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When Extraction Is Not an Option

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Treating teeth with periodontal disease is a regular practice at most veterinary clinics. When advanced periodontal disease is present, extraction of the affected tooth or teeth is recommended. However, there are patients for which extraction of a tooth is not the only option. In young patients with a long life expectancy, keeping the tooth can be beneficial to the animal and a good investment for the client. Show dogs need a complete dentition within their breed standard while they are in competition. There are also owners who insist that teeth not be extracted, even when preservation of the teeth is not in the patient's best interest. Often, these owners fear that tooth extraction will adversely affect the pet's ability to eat or its appearance. This article presents techniques other than extraction that can be used to treat teeth with moderate or advanced periodontal disease. These procedures are generally performed in dogs.

Many of the procedures discussed are to be performed by veterinarians. They require advanced training, usually with a veterinary dentist. If these procedures are not within the clinic's scope of practice, appropriate patients can easily be referred to a veterinary dentist. A list of dental training courses and a directory of veterinary dentists can be found on the American Veterinary Dental College (AVDC) website (avdc.org).

In practices that do provide these treatments, all staff members who interact with owners should be knowledgeable enough about the procedures to effectively and efficiently answer or refer questions that arise after the veterinarian has gone over the initial treatment options. Client education is critical in these cases, which have progressed beyond gingivitis to periodontitis and may involve multiple treatments and extra costs. For owners who are concerned about cosmetic or functional effects of tooth extraction, education about the benefits of extraction compared with tooth preservation is especially important. Veterinary technicians, in particular, need to be able to handle follow-up questions about the treatment plan. It is important for technicians to know the anatomy of the periodontium and to be able to explain the steps of the procedures, as well as the reasoning behind each step. If available, the use of models or drawings can be helpful.

ANATOMY OF THE PERIODONTIUM

The structures that make up the periodontium are illustrated in **FIGURES 1 and 2**. The gingival sulcus is the space between the tooth surface and the unattached crest of the gingiva that surrounds the tooth (the free gingiva).[1] The normal gingival sulcus depth ranges from 0 to 3 mm in dogs and 0 to 0.5 mm in cats.[2] Below the free gingiva is the attached gingiva, which extends to the alveolar mucosa.[1] The point where these two tissues meet is indicated by the mucogingival line.[1] These soft

