BEYOND THE BASIC PERIODONTAL FLAP

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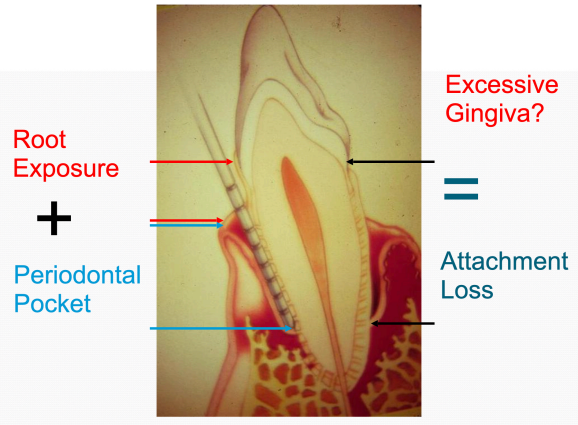
Periodontal disease (PD) is the most common disease in dogs and cats.[1,2] It is considered preventable in most instances, but due to its often hidden nature, lack of outward clinical signs, and diminished client realization of the need for management, pets are 5 times more likely to have periodontal disease than humans.[3] It is known that PD incidence increases with age.[2,4,5] The prevalence of periodontal attachment loss has been shown to be 80-87% in dogs aged three years and above and 53% in a population of dogs aged one to two years.[5]

Periodontal disease is staged based on the amount of bone loss surrounding a tooth root. Should one root of a multirooted tooth have more bone loss than the other, the PD classification is based on the worst root. To review: PD1 = no attachment loss (gingivitis, reversible); PD2 = < 25% attachment loss; PD3 = 25-50% attachment loss or stage 2 furcation exposure (greater than half way under crown); PD4 = greater than 50% attachment loss or furcation exposure 3 (through and through). In many cases, one could interchange the term bone loss instead of attachment loss as the best way to verify PD stage is by radiographic evaluation of the level of bone around a tooth root. Please note, once there is bone loss – even as little as 1% (PD2), the periodontal disease is no longer reversible. ie Some degree of bone loss is permanent. This means once PD2 or greater is present, the best a tooth can be is PD2. As we will review later in this document, in cases of vertical bone loss, we can return bone with advanced techniques such as guided tissue regeneration (GTR) to have the potential outcome be bone returned as high as the lowest bony wall. Any horizontal bone loss is lost for good. An infrabony pocket that may have >50% attachment loss (PD4) through the use of GTR can return to PD2 provided the lowest wall of the infrabony pocket (vertical bone loss) has <25% attachment loss (AL). It can never be PD1 as there is always at least 1% AL once PD has progressed beyond gingivitis. When charting we often record PD1, PRO indicating the presence of gingivitis in the mouth as a whole treated with dental prophylaxis (PRO) even though specific teeth may be at a more advanced stage than PD1 due to permanent attachment loss.

It's also important to note attachment loss (AL) rarely equates to periodontal pocket depth (PP). Any root exposure (RE) and/or gingival enlargement (GE) should be noted. In cases of root exposure, PP+RE = AL. In Martel's paper[6] comparing closed root planing (RP/C) of pockets 3-6mm in depth to perioceutic medications, RP/C was equal or better than perioceutic upon evaluation of the sites 3 months after the initial procedure. Within the paper, a RP/C site at the mesial aspect of the mandibular canine is shown with an initial PP depth of 3.5 mm resulting in PP of 2 mm at the 3-month follow-up. The photographs of the periodontal probe inserted into the pocket reveals there is an additional 1.5 mm of crown height now visible. This case of reduction of pocket depth resulted in no significant difference in attachment and instead, a PP reduction due to a decrease of pocket inflammation primarily through reduction of gingival enlargement. Closed root planing served to turn a pocket of active periodontal disease inactive. Daily active home care and more regular anesthetic scaling and root planing (SRP)



(COHAT) procedures are needed to maintain the attachment level. While there are no hard and fast rules, patients receiving advanced periodontal procedures to preserve PD4 teeth (such as GTR) should have their next anesthetic SRP in 3 months. Patients with PD3 teeth treated/preserved need their next SRP in 3-6 months. Patients with PD2 treated teeth need their next SRP in 6-12 months. Patients with remaining teeth only affected by gingivitis (PD1) need their next SRP in 9-12 months. Base your timeline on individual variations and breed/size periodontal predilections knowing that PD occurs faster in smaller patients.

