old with virtually no periodontal disease.

causing localized periodontal disease. Other chewing vices may traumatize the gingiva.

Mouth breathing: constant wetting and drying of the mouth is irritating to tissues.

Endocrine: Cushings disease, pregnancy and other endocrine imbalances weaken host defenses.

Nutrition: malnutrition weakens host defenses.

Psychological: stress, tension, fatigue all weaken defenses.

Metabolic Disease: several such as diabetes mellitus will predispose. Diabetis mellitus reduces peripheral circulation and so reduces local immune response and healing capacity in the gingiva.

Hematology: as it relates to tissue perfusion and host defenses.

Grading Periodontal Disease

There is no universally accepted grading system for periodontal disease yet. Here is one based on the grading systems adopted by the American Veterinary Dental College.

Periodontal disease can be categorized into two broad headings. They are gingivitis and periodontitis and each should be scored separately. In doing a thorough periodontal assessment, mobility and furcation exposure should also be measured and recorded. Collecting and recording this data allows for more accurate treatment planning, prognostication and monitoring of the condition.

Gingivitis Index:

By definition, gingivitis is inflammation affecting the gingiva only. If treated properly, it is entirely reversible. When charting a mouth, each tooth should be assessed as to its Gingivitis Index (GI#), which is a number assigned to designate the degree of gingival inflammation at this time. The scores are as follows:

GI0 = Normal, healthy gingiva with sharp gingival margins; gingiva wrapped tightly around each tooth; gingiva shrimp coloured and stippled from mucogingival junction to free gingival margin; gingival sulcus of normal depth for animal and tooth; no odour; minimal crevicular fluid.

GI1 = Marginal gingivitis; mild inflammation at the free gingival margin only; slight colour change at margin; slight edema; no bleeding on gentle probing and no increase in sulcar depth.

GI2 = Moderate gingivitis; increased hyperemia of the marginal gingiva; wider band of inflammation; edema and glazing of marginal gingiva, bleeds on gentle probing; normal sulcar depths.

GI3 = Advanced gingivitis; inflammation affecting gingiva from free gingival margin to mucogingival junction; marked hyperemia and edema; thickening of free gingival margin; ulceration; tendency to spontaneous bleeding. At this stage there will often be periodontitis as well with attachment loss as described below.

Periodontal Index:

Periodontitis is inflammation or disease that has progressed to affect the deeper structures of the periodontium, namely the periodontal ligament, alveolar bone and cementum. It is quite possible for a tooth to have advanced gingivitis with minimal involvement of the deeper structures. That tooth would have a high gingival index but a low periodontal index.

On the other hand, a tooth may have been treated to resolve the gingival inflammation but still have alveolar bone loss and gingival recession. In that case, the tooth would have a high periodontal index with a low gingivitis index.

The periodontal index (PI#) is a measure of the amount of periodontal attachment loss without regard for the current level of inflammation. This refers to the percentage of the periodontal support apparatus that has been destroyed by the progression of disease. Attachment loss is measured with a periodontal probe, in millimeters, from the cemento-enamel junction to the apical extent of the defect.

In Figure #13.2, (A) represents a healthy tooth in its socket. The enamel covering the crown ends at the cemento-enamel junction. The gingiva covers the alveolar bone, the free gingival margin extends above the cemento-enamel junction and then turns apically to attach at the coronal extent of the root cementum.

On the left side of tooth B, there has been loss of periodontal bone as well as gingival hyperplasia (gingiva extends further coronally than normal). It also includes a periodontal pocket whose floor lies well below the cementoenamel junction. In this case, there are 7 millimeters of gingiva coronal to the cementoenamel junction and the pocket depth probes at 13 millimeters (from free

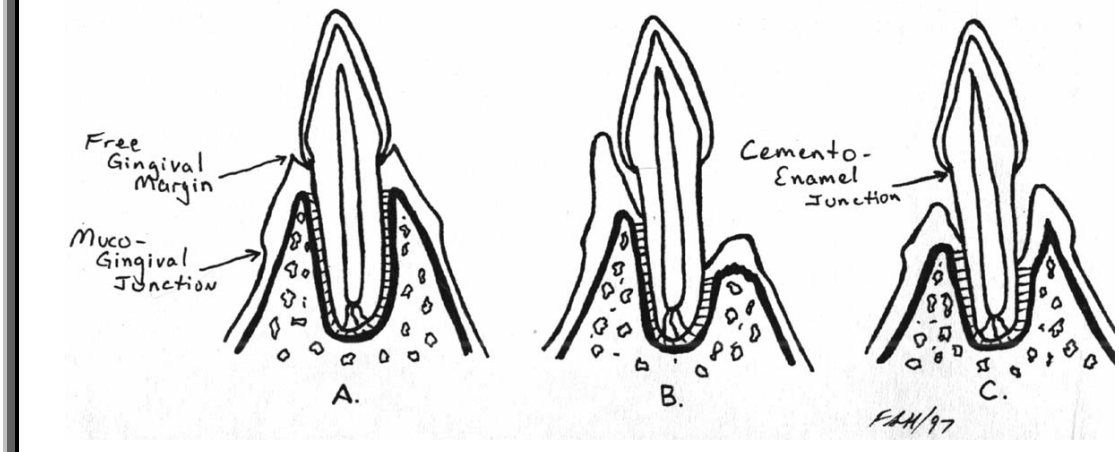

Figure #13.2.

gingival margin to bottom of pocket). Therefore, attachment loss is 13 millimeters less the 7 millimeter above the cementoenamel junction = 6 millimeters.

On the right side of tooth B, there is more extensive bone loss but there is also gingival recession of 11 millimeters measured from the cementoenamel junction. The pocket (from current free gingival margin to bottom of pocket) is 4 millimeters. Therefore, the attachment loss is 15 millimeters.

In charting teeth it is important to record at least two of the three numbers (pocket depth, gingival recession/hyperplasia and attachment loss). With two numbers recorded, the third can be calculated. If only pocket depths were given, it would be misleading. On the left, the pocket depth is 13 millimeters, which sounds worse than the 4-millimeter deep pocket on the right. However, looking at the illustration, you can see that the right side of the tooth has far worse periodontal disease

On the left side of tooth C, the bone level is even with the bottom of the periodontal pocket. This is known as a supra-bony pocket. These pockets are easier to debride thoroughly as the instruments can reach to the bottom without getting wedged between the root and the bone.

On the right side of tooth C, the bottom of the pocket extends below the current alveolar crest. This is known as an infra-bony pocket and is the type most commonly seen on the palatal side of maxillary canine teeth. These pockets are more challenging to treat, but with advanced periodontal surgery, it is possible to get regeneration of bone and periodontal ligament to fill much of the defect.

Attachment loss is measured from the cementoenamel junction to the bottom of the pocket. Gingival recession is estimated by measuring from the cementoenamel junction to the current free gingival margin and then adding 1 to 2 millimeters to account for the fact that the normal free gingival margin is 1 to 2 millimeters coronal to the cementoenamel junction. Pocket depth is measured from the current free gingival margin to the bottom of the pocket.

PI0 = Healthy gingiva and deeper periodontal structures; no clinical disease.

PI1 = Gingivitis only with no attachment loss.

PI2 = Less than 25% attachment loss.

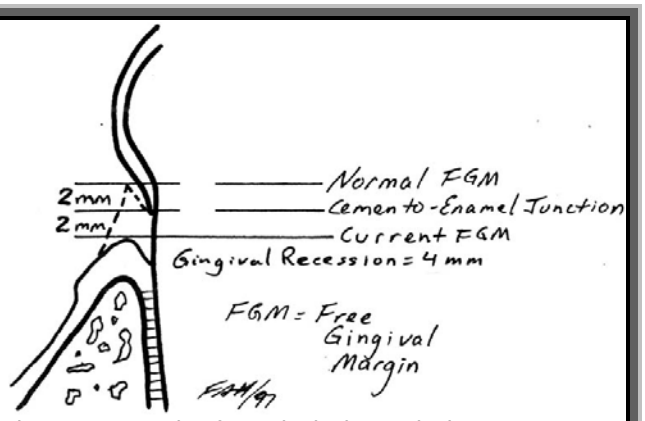

Figure #13.3. The free gingival margin is 1 to 2 mms coronal to the cemento-enamel junction in health. Measurements of gingival recession should take this into account.

PI3 = 25% to 50% attachment loss.

PI4 = Greater than 50 % attachment loss.

Mobility Index

Another criterion that should be recorded is mobility index (M#). A canine tooth in a large dog may have 50% attachment loss yet still be solidly attached to the remaining bone. On the other hand, a first premolar in a small dog does not need to lose much support before it becomes loose. The mobility index is just one more way to assess the prognosis for a tooth as part of the diagnostic phase of treatment planing.