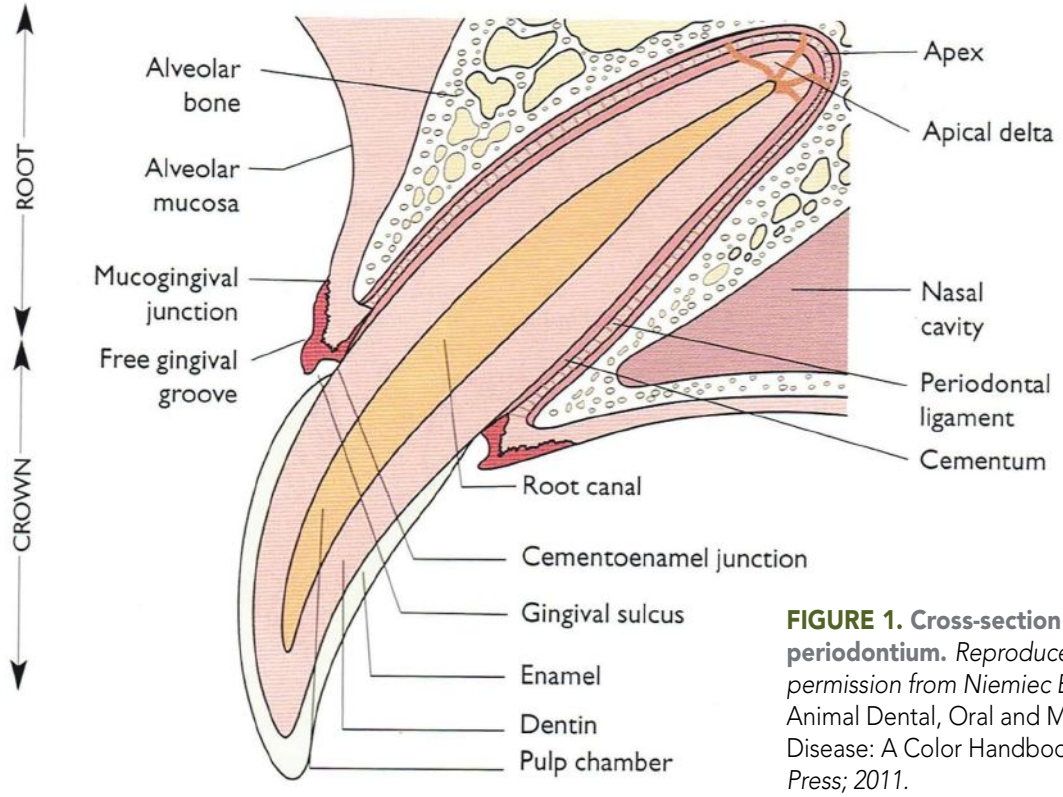

FIGURE 1. Cross-section of the periodontium. *Reproduced with permission from Niemiec B.* Small Animal Dental, Oral and Maxillofacial Disease: A Color Handbook. *CRC Press; 2011.*

tissue structures are visible to the naked eye and can be easily pointed out to clients.

Underlying the gingiva and mucosa are the periodontal attachment tissues: the cementum, a layer of bonelike connective tissue that covers the tooth root; the periodontal ligament, a layer of connective tissue that surrounds the cementum and connects to the alveolar bone; and the alveolar bone itself, which is the maxillary or mandibular bone that surrounds the root of the tooth.[1] Periodontal therapy often involves procedures that affect these structures. Clients need to understand that even if extraction is not being performed, surgery is necessary to reach these tissues.

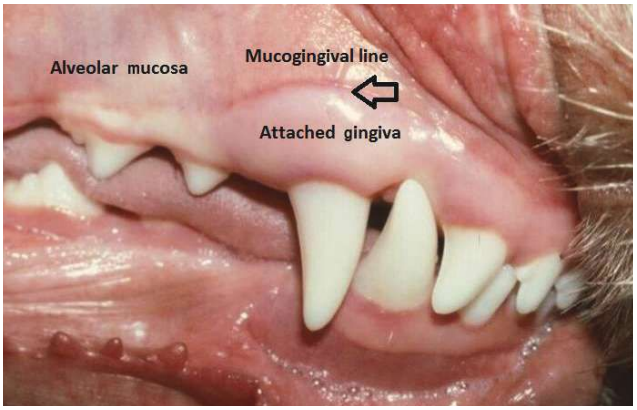

FIGURE 2. Buccal aspect of the maxillary gingiva showing delineations.

THE NEED FOR PERIODONTAL TREATMENT

Within hours after toothbrushing or a professional dental cleaning, plaque bacteria accumulate on tooth surfaces. Left alone, the bacteria continue to multiply and move apically. As calcium deposits from the saliva bond to form calculus, the bacteria infiltrate the roughened surface of the calculus and become pathogenic. At this point, depending on the patient's immune system, periodontal pockets form as the apical migration of plaque bacteria causes destruction of both soft and bony periodontal structures (FIGURES 1 and 2). Damage to any of these structures causes loss of attachment of the tooth and requires treatment, whether periodontal therapy or periodontal surgery.

Attachment loss >50% carries a guarded to poor prognosis for tooth-preserving therapies, and loss >75% carries a poor prognosis for long-term success. The success of any nonextraction therapy relies on the use of professional treatments and rigorous home care.[3] Owners who are unable to provide home care should not be given options other than extraction.