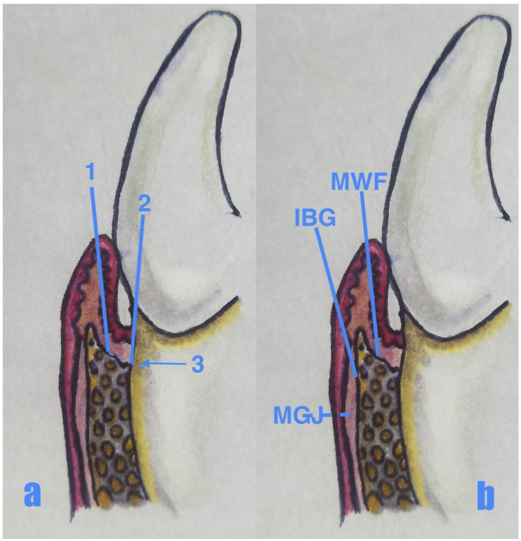
Full mouth intraoral radiographs are needed on each pet and each tooth patient (typically 42 tooth patients in dogs and 30 in cats) receives their own treatment plan. After considering a patient's comorbidities and knowing owner consent is needed prior to any treatment, most teeth presenting with PD4 require oral surgical extraction followed by periodontal flap therapy. Cases of vertical bone loss may have the potential to preserve the tooth through some of the periodontal therapies mentioned further in this document. A PD3 tooth can often go either way. Most PD2 teeth only require a form of root planing unless there are additional factors such as gingival enlargement contributing to an increased pocket depth. PD1 teeth are healthy with reversible gingivitis (reversible through SRP treatment) and no attachment loss. The basic flaps for oral surgical extractions are envelope flaps, triangle flaps (one vertical releasing incision), and square flaps (two divergent releasing incisions). Creation of periodontal flaps in order to extract teeth is beyond the scope of this discussion.

While there can be tooth type and breed/size variations in establishing normal periodontal pocket depth, it is known that the typical sulcus depth is 1-3 mm in the dog as well as people and 0.5mm in the cat. A 3 mm pocket depth around a small breed dog's incisor is a significant indicator of disease while a 4-6 mm pocket depth at a canine tooth of a giant breed dog may be completely normal and have a gingival index of 0. In essence, use logic when evaluating each case. As dogs and people have the same normal sulcular depth, human data is likely to correlate with respect to critical probing depth. Critical probing depth (CPD) is defined as the value above which treatment will result in attachment gain and below which treatment outcome will result in clinical attachment loss.[7] The CPD for RP/C is 2.9 +/- 0.3 mm. The CPD for periodontal access flap surgery utilizing the Modified Widman Flap (MWF) is 4.2 +/- 0.2 mm, yet there is a difference in outcome and CPD depending if the primary goal is pocket reduction or gain of attachment. Once the PP is equal or greater than 5.4 mm, treatment is best served through open flap debridement (periodontal surgical techniques). While all of this CPD information can be confusing, what has really been determined is:

Initial probing depth	Outcome goal(s)	Conclusion
2.9 – 4.1 mm	Gain of attachment	Treatment favors RP/C
4.2- 5.3 mm	Gain of attachment	Treatment favors RP/C
4.2- 5.3 mm	Pocket depth reduction	Treatment favors surgery
>5.4 mm	Gain of attachment and pocket depth reduction	Treatment favors surgery

The above data has been summarized over several human studies. It's important to remember these studies involve humans that tend to have better oral hygiene than our veterinary patients. While gain of attachment is a good thing, one must consider owner compliance with follow up veterinary anesthetic dental procedures with the goal to keep that attachment instead of active PD returning to the site. It is for this reason and the fact that periodontal surgery serves to remove the diseased pocket lining that the veterinary surgeon should prefer periodontal pocket depth reduction (over gain of attachment) as the preferred outcome in veterinary patients. With owner

compliance and patient comorbidities in mind, one can simplify the PP measurements in the above table to help decide what treatment is usually best: PP depths 2.9-4mm should receive closed root planing while PP depths of 5 mm or more are best served by some form of open flap debridement surgery for an average patient. (As noted previously, 5mm may be normal in large breed while 3mm may be problematic in small teeth/breeds making this number variable based upon each situation.)



a) Modified Widman Flap incisions: 1) internal bevel incision to remove pocket lining 2) sulcular or crevicular incision to undermine tissue. 3) tissue removal incision b) Comparison of first incision of modified Widman flap to internal bevel gingivectomy: MWF = first incision of Modified Widman Flap to remove pocket lining. IBG = first incision of Internal Bevel Gingivectomy, which removes the pocket wall but requires adequate attached gingiva. MGJ = mucogingival junction