M0 = no tooth mobility.

M1 = slight tooth mobility (less than 1 millimeter laterally with no apical mobility).

M2 = moderate tooth mobility (1 to 2 millimeters laterally with no apical mobility).

M3 = marker tooth mobility (both lateral and apical mobility).

A tooth with M3 is considered a hopeless case and requires extraction.

Furcation Index

Furcation index (F#) records the degree to which the furcation of a multi-rooted tooth has become exposed by gingival recession and periodontal bone loss. Exposed furca are highly plaque-retentive and can be very challenging to get clean and keep clean.

F1 = furcation can be probed due to gingival attachment loss or gingival recession but there is no furcational bone loss evident clinically or on radiograph

F2 = furcation is undermined so that the probe will “fall” into the furcation. Radiographically there will be decreased density of furcal bone.

F3 = there is through-and-through exposure so that it is possible to place the probe through the furcation from lingual to palatal. Radiographically, there is obvious bone loss in the furcation but clinically, the furcation is occluded by soft tissue.

F4 = some authors offer this classification to denote teeth in which both gingival and bone have receded sufficiently so that you can see through the furcation without having to reflect any tissues.

Treatment

The treatment of periodontal disease is divided into three stages as follows.

Initial Treatment:

- client evaluation and education with respect to plaque control
- diet analysis and evaluation
- periodontal probing and charting
- intra-oral radiographs
- appropriate extractions and wound closure
- scaling and root planing
- reduction of pocket depth

  i) sub-gingival curettage

  ii) gingivectomy where indicated (only in cases of gingival hyperplasia)

  iii) periodontal flap procedures

  iv) osseous recontouring

  v) periodontal regenerative procedures
- temporary splinting of mobile teeth

Home-care

- appropriate diet and chew treats
- daily tooth brushing
- chemical plaque control agents

Maintenance Periodontal Treatment

- re-evaluation every 3-12 months (probing, charting, radiographs)
- periodontal maintenance therapy

The Prophy

According to the American Veterinary Dental College, the purpose of a Dental Prophylaxis is as follows:

a procedure to remove all hard and soft substances from the tooth surfaces. The primary objective is always a thorough and complete removal of the bacterial plaque, calculus and extrinsic stains. This must be accomplished by a procedure known as scaling and polishing. If calculus is present below the gingival margin, subgingival scaling, as well as

supragingival scaling, is performed. Dental record keeping, thorough charting and client education are also necessary portions for the prevention of disease.

Each prophy should start with a thorough examination of the patient. Do not go directly to the mouth, but rather, look at the whole animal first. Start with patient history and signalment as this may reveal information that will change your approach to the case.

Review past history for:

- previous dental treatment,
- most recent illness,
- surgical history,
- gastrointestinal status,
- cardiovascular status,
- endocrine disturbances,
- allergies and drug sensitivities,
- bleeding disorders,
- present medication,
- diet,
- vices,
- home-care.

A physical examination should follow history taking. You may well find a problem that supersedes the dental concern and that should be treated before dental procedures are done.

After looking at the whole animal, look carefully at the head. Check for symmetry of the head and face. Observe any nasal or ocular discharges, as tooth root abscesses will often communicate with other cranial structures. Note any swellings.

Next, look at the lips and muco-cutaneous junctions. Many immune-mediated diseases will be evident in this location.

Now you may start the oral examination. This involves the whole oral cavity, not just the teeth. The exam should be organized in an orderly fashion with a consistent routine to ensure no area is neglected. Look at the buccal mucosa, the tongue, the palates, oropharyngeal area and tonsils, the floor of the mouth, occlusion and finally the teeth.

The findings should be recorded accurately on a suitable dental chart to facilitate communication and assessment of progress at subsequent treatments. See sample charts in Appendix D.

Some of the things to look for are:

- colour, texture and form of gingiva
- exudate if present
- plaque and calculus deposition and distribution
- pocket depth in millimeters
- attachment loss in millimeters
- gingival recession in millimeters
- contact relationships of teeth
- occlusal relationships
- traumatic occlusal factors
- wear patterns on teeth
- mobility of teeth
- migration of teeth
- food impaction
- anatomic variations
- abnormal frenulae
- mucogingival line
- signs of oral vices
- anything else of interest

The advent of small, fine instruments has made it possible for operators to develop a delicate, tactile approach to the treatment of periodontal disease. Each instrument has been designed to do just so much work effectively, but when it is pushed beyond these limits, its efficiency drops proportionally. Some basic principles of hand instrumentation are as follows:

- work comfortably, seated on a stool at the appropriate height
- follow an orderly and consistent sequence of instrumentation
- ensure maximum visibility with a good source of light (but do not open the mouth excessively as this will cause damage to the temperomandibular joint) and magnification
- obtain good access with retractors, dental mirrors and mouth gags

- maintain control over the instruments
- maintain a clear field with frequent flushing
- use sharp instruments
- use a modified pen grasp
- be gentle and careful, do not rush yourself
- know the function and limitations of each instrument
- use as few instruments as possible
- know the relation of the instrument to the tooth and periodontal structures before activating it
- check for completeness
- support hand on a tooth or structure in the same quadrant as you are working on.

The pictures that follow depict the use of a periodontal probe, a curved sickle scaler and a Gracey curette.

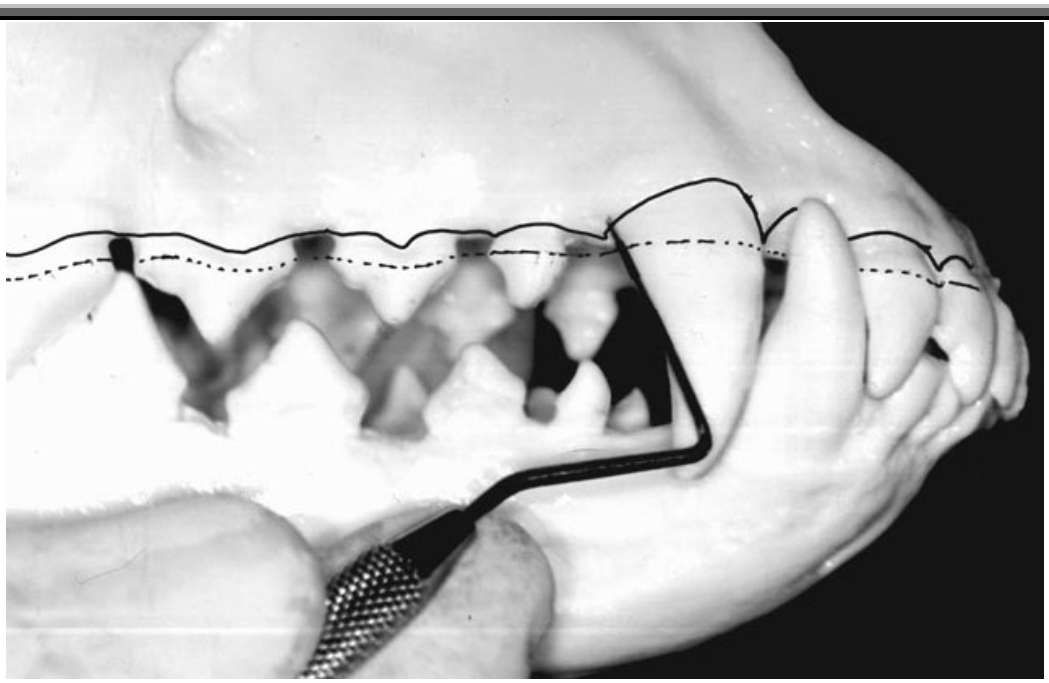

Figure #13.4. Periodontal probing. The solid black line highlights the alveolar crestal bone. The dotted line represents the free gingival margin as it would be in a healthy animal. The instrument is held in a modified pen grasp. The tip is gently introduced below the gum until it meets resistance at which point the depth is read from the graduations. The instrument is withdrawn a few millimeters, moved to a new location and then advanced to take the next measurement. The instrument is hopped around the entire circumference of the tooth and measurements recorded on the dental chart.

Radiology in Periodontal Disease

When treating periodontal disease, the condition of each tooth must be accurately assessed in order to make the appropriate treatment decisions. While the use of a periodontal probe to measure gingival recession and periodontal bone loss is essential, it is only part of the picture. Intra-oral dental radiographs are absolutely essential for evaluating the degree and location of pathology (bone loss, root caries or resorption, endodontic disease). It just is not possible to accurately assess the periodontal status of affected teeth without radiographs. Failing to take dental radiographs will lead to misdiagnosis and mistreatment more often than not. The day may not be far off when failure to take intra-oral dental radiographs will be considered malpractice.