TOOLKIT FOR DIAGNOSIS

Proper staging of periodontal disease requires a periodontal probe and dental radiographs. The periodontal probe is used to measure the depth of the gingival sulcus (FIGURE 3). A depth >3 mm in dogs and >0.5 mm in cats is considered pathologic; namely, a periodontal pocket representing attachment loss. The periodontal probe is also used to determine if a tooth is mobile or has furcation exposure. The presence of either of these conditions is also proof of attachment loss. These conditions should be specifically noted on the dental chart.[4]

Dental radiographs should be obtained either before or after probing. Dental radiographs confirm the degree of attachment loss by showing alveolar bone destruction and loss of periodontal ligament. Combined, periodontal probing and dental radiographs are used to stage periodontal disease (BOX 1).[4] Once periodontal disease is diagnosed, periodontal treatment or tooth extraction is necessary.

PERIODONTAL THERAPIES

The AVDC defines periodontal therapy as "… treatment of diseased periodontal tissues that includes professional dental cleaning […] and one or more of the following: root planing, gingival curettage, periodontal flaps, regenerative surgery, gingivectomy/gingivoplasty, and local administration of antiseptics/antibiotics."[4] The goals of periodontal therapy are threefold: the first is the reduction of periodontal pockets or the elimination of soft tissue or bony lesions; the second is to slow or stop the progress of periodontal lesions; and the third is to return the tissues to a more normal environment.[5]

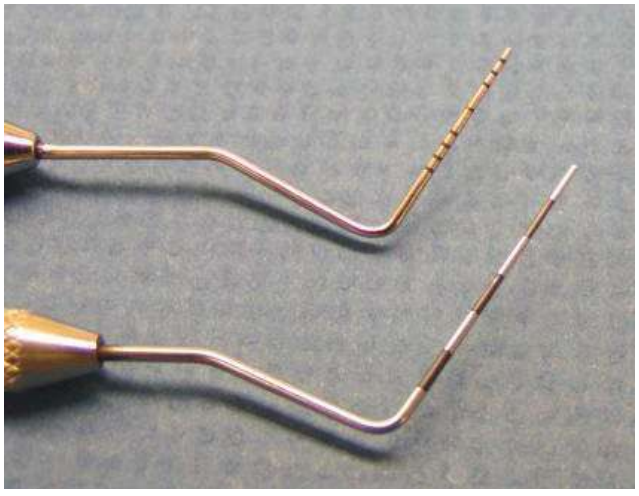

FIGURE 3. Periodontal probes. Increments can be notched directly into the metal tip (top) or indicated by color change (bottom). Increments are usually shown at 1, 3, and 5 mm.

Root Planing and Subgingival Curettage

When exposed in a periodontal pocket, the cementum covering the tooth root provides an irregular surface in which calculus can become embedded. If dentinal tubules are exposed, they can become infected. Removal of the calculus requires the root surface to be cleaned and smoothed by root planing. This process also removes a small amount of cementum, root surface, and possibly some dentin.[6,7]

In dogs, periodontal pockets between 3 and 5 mm in depth with no pathology such as mobility, furcation exposure, or root caries can be treated with scaling, closed root planing, and subgingival curettage to remove plaque, calculus, and granulation tissue and disrupt the bacterial colonies. If periodontal pockets are deeper than 5 mm with pathology (mobility, furcation exposure), direct root visualization and open root planing are necessary for adequate cleaning. Direct root visualization requires periodontal flap surgery to move the gingiva aside and gain better access to the tooth root.

The curette used for root planing must be sharp. To be most effective, the working end should be placed at a 90° angle to the tooth surface. Slight pressure is applied, and short, firm, overlapping strokes are used to remove debris

BOX 1
Periodontal Disease Classification[4]

- **Normal (PD 0):** No gingival inflammation or periodontitis is evident.
- **Stage 1 (PD 1):** Gingivitis is present without attachment loss.
- **Stage 2 (PD 2):** Early periodontitis. Attachment loss is <25%, or stage 1 furcation involvement is present. In stage 1 furcation involvement, a periodontal probe can be extended less than halfway under the crown of a multirooted tooth.
- **Stage 3 (PD 3):** Moderate periodontitis. Attachment loss is 25% to 50%, or stage 2 furcation involvement is present. In stage 2 furcation involvement, a periodontal probe can be extended more than halfway under the crown of a multirooted tooth.
- **Stage 4 (PD 4):** Advanced periodontitis. Attachment loss is >50%, or stage 3 furcation involvement is present. In stage 3 furcation involvement, a periodontal probe can be extended through a furcation under the crown of a multirooted tooth from one side to the other.