The simplest of periodontal flaps are the non-displaced flaps: internal bevel gingivectomy (IBG), the modified Widman flap (MWF), and distal molar surgery. All of these flaps serve to examine the underlying bone and remove diseased tissue. The IBG is only different from the MWF in that the soft-tissue pocket wall is removed with the initial incision. These incisions help preserve the height of the attached gingiva while removing the tissue lining the pocket, as opposed to a standard gingivectomy with external bevel incisions that remove the increased height of the enlarged gingival margin, leave cut margins exposed post-operatively, and do nothing to the pocket wall. Distal molar surgery's main goal is to remove redundant tissue. The proximal wedge technique (PWT) (submitted to journal for publication) is a non-displaced flap combining MWF and distal molar surgery to accomplish removal of pocket lining, removal of thickened or redundant tissue, and improve the underlying bony architecture. The result is a consistent reduction in pocket depth with maintenance of healthy gingival margin for at least a year. At minimum, this technique should always be considered and likely performed anytime an extraction of a mandibular third incisor is indicated.

Part of the reason to consider open root planing which usually extends into some form of a flap and oral surgery is that it has been surmised that despite the best efforts with meticulous cleaning in closed pockets, residual plaque and calculus are still found at depths greater than 5mm.[1] In other situations, a practitioner may not be cleaning the site as thoroughly, instead relying on the action of a perioceutic medication while under the false impression that the local antimicrobial will take care of the problem. The advantages to open flap treatments are:

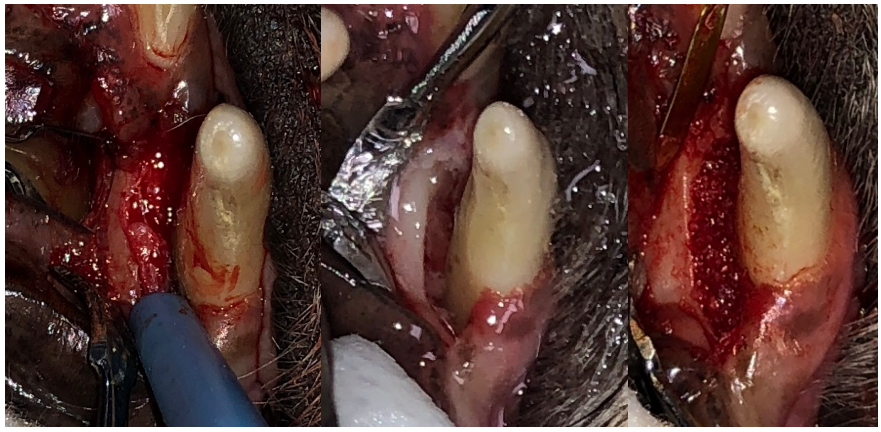
-The ability to clean the root with direct visualization
-The resection of diseased pocket lining and treatment of soft tissues
-Allowing repair of the site typically with primary intention healing
-Evaluation of underlying/adjacent bone and treatment of bony defects if present
-Minimal alveolar bone resorption during healing

Once a flap is opened and the tissue treated depending on flap type and site indications, the tools used to treat the root and surrounding bone are hand curettes, serrated periosteal elevators, specialized ultrasonics on lower power setting so as not to damage the cementum, and diamond burs (usually medium grit) for root preparation. The tool of choice is dependent upon the site. Bony defects between and around teeth are one of the most common periodontal bone defects. A crater within alveolar bone (not bone that is a pocket wall) is a primary example of

reverse or negative architecture which requires definitive osseous surgery. This is accomplished through resection or removal of bone to reestablish positive or normal physiologic bony architecture usually by reducing the defect walls so that the original depression becomes a leveled floor and the site is made smooth with harmonic slopes.

In cases of pockets with vertical bone loss as is more common at the palatal aspects of maxillary canines, the intrabony defect provides the potential for regenerative procedures. Guided tissue regeneration (GTR) is the removal of irritants (calculus, bacteria, granulation tissue, and debris) to allow for the encouragement of PDL, bone, and cementum by excluding gingival tissues through use of a barrier. We can simplify this by stating the goal is formation of new bone through use of a barrier membrane. Traditionally a bone graft is used to aid in new bone formation, yet without a barrier this is not likely to be successful as epithelial cells have been shown to migrate ten times faster than any other type of periodontal cell type.[9] This means that GTR *must* have a barrier. Many types of barrier/membrane and graft products exist on the market with others becoming available to the veterinary industry each year. Becoming familiar with the properties and source of each of these products can aid in the practitioner's selection of products. Many of the available products are listed within: https://tooth.vet/vdf-2023.

Access to the palatal aspect of the maxillary canine tooth in order to perform GTR can be accomplished through a crescent flap[10] or, alternatively, mesial and distal releasing incisions can be made as pictured. Pictures show 1) the granulation tissue within the 7mm infrabony pocket, 2) after removal of the granulation tissue with some additional open root planing needed, 3) placed osteoinductive Demineralize Bone Matrix (DBM) and osteoconductive cancellous bone chips (Osteoallograft Periomix, VTS) combined with blood. A barrier and surgical closure (ideally with 5-0 poliglecaprone 25) are the remaining steps for this GTR site. GTR access of the mesial or distal mandibular first molar is typically accomplished through a single vertical releasing incision made overlying bone at a line angle,[10] not at radicular midface locations.