Figure #13.5. A curved sickle scaler being used to remove supra-gingival calculus. The instrument is held in a modified pen grasp with the thumb and first two fingers. The third finger is supporting the hand on the adjacent incisors. The cutting edge of the scaler is placed under the calculus so that as the hand is rotated about the wrist, the calculus is pulled off the tooth and away from the gingiva.

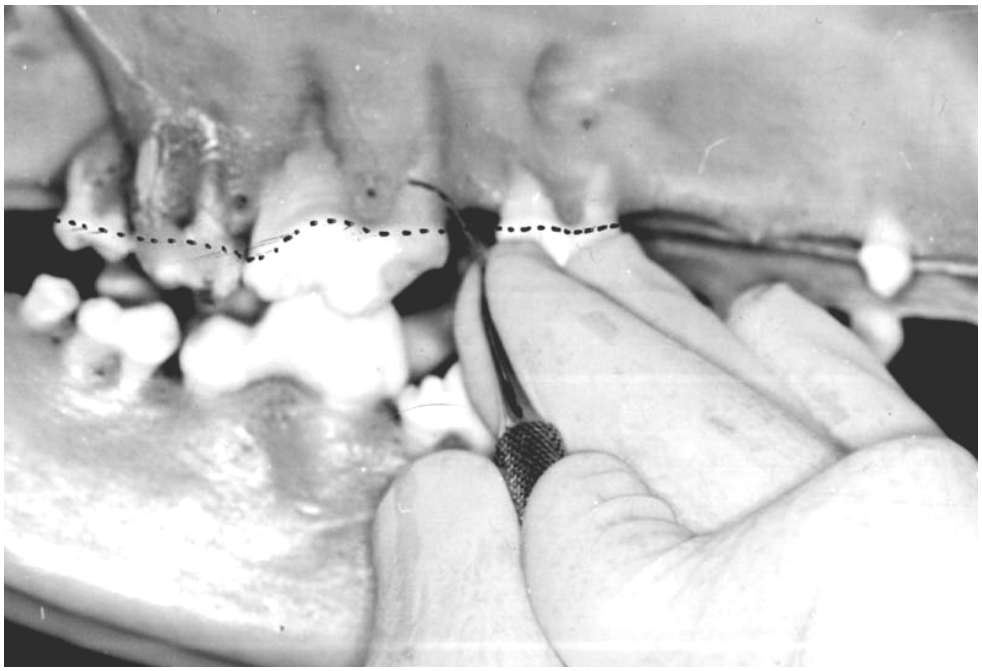

Figure #13.6. A Gracey curette being used for sub-gingival scaling of the root surface. Again, the modified pen grasp is used and the third finger stabilizes the hand on the tooth adjacent to the one being cleaned. The dotted line represents the free gingival margin. Can you see the developmental abnormality in this mature dog skeleton?

Scaling and Root Planing

Scaling refers to the removal of calculus from the crowns of the teeth. This can be achieved with mechanical scalers, hand scalers or a combination. Though the calculus on the crowns of the teeth is not the big problem (subgingival accumulations are much more significant), complete removal of all calculus is the goal. Mechanical scalers work by vibrating and so they do not tend to work well in tight quarters, such as between closely spaced teeth. That is when hand instruments must be used.

When wet, small accretions of calculus will be difficult to see, as it can be almost the same colour as the tooth. Blowing the tooth surface dry will reveal the dull, chalky calculus against the shiny enamel surface.

Root planing is the process of removing plaque, calculus and necrotic cementum from the root surfaces. Doing a thorough job of root planing is far more important than getting the crowns of the teeth clean, as it is the bacteria below the gum line that is causing the periodontal disease.

Root planing is accomplished with dental curettes (not scalers). Hand instruments used to be the only acceptable tool for root planing, but some mechanical scaling devices (ultra-sonic scalers) have been designed for use in root planing and have been shown to work well when used properly.

For shallow defects, (less than 5 millimeters), closed root planing is often sufficient. This is root planing without reflecting a gingival flap for access and visualization of the root. If the pocket is over 5 millimeters deep then a gingival flap should be reflected to allow access to and visualization of the root (open root planing).

As study was done in which human periodontists did closed root planing on deep pockets until they felt the roots were good and clean. Then they reflected gingival flaps and consistently found that there was still calculus (and therefore, plaque) on the root surfaces. The conclusion was that even in the most skilled hands, deep pockets need open root planing.

Subgingival Curettage

As well as removing the plaque, calculus and necrotic cementum from the root surface, it is also important to remove infected and inflamed soft tissue from periodontal pockets. This procedure is known as subgingival curettage. In some cases, this tissue can be removed with the same curette that is used to plane the root surface, in other cases, specific periodontal incisions are made to remove the undesirable tissue.

When finished, the goal is to have a clean cementum surface on one side of the periodontal pocket and either fresh bleeding connective tissue or clean bone on the other side. Then healing can take place.

Figure # 13.7. The radiograph shows a deep infrabony pocket along the distal aspect of the distal root of the mandibular first molar. Though a treatable lesion in many cases, the tooth was extracted in this case. Looking at the tooth from the lingual aspect, you can see not only the calculus on the root surface, but also the inflamed soft tissue that had been interposed between root and bone. In order to get this periodontal defect to heal, it would have been necessary to remove all plaque, calculus AND inflamed soft tissue from the pocket. This would require open debridement.

It is beyond the scope of this book to go into great detail on these more advance periodontal procedures. The very important message that must be delivered is that, when dealing with the treatment of established periodontal disease, all subgingival pathology must be addressed if there is to be any hope of success. **It makes no difference how clean the crowns are if there is plaque, calculus and inflamed soft tissue left in the pockets.**

Polishing

Polishing at the end of the procedure serves two essential functions.

Firstly, scaling by hand or with power equipment will micro-etch the enamel and cementum. This leaves these surfaces rough and, therefore, more plaque retentive. Polishing helps to remove the microscopic grooves, leaving a smoother surface with less total surface area and fewer places for the plaque to hide.

Secondly, and perhaps more importantly, polishing removes plaque.

You will likely do a thorough job of removing calculus when you scale, but since plaque is less visible, considerable amounts can be left behind. The use of a plaque disclosing solution will reveal areas of retained plaque following scaling. This is a good way for you to run a self-assessment on your dental prophylaxis.

Since plaque will start to mineralize within a few days, to leave any behind is to do an incomplete job.

If we are going to put our patients through the risk of an anesthetic, and charge our clients for dental cleaning, it is incumbent upon us to do a complete and thorough job of it, especially when polishing is so quick and easy.

As with almost all beneficial treatments, polishing is not completely without risk. As the polishing cup will generate a lot of frictional heat, it can cause thermal damage to the pulp causing pain and possibly pulp necrosis. To avoid this:

- keep the prophy cup moving over the tooth surface constantly,
- leave the cup on any one tooth for a maximum of five seconds - if that tooth is not completely polished in that time then leave it to cool down and come back to it later,
- keep plenty of prophy paste in the cup,
- wet the teeth with water periodically to cool them - this also rinses away paste and blood allowing better visualization of the job site,
- use a light touch,
- potentially contrary to that last point, apply enough pressure so that the lip of the prophy cup flares out on the tooth surface to reach into the gingival sulcus. Remember that it is the plaque below the gum line that causes the most significant problems. If you do not get the enamel in the sulcus polished well, you have done little for the long term benefit of your patient,
- buy the softest available prophy cups to minimize the pressure required to cause the cup to flair,
- use a medium or fine grit prophy paste or flour grade pumice mixed with water,
- if your polisher has adjustable speed, set it to below 3000 RPM.

Sulcar Lavage

The prophy paste is a pumice mixture. Pumice is a foreign body, so flush the gingival sulcus thoroughly to remove all paste. This will also remove any loose calculus and cellular debris to establish a clean sulcus. You can flush the sulcus with a 20 or 60 cc syringe with a small intra-venous catheter. Gently introduce the cannula to the bottom of the sulcus and infuse your irrigant at low pressure.

For lavage of a gingival sulcus (i.e. no attachment loss), a solution of 0.12% chlorhexidine is a good choice because the disinfectant will establish an electrical bond to the tooth structure and remains active for several hours. When there is a periodontal pocket, use only saline, as chlorhexidine and fluoride will interfere with the reattachment of the freshly exposed connective tissue to the clean root surface.

Fluoride Treatment

Fluoride has a few desirable properties. It can bind to enamel and replace lost calcium to reverse incipient caries lesions (tooth decay). It desensitizes exposed dentin. It is antibacterial.

Fluoride is used extensively in human dentistry, mainly for its anticariogenic properties (it prevents tooth decay). However, cats do not get caries and only about 5% of dogs ever get them.

Therefore, the wholesale use of fluoride seems unjustified in veterinary dentistry.