TECHPOINT

For periodontal therapy to be successful, a complete physical examination, blood chemistry testing, and a full history are needed to assess the patient's suitability for anesthesia.

and clean the surface (FIGURE 4).[4] Large deposits of debris/calculus should be removed in small sections to reduce the risk of trauma to the surrounding tissues. Open root planing can also be performed using a power scaler fitted with an ultrasonic tip on a low setting. A combination of both power and hand instrumentation is recommended to ensure removal of all calculus in open root planing.[6,7]

Subgingival curettage removes the infected epithelial lining of the pocket along with the granulation tissue apical to the pocket to the level of the alveolar crest. Removal of this tissue helps reestablish attachment. A Gracey or Universal curette is used.[6]

After root planing, the debrided pocket can be treated with a perioceutic product to enhance healing. Perioceutics used in this circumstance are locally applied, slow-release, flowable antibiotic gels (e.g., clindamycin, doxycycline) that are injected into the periodontal pocket. A drop of water is added to hasten solidification of the material. The prepared material can then be better manipulated in the pocket.[8] In some cases, the gingiva may need to be readapted with digital pressure and possibly interdental sutures to hold it in place.[6] The owner should not brush the treated area for 14 days and should instead use an oral rinse or gel to keep the area clean during the healing process, along with the appropriate antimicrobial and pain management therapy.[8] The localized application of these medications helps avoid adverse systemic and gastrointestinal effects.[9]

Periodontal Flaps

A flap is a section of tissue that has been cut and raised with a pedicle still attached. Flaps are useful in periodontal therapy because they allow exposure of the root surface while maintaining the attached gingiva and allow the gingiva to be sutured in such a way that the pocket can be treated.[10]

The objective of flap surgery is to allow adequate access to, and visualization of, the diseased area. The base of the flap should be 1.5 times as wide as the coronal aspect to allow adequate blood flow. When the therapeutic procedure is complete, the flap must be sutured closed to prevent displacement, bleeding, hematoma formation, and infection.[10]

Types of Flaps

There are two types of flaps: full thickness and partial thickness. Most periodontal flaps are full thickness. Full-thickness flaps are used to gain access to bony areas for procedures such as root planing and pocket elimination. To create a full-thickness flap, a periosteal elevator is placed under the periosteum and rocked until the periosteum (attached gingiva) is peeled away from the bone. Partial-thickness flaps leave the periosteum attached to the bone. Partial-thickness flaps are used in areas where lateral sliding flaps are needed, where there are thin, bony plates, where dehiscence is present, where bone must be protected, or where bone loss is permanent.[10]

Envelope flaps are created along the arcade with or without vertical releasing incisions. The gingiva is stretched to allow visualization. The flap should extend to one tooth on either side of the diseased area. Closing sutures are placed interdentally.[3,10]