Patients that appear to have an infrabony pocket of a maxillary canine tooth may actually be an inapparent oral nasal fistula (ONF). Other patients with ONFs may have horizontal bone loss, communication between the maxillary third incisor and nose, and or significant gingival recession. Due to the significant bone loss with disease reaching the apex occurring in ONF cases, oral surgical extraction is known to be the best treatment. Periodontal flap closure of this site can be challenging and may require a revision procedure due the respiratory forces tugging on the unsupported soft tissues. Keys for success in ONF repairs are large, wide *tension-free* flaps. Recall that mucosal tissues can elongate nearly ten times their original size once the underlying periosteum has been released. Most failures relate to inadequate flap release and remaining tension. A tension-free flap should allow the surgeon to set the cut margin in the final desired location and let go while viewing the tissue remaining in the same place without retracting (an indicator of tension).

ONF patients with drastic gingival recession and insufficient buccal mucosa may instead require one of the following: a) a two-stage procedure with extraction of adjacent premolars and/or incisors to provide additional healed soft tissue from which to create a wide tension free flap, b) a double layer flap[11] technique: "the palatal edge of the defect provides the base or hinge, with the releasing incisions advanced palatally and joined across to provide a flap of sufficient size. The defect is prepared, with an attempt to preserve part of the tissue at the dorsal aspect of the defect to be the anchor for the edge of the palatal flap. The edges of the palatal flap are also secured. A buccal mucosa flap, extending from the lateral vestibule as a simple advancement flap is then closed over the site of the original defect as well as onto the harvest site of the palate," or c) a free auricular cartilage autograft.[11] A modified lateral sliding flap can also be used to close extracted canine sites should the gingival recession be relatively narrow and vertical.

Cases of narrow triangular labial gingival recession (Stillman cleft)[10] with stable palatal /lingual periodontal health are best treated with a laterally repositioned sliding flap (LRSP) to preserve the tooth. A requirement for this procedure is to create a flap that is 1.5 times the size of the widest portion of the defect (usually the coronal margin defect). First, the surgeon decides from which side the anatomy is best to create the donor flap (mesial or distal). At least 1mm of diseased tissue is removed in a V-shape along the margins of the cleft through the utilization of beveled incisions: a) external bevel at the recipient site and b) an internal bevel at the donor site. An internal bevel also created at the horizontal portion of the incision beginning 2 mm apical to the margin of attached gingiva and ending 2.5 times the width of the cleft defect to allow for adequate coverage (1.5 times defect) and flap stability. This donor flap is usually lifted with full thickness progressing to a partial thickness flap at the furthest point in which a small vertical releasing incision is made allowing this donor flap to slide laterally with the newly exposed area having partial tissue coverage. Periodontal curettes are used to clean the exposed root surface and externally bevel the alveolar bone margin to ensure a smooth transition between tooth and bone. Closure is again best served with 5-0 poliglecaprone 25. Release of adjacent tissues may allow for tension-free closure of the furthest extend of the donor site otherwise the partial thickness flap creation at this site can be allowed to heal by second intention.

Most cases for the application of a LRSP have Miller class II gingival recession[12], while Miller class I defects also have a good prognosis for defect correction through gingival augmentation: A semilunar coronally advanced flap (CAF) to correct some gingival recession of the upper 4th premolar has been published with success.[13] Just as the furthest extent of the LRSP site is also partial thickness preserving the periosteum overlying the area, the CAF heals by second intention after the flap is repositioned and held in place with digital pressure for 5 minutes. No sutures are utilized for the CAF technique as it is only appropriate in the maxillary arcades due to passive retention of the flap in the advanced position.

One of the last main types of periodontal flap procedures that has not yet been covered within this document is a type II crown lengthening. Unlike the other covered procedures which are used to treat varying types of periodontal disease and improve periodontal health, this surgery is performed in order to expose more tooth crown through the removal of surrounding bone intentionally creating AL. The canine tooth that receives this procedure will end up with additional exposed crown and the ability to prepare the tooth to accept a full metal crown. A gingival collar expansion technique[14], an apically repositioned flap as described by Hale[15], and a summer dress technique as shown in the BSAVA Manual[16] are all methods of obtaining additional crown through type II crown lengthening.

These references as well as additional details beyond the basic periodontal flap can be found at https://tooth.vet/vdf-2023.

'Beyond the Basic Periodontal Flap' References and Resources:

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