Dentin may be exposed by chip fractures and this will certainly cause sensitivity, but this can be more effectively treated by sealing the exposed dentin tubules with a dentin bonding agent (some of which do contain fluoride).

Fluoride is antibacterial but there are many other oral antiseptics to choose from and the effects of an in-office application are short-lived.

On the other hand, fluoride is a toxic substance. This is why fluoride-containing toothpastes are not to be used in children under three-years-of-age as they will swallow rather than rinsing and spitting. Dogs and cat also do not rinse and spit, but swallow what goes in their mouths.

If a patient has extensive gingival recession with exposure of root or has enamel hypocalcification, the use of fluoride might be justified. However, in the vast majority of veterinary dental patients, there is no confirmed benefit from providing fluoride as either an in-office procedure or in a home-care product.

Figure # 13.8. There was end-stage periodontal disease affecting the second and third molars as well as horizontal and vertical bone loss around the distal root of the first molar with an infrabony pocket. The second and third molars were extracted, giving good access to the distal root of the first molar. Open root planing and subgingival curettage was followed by suturing of the labial and lingual gingival flaps. Six months later, the infrabony pocket has filled in completely with new bone, there is regeneration of the periodontal ligament and probing depths were normal (1-2 millimeters). Nothing was placing in the pocket or below the gingival flap. Treatment simply involved scrupulous surgical debridement of the defect and wound closure.

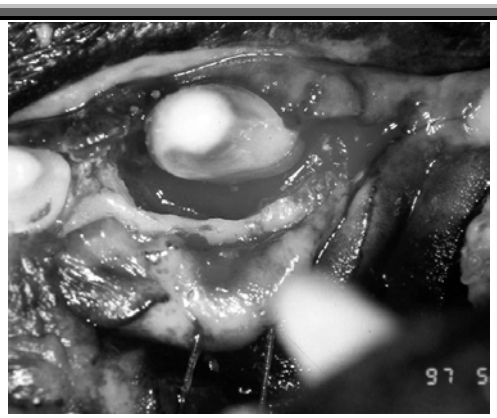

Figure #13.9. This deep infrabony pocket on the palatal side of this maxillary canine tooth has been debrided and is awaiting placement of a synthetic bone grafting material. Access to the pocket was facilitated by reflecting the palatal mucosa (open root planing and subgingival curettage). The flap is being retracted by means of a stay-suture looped around the crown of the contra-lateral canine tooth.

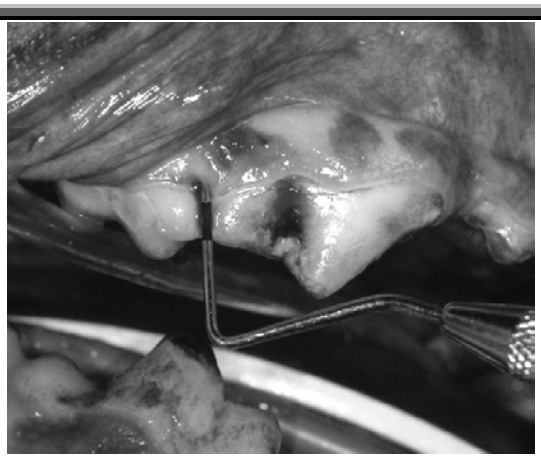

Figure #13.10. There was no gingival recession or gingivitis. There was nothing to hint at the level of disease, yet the periodontal probe has found an 8-mm deep pocket between teeth 108 and 109.

Chapter 14: Home Care

The Dangers of Home Care

The message from the veterinary dental community over the past many years has been "Brush, Brush, Brush!" Since the idea of having clients brush their pet's teeth is still a relatively new concept, we have had to shout loudly to get anyone to listen. We have been saying every client should be brushing every pet's teeth all the time. Well, as with everything in life, it ain't quite that simple.

Home care can be harmful to the pet and the owner and can be counterproductive if not approached in the proper manner. To start, you should **never** recommend a home care program to a pet that has not had a recent, very thorough oral examination (preferably under general anesthetic).

Home care can cause pain to the animal. If an owner tries to brush the teeth of a cat that has resorptive lesions, it will cause pain. If an owner tries to brush a tooth that has a crown fracture and exposed pulp, it will cause pain. If an owner tries to brush the teeth of an animal that has serious gingival inflammation, oral ulcerations, mobile teeth…, it will cause pain. If an owner brushes too vigorously or roughly, it will cause pain. If the animal's early experience with home care involves pain, it will be very difficult to ever get this animal (or owner) to accept and enjoy daily home care ever, even after the painful conditions have been resolved.

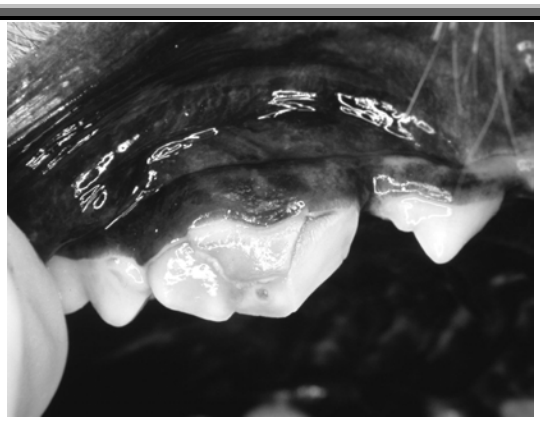

Figure #14.1. This slab fracture with pulp exposure would be very sensitive. An owner attempting to brush this tooth would cause the animal considerable pain.

Home care can lead to a false sense of security. If an owner is brushing the crowns of the teeth daily, the crowns will remain nice and clean. Therefore, at annual examination, you will see clean crowns and will be inclined to say that no further dental examination or treatment is required. However, there may well be problems brewing in an area that is not only hard for the owners to brush, but hard for you to examine with the animal awake.

The problem could be a foreign-body induced periodontal pocket between the mandibular first and second molars, a caries lesion in the occlusal pit of the maxillary first molar, a previously formed periodontal pocket, a crown fracture or any number of problems. If you are not regularly anesthetizing your patients to do a thorough oral examination, you are going to miss these hidden problems until they become very advanced and obvious.

One suggestion is to always do a thorough oral examination (examine each tooth above and below the gum line and take appropriate dental radiographs) anytime you have an animal anesthetized for any reason whatever. Never squander an opportunity to look for problems and you will be amazed at what you find.

So, home care is for pets with clean, healthy mouths and should never be used as a substitute for proper, professional care.

Why is Home Care Essential?

For animals predisposed to or afflicted with periodontal disease, professional treatment is only part of the plan. What the owner does at home on a daily basis for plaque control has as much or more impact on the long-term prognosis. To understand why home care is so important, it is important to understand some things about plaque and calculus and the progression of periodontal disease.

Following a professional dental cleaning the tooth surface is considered clean. Within hours, a film of salivary glycoproteins, known as the *acquired pellicle*, starts to form on the exposed dental surfaces. In a few more hours, oral bacteria colonize this pellicle. This is the beginning of the development of *dental plaque*, which is a mixture of salivary glycoproteins, sloughed epithelial cells, white blood cells, food

What Home Care IS NOT:

Home care is NOT a treatment for established disease.

Home care is daily plaque control designed to maintain oral hygiene and prevent the development of gingivitis and periodontal disease. It does not remove calculus and it cannot reach into periodontal pockets. Therefore, home care should only be instituted AFTER appropriate professional treatment has established a clean and healthy mouth. Home care is then used in an attempt to maintain this healthy situation or to prevent the situation from deteriorating.

Home care is NOT a substitute for regular professional examinations and treatment.

Since home care only cleans the crowns of the teeth and maybe 1 to 2 millimeters subgingivally, it will have little or no effect on established periodontal pockets. Home care is also only effective for those teeth (or tooth surfaces) the owner is able to reach. Therefore, even with home care, the animal should have regular professional examinations and treatments. I brush my own teeth 2-3 times a day and floss daily and I still see my hygienist and dentist every nine months.

Home care is NOT an Over-the-Counter concept.

There is a dizzying array of home care products and aids available for your clients to choose from. It can be confusing to veterinarians which products to use when. Do not leave it up to your clients to decide for themselves which products to use or how to use them.

For those animals that need home care, take the time to discuss the situation with the owner and explain what they need to be doing. Listen to their thoughts and concerns, consider the animal involved and then customize a program based on the situation.

particles and bacteria. Immature plaque is a rather disorganized slime on the tooth surface.

If the immature plaque is left undisturbed, it becomes more organized and more firmly attached to the tooth surface. It starts to evolve into a highly complex society of co-operative and synergistic bacteria and protozoa. Aerobic bacteria live on the outer surface of this biofilm with anaerobes living closer to the tooth surface. The mixed population of bacteria produces and secretes substances that act as a matrix, enhance adhesion and protect the residents of the biofilm from chemical and cellular antimicrobial agents. Mature plaque is 25% bacteria and 75% matrix.