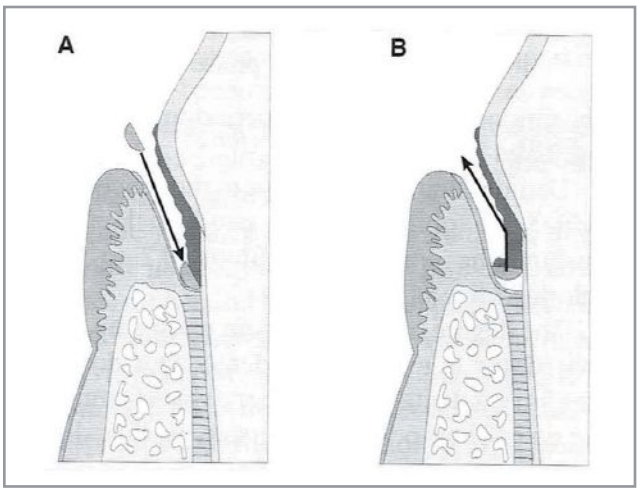

FIGURE 4. In closed root planing, the dental curette is inserted under the gingiva before being angled to remove debris. *Image drawn by David Crossley and reproduced with permission from* The BSAVA Manual of Small Animal Dentistry, *2nd edition. ©BSAVA*

Full mucoperiosteal flaps involve the addition of one or two vertical releasing incisions on one or both sides of the lesion to allow exposure without stretching the gingiva excessively. The horizontal or sulcal incision is made just below the diseased gingival margin, being careful to maintain as much of the attached gingiva as possible. This excises the diseased pocket epithelium and granulation tissue. The collaret of diseased gingival margin tissue is removed, and the edges of the flap are sutured closed at each releasing incision and interdentally (FIGURES 5A and 5B).[3,10]

Regenerative Periodontal Therapy/Guided Tissue Regeneration

Although periodontal ligament cells can regenerate to restore tooth attachment, the gingival soft tissues grow faster and can recolonize the pocket with junctional epithelium first.[11] This temporarily heals the problem and resolves the infection, but in these cases, the infection does come back. When repairing bony pockets, it is therefore necessary to slow the growth of the gingival tissues long enough to allow the periodontal attachment tissue time to regrow. This procedure is called *guided tissue regeneration* or *regenerative therapy.* The ultimate goal of this type of therapy is to reduce a periodontal pocket as well as recreate normal periodontal attachment.

Various materials, described below, are used to keep the faster-growing alveolar mucosa and gingival connective tissue out of the lesion while encouraging the growth of periodontal ligament and bone.

TECHPOINT

Recheck examinations are needed to make sure healing is taking place and the owner is comfortable giving medications and providing home care.

Barrier Membranes

Barrier membranes contain components that stimulate regeneration of the periodontium. First-generation (nonresorbable) membranes used in regenerative therapy are usually made of cellulose or Teflon. They have been shown to promote regeneration of alveolar bone, cementum, and periodontal ligament, although bone augmentation is not consistent. These membranes must be removed in 3 to 6 weeks, which adds another anesthesia episode.[11]

Second-generation (resorbable) membranes come in prepackaged sheets that must be trimmed to size. These membranes can also serve as carriers for substances that can improve attachment, which makes them similar to perioceutics. They are usually made of a combination of polylactic acid, polyglycolic acid, and trimethylene

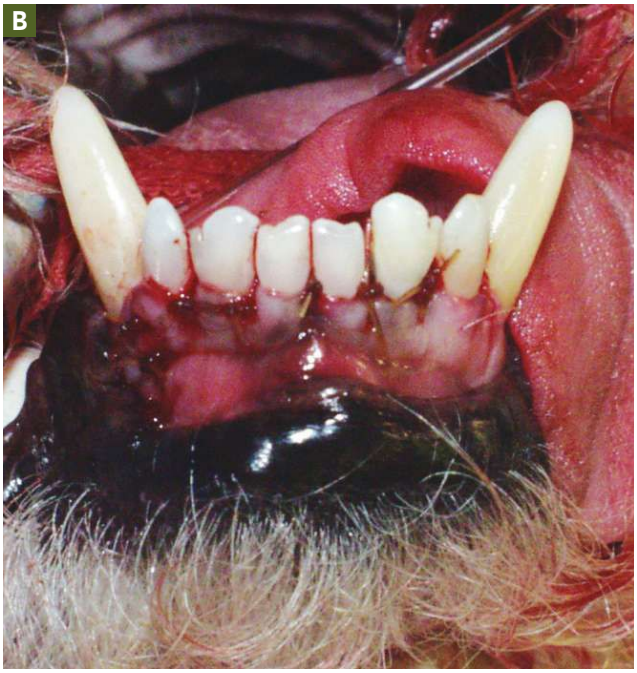

FIGURE 5. (A) Full-thickness flap made to provide better visualization for open root planing. (B) Full-thickness flap after closure. Note the interdental sutures. *Courtesy of R. Michael Peak, DVM, DAVDC*