Within as little as two days, undisturbed plaque can start to precipitate salivary minerals to form *calculus*. Calculus itself does not cause periodontal disease, but it does provide a very safe environment in which the periodontal pathogens can live. The rough porous surface provides a foothold for the bacteria that is not easily dislodged.

The bacteria in plaque produce toxins, which cause inflammation of the gingiva. If left untreated, this gingivitis may progress to periodontitis (inflammation and destruction of the gingiva, periodontal ligament, alveolar bone and root cementum). To prevent gingivitis and periodontitis from developing and to maintain gingival health, plaque must be removed before it becomes organized and mineralized.

In the wild, plaque is controlled by chewing through the hides of prey, and by eating raw, fibrous meats such as heart and diaphragm. Also, feral dogs live for about six years and feral cats last for two to three years. Their mouths are designed to last this 'lifetime'.

As our pet cats and dogs are living well into their teens and their diets offer little challenge to plaque, we must lend aid in the fight.

From the above, you can see that if the owners are not doing anything for plaque control at home on a daily basis, noticeable calculus and gingivitis may be back by the two-week recheck appointment. Home care refers to anything the owners are doing at home on a regular basis to control plaque and maintain periodontal health. In numerous studies, daily brushing of the teeth with a soft-bristled toothbrush has been shown to be the most effective means of plaque control. It is the mechanical action of the bristles against the tooth surface that removes the plaque.

Feeding large pieces of raw vegetables or lightly cooked fibrous meat at least twice weekly will remove some plaque. Mildly abrasive chew treats such as rawhide strips are also beneficial. *However, there is nothing as effective as daily brushing*, and this should be your first recommendation. Save the other suggestions for cases where daily brushing is impossible or as an adjunct to brushing.

Another benefit of daily brushing is that it can stimulate gingival fibroblasts to produce collagen to keep the gingiva firm and healthy.

I suggest that dental patients be sent home with a home care sheet (as provided in Appendix C), an appropriate toothbrush and cleansing product. If you provide your client with all the tools and they choose not to use them, then it is their fault if the teeth are dirty again in a year. If you do not, then you must share the blame. You may also want to send dental kits home with puppies and kittens and young animal not yet in need of your professional services.

Do not think that you can just send all these goodies home and expect compliance. Plan to spend several minutes at discharge or at recheck demonstrating technique and answering questions. Take time to select the home care product that is most appropriate for the circumstances and let the client know you are available to offer moral support and suggestions if the going gets tough.

The rewards of having clients involved with home care are great. First and foremost, your patient benefits from better oral health. Secondly, your clients will become more aware of dental concerns and will actually start requesting more dental treatment. They will notice small problems early, when they are easily treated, rather than leaving them as surprises for you to find at vaccine time.

Does Every Pet Require Home Care?

Here is some more heresy. I have found that not all dogs and cats require homecare. I have seen mature, even geriatric dogs and cats that have never had any homecare, never had any professional dental treatment and yet still have no significant gingivitis or periodontitis. They may have broken or worn teeth from inappropriate chewing or other dental/oral disease, but nothing that would have been prevented by brushing.

In dogs and cats, as in humans, it seems that the single most important factor in determining the development of periodontal disease is genetics. Some pets have a great natural resistance to periodontal disease and some seem to have very little resistance. Certainly, factors such as diet, chewing habits, general health status, the physical architecture of the mouth and teeth all play a role as well. But they are secondary to the inborn ability of the animal to cope with oral bacteria.

For those animals blessed with excellent natural resistance, there may be little or no need to spend any time talking the owners into brushing. Pick your battles and spend your time and energy where it will do the most good.

How to Institute A Home Care Program

There is a client education sheet in Appendix C on this subject, but more details are needed.

Home care is not something we do TO animals; it must be something we do FOR them. It does not matter how motivated the owners are, if the animal is not a willing and enthusiastic participant, the program will fail. Therefore, we must train the animal to truly enjoy having its teeth brushed. If this is accomplished, the animal will request this attention and will give the owners grief if they try to skip a day.

Teaching a dog to fetch a stick or shake a paw is like teaching a fish to swim. They are basically natural behaviors that we encourage with positive feedback. Having someone poke a toothbrush in their mouths is a very unnatural behaviour and so we must start with something the animal is already doing, reward that and then gradually shape the behavior until it is what we want.

When doing behaviour shaping or training of any sort, consistency is very important. The first step is to decide who in the family is going to be responsible for home care. Training should be done by one person. Once the program is up and running well, the job can be shared, but the training phase should be a one-person job. In a perfect world, it would be the person who is the most motivated or has the best relationship with the pet. However, sometimes the job defaults to the person who is consistently home every day.

The next decision is when the brushing will happen. Dogs and cats are creatures of habit and like things to happen the same time each day. For many, late evening or just before bedtime works well as the pets are in a quite mood and often looking for attention anyway.

The third decision is where brushing will happen. The owner should do this in the same place every day, not only for consistency but also to ensure that all materials, including the rewards, are all close at hand.

What follows are guidelines, not hard rules. Each program must be tailored to the home situation.

In many homes, the pet will seek the owner's company and attention by climbing on their lap or nudging their hand looking to be petted. In this situation, the animal is coming to the owner looking for something. It is the animal's idea; the animal is initiating the interaction and this is ideal. At this time, the owner should get down at eye level with the animal and give it the attention it is seeking.

The first step is to have the animal sit quietly while the owner strokes under the chin and mandibles, using lots of gentle praise. After ten seconds or so, the animal is given a reward (usually a food treat). It is important that the reward follows the behaviour within seconds for the animal to draw a connection between the two.

Each day, the owner tries to increase the amount of time the animal sits quietly having its lower jaw massages before getting the reward.

When the animal is happy to sit for thirty seconds or so, the owner can start working on stroking and massaging the maxilla as well. They should go slowly, as animals are naturally very protective of their eyes.

Next step is to gently and casually start manipulating the lips, pushing the upper lip up, retracting the commissures of the lips caudally and the lower lip ventrally. This should be done without pulling on the whiskers or pinching the lips. After a few days of this, it should be possible to slip a finger (one without long nails) inside the mouth to start gently rubbing the teeth. Start with the anterior teeth (canines and incisors) and gradually work farther back in the mouth to massage the premolars and molars. It is not necessary to open the mouth or even lift the lips for this – it can all be done by feel.

Figure #14.2. Step one – Molly is sitting quietly while I massage her mandibles and maxilla, being careful to respect her need to protect her eyes. Lost of gentle praise and affection during the massage and a food treat after makes this a pleasant experience for Molly and so she will be looking forward to repeating it tomorrow.

When the pet is comfortable accepting a naked finger rubbing along the buccal surface of the upper teeth, the finger can be wrapped in a gauze square, a bit of pantyhose or some other mildly abrasive material. The covered finger is again used to massage the teeth and gums, starting with the anteriors and day-by-day moving to the back teeth.

Figure # 14.3. I am lifting the upper lip so that you can see my finger massaging the upper premolars. Usually this is done with the lip hanging down. We want to be as gentle as possible so that this can remain a pleasant experience for the pet.

If a toothpaste is going to be used, now is the time to introduce it. More on home care products follows this section, but for now I will just say that I view most veterinary tooth pastes as nothing more than flavouring. If the pet likes the flavour of the paste, it becomes part of the positive reinforcement. If the pet does not like the paste, it will have a negative impact on the program and should be left out. The owner should put some paste on the end of a finger and offer it to the animal. If the animal does not lick it off right away, the owner can dab a bit on the tip of the animal's nose. The pet will lick it off and then will either want more or will turn away from it when the paste-laden finger is offered. If the animal likes the paste, use it. If the animal does not like the paste, try a different flavour or skip it altogether.

Figure #14.4. Again, I have elevated the lip to aide visualization. Brushing is usually done with the lips hanging down, going by feel.

The next step is to introduce the toothbrush. It should be a small, soft-bristled child's or toddler's brush. With the forefinger guarding the end of the brush, it is slipped into the buccal pouch under the upper lip and gently rubbed back and forth along the tooth at the gum line. Start with the anterior teeth and gradually work to the back of the mouth.

The bristles of the brush are held at 45 degrees to the long axis of the tooth at the gum line and the brush used to sweep the crown and marginal gingiva to remove plaque and stimulate gingival fibroblasts. Owners should be cautioned about brushing too hard. They can practice on a ripe tomato. They should brush hard enough to dent the skin but not hard enough to tear it.

Some owners with complain that they cannot brush the back teeth because the pet keeps chewing on the brush. That is not a bad thing. While the owner goes back and forth, the chewing action is brushing up and down and getting the bristles in between the teeth, almost like flossing.

Figure #14.5. The brush is now reaching to the back teeth. Take care to avoid trauma to the back of the mouth by poking it too aggressively with the hard plastic end of the brush.

Figure #14.6. At the end of each session, a reward is given to positively reinforce the pleasant time spent together. The pet will soon look forward to receiving this treat.

Once the animal is accepting of having the buccal surface of the upper teeth brushed, the owners can start to work on getting at the lower teeth and to the lingual and palatal aspects. This will involve opening the mouth. Approached gently, this is usually no particular challenge. If prior dental treatments have identified trouble areas, the owners should concentrate on these.

This is not a race or a competition. The animal sets the pace and determines how long is spent on each phase before moving to the next. If the owners try to progress too fast and evoke a negative response from the pet, that is what the pet remembers the next night and the game is lost. It is far better to go too slow than to go too fast.

If the owners have made earlier attempts at home care without going through a gradual process of behaviour shaping, chances are it did not go well and the owners gave up because the animal was non-compliant. These owners will have to be particularly patient and give the animal time to forget past negative experiences and learn new positive ones.

Similarly, if the animal has been living with dental pain for sometime, the owners will have to proceed slowly to gain the animal's trust and help them to learn that it no longer hurts to have their mouth handled.

If owners approach home care with enthusiasm, follow the steps and take it slowly with lots of praise, affection and rewards, many animals will come to truly enjoy home care. Many owners claim their pets will not let them skip a day as they do not want to miss the attention and treats.

Home Care Products

This section will discuss **some** home care products and how they work (according to manufacturer's claims or as confirmed by independent research). Inclusion here does not imply an endorsement and exclusion does not imply an indictment. There are far too many to cover them all in these pages, so you will have to apply the principles discussed to critically evaluate the claims of each product to see how it might fit into your dental program. Above all, remember that daily brushing is the most important part of the home care program. What, if anything, the owners put on the brush is secondary.

No one product is appropriate for all cases and so familiarity with the actions and effects of each will increase your chance of success. The best oral anti-septic sitting in the bottle is not as effective as the fourth best sitting in the mouth. If you select a product that your patient or client does not like, it will not get used and so will do no good. Consider the likelihood of getting compliance with your recommendations and choose a product with the greatest chance of being accepted.

Chemical Plaque Control

Chemical plaque control agents come in many forms including toothpastes, gels, rinses, water treatments. No chemical agent has been shown to be effective in plaque control by itself. Most will reduce or retard plaque accumulation to a degree, but they cannot stop it from forming. Claims such as "reduces plaque by 30%" means that there was still 70% as much plaque as without the product.

Once a plaque film has formed, it will be very resistant to chemical agents that are applied passively. Bacteria in a biofilm are considered to be 1500 times more resistant to antimicrobial agents than they would be in monoculture.

Pastes are meant to be used on the toothbrush and may have a number of functions. Most veterinary pastes are flavoured for the peculiar taste preferences of dogs and cats and so can improve compliance. If the animal likes the taste of the paste, it becomes part of the positive reinforcement so important to establishing this habit.

Pastes also often have some abrasive material such as ground walnut shells, to improve the mechanical cleaning action of the brush.

Virbac™ markets a line of veterinary toothpastes under the brand **C. E. T.™**. These pastes contain a "dual-enzyme system" consisting of glucose oxidase, lactoperoxidase and a substrate (not specified). These ingredients combine with water (from saliva) and oxygen to eventually form hypothiocyanite (OSCN). This ion is produced naturally in human and canine saliva (possibly in cat saliva as well), where it has been shown to have an antibacterial effect.

I have never disputed the value of the endogenous salivary lactoperoxidase enzyme system as part of the host defense system. What I have asked on several occasions over the years is, "Is there any research to show that adding more of this enzyme system in a toothpaste or other product has any beneficial effect?" I know that brushing a pet's teeth with C. E. T.™ will be beneficial, but would we get the same benefit from brushing with a placebo paste that lacks the enzyme system? To date, this research has not been done. For now, I tell clients that many pets like the taste of C.E.T.™ and so it can be useful in boosting compliance. If it also does have some antibacterial effect, I look on that as a bonus. At time of writing, I cannot support their antibacterial claim, as they have no scientific studies to back it up.

There are also a variety of gels and rinses available which act as oral antiseptics. The most common active ingredient in these products is chlorhexidine. Chlorhexidine is a non-specific antibacterial agent as well as having some effect on fungus and viruses. There is a large body of research on the efficacy of chlorhexidine as an antimicrobial agent. It acts by causing precipitation of the cytoplasmic contents of the bacterium – a mechanism against which resistance cannot develop. While chlorhexidine has been shown to reduce plaque and gingivitis, it paradoxically can increase the rate of mineralization of plaque (calculus formation). Chlorhexidine also causes a brown staining on the teeth when used as a rinse (can be polished off but looks terrible) and can cause a decrease in the sense of taste. Chlorhexidine is likely best used as a pre-operatative oral rinse and at home for the healing period following professional treatment.

Chlorhexidine comes in two forms; acetate and gluconate. Of the two, gluconate is more soluble and has been studied more. Both form ionic bonds with oral hard and soft tissues to give a prolonged effect (12 hours) from a single rinse.

Maxi/Guard™ is available as a gel and as a rinse. Both contain zinc and ascorbic acid (vitamin C) and taurine. Zinc is antibacterial and important for healthy epithelium. Vitamin C is important in the production of collagen, which is the main structural protein in gingiva. The taurine chelates volatile sulphur compounds produced by oral pathogens, which has an obvious effect of reducing halitosis and may reduce the damage to oral tissues that may be caused by these volatile sulphur compounds. The gel is tasteless and alcohol free and makes a nice oral anti-septic for the post-operative period. It has also found a use as a plaque retardant in cats that will tolerate no other forms of home care. Maxi/Guard™ has a relatively low pH (4.6) and this may cause some cats to hypersalivate a bit.

Ora/Zn™, produced by the makers of Maxi/Guard™, contains zinc alone as the active ingredient and is pH neutral so may be better accepted by the pets.

Sodium **Hexametaphosphate** (HMP) is a sequestrant that binds salivary calcium, making it unavailable for precipitation as calculus. It has no direct effect on oral bacteria or plaque, but by reducing calculus accumulation, it would make plaque control easier. HMP is delivered as a coating on various treats and diets and may also be found in some toothpastes (not available in Canada currently).

Chew Toys

There are a variety of items on the market upon which dogs are meant to chew. Most of them will claim some dental benefit such as “Cleans Dog Teeth”. While many of these toys can legitimately claim to help keep a dog’s teeth clean, many are also a major cause of dental fracture. Examples would include all natural bone, whether processed or fresh from the butcher and dried cow hooves. Hard-pressed rawhide bones and nylon bones are also sufficiently resilient to cause dental fracture.

What we are looking for here is a substance for the dog to chew on. This will be recreational for the dog. It will also exercise the muscles of mastication. Also, the jawbones get stronger with use and strong, dense bone supports the teeth better than the soft bone that develops with disuse atrophy. Chewing also acts to strengthen the periodontal ligaments and increase crevicular flushing.

Another effect we are looking for from a chew toy is gentle abrasion. While the dog is chewing, it can be removing food debris and plaque from the crowns of the teeth, if it is chewing on the right thing.

Among the safer choices are the Kong™ toys. Used properly, these toys offer plenty of recreational activity, some plaque removal and low risk of dental fracture. They should never be thrown at an animal, as they are heavy enough to fracture canines and incisors if caught out of the air. Also, the animal should be monitored as some dogs can tear these toys apart and then swallow chunks of indigestible rubber.

Tennis balls are a favourite toy for dogs, however, they can be quite damaging. The nylon fuzz itself is quite abrasive. Also, the fuzz will retain grit picked up from the ground. So chewing on a tennis ball will be like chewing on emery cloth. Dogs that chew tennis balls a lot can wear their teeth to the point of causing pulp exposure.

To be avoided are toys that approach the hardness of the teeth. If something is going to break, let it be the toy. Chewing on hard objects causes just about every slab fracture you will ever see. Don't let us cause them by recommending hard toys. If you choose to sell these sorts of toys in your practice, then I feel you should pay for the treatment when the toy causes a dental fracture.

The criterion I use in practice is as follows. If you do not want me to hit you in the knee with a toy, then you should not give it to your dog to chew. If it is hard enough to hurt your knee, then it is hard enough to be a potential cause of dental fracture.

Many clients are in the habit of giving their dogs natural bones. They believe that a large knuckle bone is a safe and useful toy. It is our job to re-educate them on this. With natural bone, there are two possibilities. First, if the teeth are harder than the bone, then fragments of bone will be broken off. These splinters might become embedded in the oral tissues and cause periodontal abscesses, foreign body abscesses and lacerations. If swallowed, the bone fragments will not be digested, but could cause serious problems anywhere from the pharynx to the anus.

If the bone is too hard for the dog to splinter, slab fractures are very likely to occur. Chronic trauma from chewing can lead to ankylosis of the

periodontal ligament and so the ligament's shock-absorbing capacity is lost. This makes fractures more likely.

If a dog bites down hard on a bone, it might traumatize the tooth/teeth enough to cause an irreversible pulpitis (remember, the pulp has no room to swell if it suffers trauma and becomes inflamed). An avascular liquifactive pulp necrosis and peri-apical abscess will follow.

Another popular item in pet stores and at flea markets is dried cow hooves. Dogs really seem to like them and they are all natural. However, there have been a number of reports of dogs swallowing part or all of a hoof. The digestive process then starts to liberate a lot of gas from the hoof and a bloat and/or torsion can develop.

Dried hooves are also hard enough to cause slab fractures and periodontal ankylosis. A study by Wiggs and Lobprise at their practice in Dallas, found that dried cow hooves were the number-one cause of tooth fracture, followed by ice cubes and bones.

The nylon chew bones are very long lasting and so many owners like them. They are of some benefit with respect to plaque control and do a good job of giving the jawbones a work-out. Unfortunately, they can lead to slab fractures and will prove indigestible if swallowed.

Nylon rope toys should be avoided. A dog chewing on this is likely to cause a lot of gingival trauma as the fine nylon threads slice through like a cheese cutter. It is also abrasive enough to cause significant wear on the crowns of the teeth. Cotton rope would be less traumatic but should still be monitored closely.

Whatever toy the owners use when playing with their pet, be sure they throw the toy away from the animal and then have the pet chase after it. If the owner tosses the toy at the pet to catch, it could well shear off a canine tooth on the way into the mouth.

Chew Aids

This category would include consumable items that are not considered to be a significant source of calories such as rawhide strips and bones, pig's ears, and Dental Ring™. Any item that you give to a dog with the understanding that it is to be chewed into little bits and possibly swallowed, bears some risk of gastrointestinal upset or blockage. Consider each item and its relative risk and choose the safest one going.

Dental Ring™ is a ring of densely packed paperboard coated with ground bone, mint flavouring and colouring. As the dog chews on the ring, teeth are expected to be forced between the layers of paperboard, thereby "brushing" the teeth. The label claims that the ring cleans teeth and strengthens enamel. While use of this device may help remove plaque and tartar, there is nothing in the ingredient panel that could be expected to strengthening enamel. In fact, chewing on the ground bone would be abrasive and would be more likely remove enamel. There is no indication on the label that there has been any research into the safety and efficacy of the product. Paper products are not digestible so if a dog swallows a chunk of the ring, gastro-intestinal blockage is a possibility.

Pig's ears are available at many pet stores and flea markets. They are basically just pigskin and cartilage, often dried and smoked to prevent decay. The skin-cartilage parfait has a mild abrasive effect on the tooth surfaces without great risk of being too abrasive. The thin and flexible nature of pig's ears makes them very unlikely to cause dental fractures. Some dogs tolerate these aids very well, while others may experience digestive upset. As the ears are sold from bulk bins generically, there is no assurance of quality control and there have been rumblings that they may harbour bacterial pathogens such as salmonella, so buyer-be-ware. If a large chunk of an ear is swallowed, it will likely be broken down by gastric juices and pass without incident. However, choking and esophageal blockage are possible. To my knowledge, no research has been published to determine the efficacy of pig's ears in the prevention of dental disease.

Rawhide strips are a consumable treat that many dogs really love, but as they provide non-digestible protein, they do not add greatly to the caloric intake. Therefore they are discussed here. Purina™ markets beef hide strips under the brand **Friskies™ Chew-eez™**. Each strip is approximately 3-4 cm wide, 10 cm long and 1-2 millimeter thick. I consider these to be among the safest chew aids you can recommend. There is still a risk of choking, but this is a very rare event. I would avoid giving these to dogs that inhale rather than chewing. A brand name offers some quality assurance and the thinness of the strips makes it very unlikely that any teeth will be damaged. The abrasive action of chewing the rawhide does help reduce plaque, calculus and gingivitis. This brand of beef hide strip has received the Veterinary Oral Health Council seal

of approval for both plaque and calculus control (see Appendix E).

Virbac™ markets rawhide strips similar to Chew-eez™, but they impregnate theirs with the C. E. T.™ enzymes. Again, there is currently no research to support the notion that raw hide with C. E. T.™ is any more beneficial that raw hide without. Given the dramatic price differential, I am recommending the Chew-eez™ currently.

The densely compacted raw hide chew aids will last longer, even with big dogs, however, there is a real danger that these larger toys might be hard enough to cause tooth fractures. Another danger with rolled or compressed rawhide is that when the toy gets small enough, the dog might swallow a chunk that would act as a foreign body. To avoid this, select the largest sized toy possible for each pet and then replace it when it gets to a swallowable size. To be even safer, just avoid them altogether.

Treats

Treats would include any consumable item that adds to the total calorie intake but that is not the main source of calories. No treat has ever been shown to be able to maintain clinically healthy gingiva, no matter how much of it is fed. Treats are only a part of the plaque control program and should be used as well as, not instead of brushing.

DentaBone™ is a compressed tapioca-based treat that has been shown in numerous short-term and mid-term studies to reduce plaque, calculus and stain while improving gingival health when given daily. Personally, I have some misgivings about these very hard treats as a potential cause for dental fracture. I have seen cases of this happening myself and heard of it from other veterinary dentists as well. I also have heard of dogs choking on chunk of these treats.

C.E.T. Forte Chews™ are designed for cats as a mildly abrasive treat, intended to improve oral hygiene. They are available in fish and poultry flavour though freeze-dried fish is the main ingredient in both. These chews contain the same dual-enzyme system found in other C.E.T.™ products. Whether it is the course texture of the chew mechanically helping to remove plaque, the enzyme system or a combination, is not clear from the research. In any event a controlled study in client owned cats found a statistically significant reduction in gingivitis when the cats received one chew a day compared to eating the same diet without the daily chew. However, as you will see in the section on resorptive lesions in cats, we may need to start being concerned about vitamin D intake and fish is high in vitamin D.

There is a large selection of biscuits and other treats with a dental claim on the label. Some have demonstrated some beneficial effect or have ingredients with a known benefit, but all can be a source of excessive calories. Some are quite high in carbohydrates, which can support the growth of the bacteria responsible for dental caries (decay). Therefore, to avoid obesity and decay, these treats should be used sparingly and viewed simply as treats, not as dental care.

Diets

No diet has ever been shown to be able to maintain clinically healthy gingiva, no matter how much of it is fed. Diets are only a part of the plaque control program and should be used as well as, not instead of brushing and regular professional care.

It has long been felt that feeding a cat or a dog a dry kibble diet is better for the teeth than feeding them a processed, canned diet. The logic goes that dry food leaves less residue in the mouth for oral bacteria to feed on and so plaque would accumulate at a slower rate. Despite that, many animals fed on commercial dry diets still have heavy plaque and calculus accumulations and periodontal disease. This is because most dry pet foods are hard but brittle so that the kibble shatters without much resistance and so there is little or no abrasive effect from chewing. Also, many kibbles are small enough to be swallowed with no chewing at all.

There are currently a number of diets (and treats) that have received recognition by the Veterinary Oral Health Council for helping to control tartar or plaque and tartar. Up-to-date listings of approved products can be found at www.vohc.org.

Hills™ Prescription Diet™ t/d Original Bites™, t/d Small Bites™ and New and Improved t/d Feline™ as well as Science Diet™ Oral Care™ for dogs and cats and Friskies™ Feline Dental Diet™ all have approval for helping to control plaque and tartar.

The mechanism of action for these diets is based on the physical properties of the kibble. Each nugget is quite large and so must be chewed before swallowing. The nuggets are hard, but not

brittle, and so the teeth sink deep into the nugget before it splits. As the tooth is penetrating the nugget, the fibers in the food gently abrade the tooth surface, thereby removing plaque.

These diets are high-fiber maintenance diets for average mature animals but would not be appropriate to support growth, gestation/lactation or a very athletic life-style Each of them is intended to be fed as the main calorie source. Research by Hill's™ found that the best results were obtained in this manner, but that there was still a measurable (but declining) benefit when the t/d™ diets were fed as 75%, 50% and even 25% of the total calorie intake. Using t/d™ simply as a treat will not meet expectations for the product. It seems reasonable to extrapolate this observation to the Friskies™ Dental Diet™, though I have not seen research examining this issue for this product.

Because t/d™ works mechanically to remove plaque and calculus, it will have its action on the teeth used for chewing. Fortunately, these are also the teeth that tend to have the greatest accumulation of plaque and calculus and are also the ones that are the hardest for the owners to reach with a toothbrush. So although the effect may be restricted to specific regions of the mouth, they are the regions where this action is most needed in most cases.

Because t/d™ works mechanically during the act of chewing, it is going to be inappropriate to feed to animals who lack chewing teeth. If a patient has lost the upper fourth premolars and upper and lower molars, they are not going to be able to chew the t/d™.

Because t/d™ works mechanically during the act of chewing, always feed the Original Bites™ when possible. The Small Bites™ will require less chewing and so be less effective. The Small Bites™ are intended for micro-dogs who just cannot manage the Original Bites™.

The Iams Company™ has recently launched a line of diets under the name **Iams Chunks™** with **Dental Defense™**. These diets have been coated with HMP to reduce calculus accumulation and have received the VOHC seal for helping to control tartar (no plaque claim). Keep in mind that calculus (tartar) does not cause gingivitis or periodontal disease, bacterial plaque does. Calculus just makes it easier for the plaque to adhere to the tooth surfaces. Reducing calculus accumulation alone will not prevent gingivitis and periodontal disease, but it may make the job easier.

Medi-Cal™ has entered the dental care market with **Canine Dental Formula™** and has plans to add a feline version soon. At the time of writing (March, 2004), this product is still very new and so there is little I can commit to print. The main mechanism of action is offered via an HMP coating to chemically inhibit calculus accumulation. The kibble size is larger than the Iams™ diets but smaller than the t/d™ Original Bites™. The larger kibble size is intended to increase the time spent chewing to increase the amount of HMP released into the oral cavity. We all know dogs who swallow small kibbles without any chewing at all and this method of ingestion would render the HMP coating virtually useless, so the larger kibble size is a logical step. The chemical action of HMP is not restricted to the chewing teeth and so this may be a benefit for animals who tend to accumulate significant calculus around the anterior teeth. The research also indicates an impact on plaque scores.

Sorting Out The Claims

Promotional material is designed to sell product. It will be full of information to make that product look good and in our busy lives, it is tempting to take this information at face value. I have outlined a few products, but there are more available at the time of writing and likely more still by the time you read this. How will you decide which of these products may have a place in your clinic?

In the past few years, there has been some excellent work done in testing various dental products by a handful of researchers working for a few different companies. They have established experimental designs that produce credible results and which are becoming the industry standard.

The protocols have some variations, but they have in common the following basic features. Mature animals with known and documented levels of dental disease are selected. They enter the experimental trial after having a thorough oral hygiene procedure (the so-called "clean tooth model"). Subjects a randomly assigned to either the experimental (group A) or the control group (group B). After a time (typically 4 weeks), they are evaluated and scored for some or all of plaque index, calculus index, stain, odour and gingivitis index. They then have

another oral hygiene procedure and cross-over so that the group A becomes group B and vice versa. In this way, each animal acts as its own control. At the end of the second period, they are evaluated again. The evaluators are blinded as to group assignment and are trained in evaluating the test criteria.

This design gives a clear answer to the question, “does the use of the test product have a therapeutic benefit to the patient compared to not using the product?” This is the sort of objective, scientific data that we need to make informed decisions for our patients and our clients. Keep in mind that the most important index to look at is the gingivitis index as it is the only one listed that actually is an index of disease. Plaque is not disease, calculus is not disease, stain is not disease; they are all merely indicators that disease may be likely to develop.

The Veterinary Oral Health Council is a volunteer organization composed of board certified veterinary dentists, human dentists and others. Their purpose is to look at the research presented by companies offering products with a dental claim and decide if they have demonstrated a significant benefit.

A company with a product may voluntarily apply for VOHC approval. They must then submit all the research on their product to the council. The VOHC reviews the information and decides if the manufacturer has demonstrated that the product is therapeutically beneficial. If they have, the product receives the VOHC stamp of approval.

As time goes by, more and more products will be scrutinized by the VOHC and so general practitioners will not have to seek out and read all the literature themselves. They can just look for the VOHC symbol. Bear in mind that the seal indicates that the product *helps* control plaque and/or tartar. This may mean as little as a 10% reduction compared to control, so do not have unreasonable expectations for any of these products.

Home Care Products

Agent/Product	Pros	Cons
Chlorhexidine	-reduces plaque by 55 to 60% -reduces gingivitis by 45 to 60 % -considered the most effective oral antiseptic -anti-fungal, anti-viral and anti-bacterial -can be used as a rinse when brushing is contra-indicated or impossible -ionic bond to tooth for 12 to 24 hours	-can cause staining of teeth over long term (removable with polishing and/or discontinuation) -possibility of changing intestinal flora if swallowed over long term -some formulations not well accepted by most cats -liquid solution does not stick to brush -actually enhances mineralization of plaque to speed calculus accumulation -in humans has been reported to alter or diminish the sense of taste
C.E.T.™ (glucose oxidase and lactoperoxidase)	-pastes available in a variety of flavours to increase chance of acceptance and offer more flexibility -paste stays on brush well -designed to be swallowed -also available on chew treats for dogs and cats	-will not reach far sub-gingivally -little documentation of efficacy
Hydrogen peroxide	-anti-bacterial	-peroxide can cause gingival ulceration, candidal overgrowth and enhance the effects of carcinogens -peroxide is an effective emetic -foaming can upset patient
Zinc Ascorbate (Maxi/Guard™)	-increases integrity of collagen in gingiva -stimulates collagen production -ascorbic acid and zinc are both bactericidal -colour indicator tells when it is stale -taurine in product helps bind sulphurs to decrease halitosis	- low pH may cause hypersalivation in some cats
Hexametaphosphate	-a sequestrant that binds salivary calcium, making it unavailable for precipitation to form calculus -available as a top-dressing on several treats and diets	-has no direct effect against plaque or oral bacteria

Conclusion

By the time you read this, there will likely be a few more products on the veterinary dental home care shelf. Whenever you are presented with a new (or old) product for consideration, consider this.

Look for the Veterinary Oral Health Council seal of approval. More and more companies will be submitting their research for evaluation and so there will likely be more products bearing this stamp in the future.

Look carefully at the claims and demand to see the research, not just a list of references or some glossy diagrams of what is supposed to be happening when you use the product.

Does the research show (in order of importance):

- Safety
- High compliance
- Efficacy
    - Reduced plaque, calculus and gingivitis scores (i.e. actual therapeutic benefit).

Also keep in mind that any product, no matter how good, will only work if it is used properly. Make sure you understand how to use the product and then make sure your clients understand.

By putting a little effort into the critical evaluation of product claims, you can increase the chances of developing a home care program that works, to everyone's benefit.

Brushes

The ideal tooth brush would fit comfortably into the pet's mouth, have a handle that is easy to hold onto and control, have bristles that are firm enough to actually remove food debris and plaque, yet be soft enough to be kind to oral tissues. The ideal brush would be universally accepted by owners and pets alike and has not yet been invented. Therefore, we try our best in each set of circumstances and tailor the compromises to fit.

In most instances, the brush of choice will be a human brush with soft bristles. These are readily available at grocery and drug stores and can be purchased in bulk from several sources at very reasonable prices. If your order is large enough, you can even get them imprinted with a message.

Due to the wide range in the size of the mouths and teeth we deal with, it is wise to have a selection of sizes to choose from. Fortunately, human brushes come in a wide range of sizes.

I have been using brushes from the John O. Butler Company in Guelph.

For large to medium sized dogs, the "Junior Critters"™ child size brush is good. For small dogs, the "Junior Critters" toddler size works well. The "Trav-ler Proxabrush"™ looks like a tiny, tapered bottle brush. Its very small size makes it ideal for brushing between teeth or through grade IV furcation exposures. For very small dogs and for cats, I favor the C.E.T.™ feline toothbrush from Virbac™.

C.E.T.™ also has brushes that are sold as special dog brushes. There are some concerns with these brushes however. The double-ended brush tends to be too big on one end and too small on the other. The other, more serious concern is that the bristles are too soft to be of real value. Rather than brushing debris away, they tend to just mush it about. The manufacturers of the brush agree the bristles are too soft.

The idea is for the bristles of the brush to reach into all the small dental grooves and inter-dental spaces to mechanically remove debris. The bristles should also massage the free gingival area to milk out crevicular debris and bacteria laden fluid. To do this effectively, they must be semi-rigid.

There are instances when the softer bristles would be desirable. Pets who have never had home care might accept the softer brush better initially; a firmer brush could be used later, once the pet is tolerating home care well.

For cats, a good training device is a cotton swab. They are better than nothing, but again, try to graduate to a real brush as the cat becomes more accepting of the program.