carbonate. This material stays intact for 16 to 24 weeks before being absorbed.[11] A bovine Achilles tendon collagen membrane is also available; it lasts 4 to 18 weeks.[11] Lastly, there is a bilayer porcine-derived collagen membrane. This material has been effective in the regeneration of infrabony pockets and is the easiest to use. Demineralized laminar bone sheets and flowable customizable membranes are also available **(FIGURE 6)**. The longer a membrane lasts, the longer the attachment tissues have to grow, and the better the chance of success; however, a correspondingly longer period of home care is needed.

Bone Graft Materials

Graft materials are used to regenerate the periodontium by reforming the periodontal ligament and growing new bone.[11] They are also used to increase healing in jaw fracture repair and tooth extraction. They have shown a positive effect as the treatment for stage 2 and 3 furcation exposure.[11] When combined with a barrier membrane, the attachment gain is more significant.

Bone graft materials augment bone growth through one or more of 3 processes: osteogenesis, osteoinduction, and osteoconduction. Materials that promote osteogenesis contain cells that cause the synthesis of new bone. Osteoinductive materials convert the surrounding stromal or progenitor cells into osteoblasts, which release growth factor and produce native bone. This accelerates bone production and speeds healing. Osteoconductive products form a scaffold that bone can form around and significantly contribute to the production of new bone.

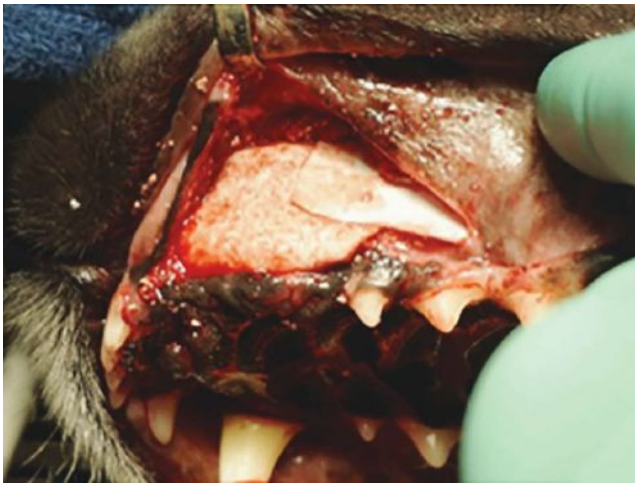

FIGURE 6. Barrier membrane placed to repair a maxillary defect. *Image used by permission: Ossiflex Bone Membranes – Veterinary Transplant Services, Kent, WA*

There are 4 types of bone graft materials. Three—autografts, allografts, and xenografts—are derived from animal tissue; non–animal-based products comprise the fourth.[11]

Autografts are bone materials taken directly from the patient, usually from the oral cavity. A large cutting bur is used to turn the harvested bone into dust. The dust is then mixed with the patient's blood or saline and placed into the defect. This material has the best outcome, but harvested quantities are small, so large defects cannot be repaired using this method. Autografts are osteogenic, osteoinductive, and osteoconductive.

Allografts are the most commonly used bone material in human dentistry. The material comes from cadavers of the same species and can be demineralized and freeze-dried, which allows for a longer shelf life. It contains bone morphologic proteins that recruit the patient's osteoblasts, making it osteoinductive. One downside to demineralized allografts is the inability to see the material on radiographs to assess the fill **(FIGURE 7)**.

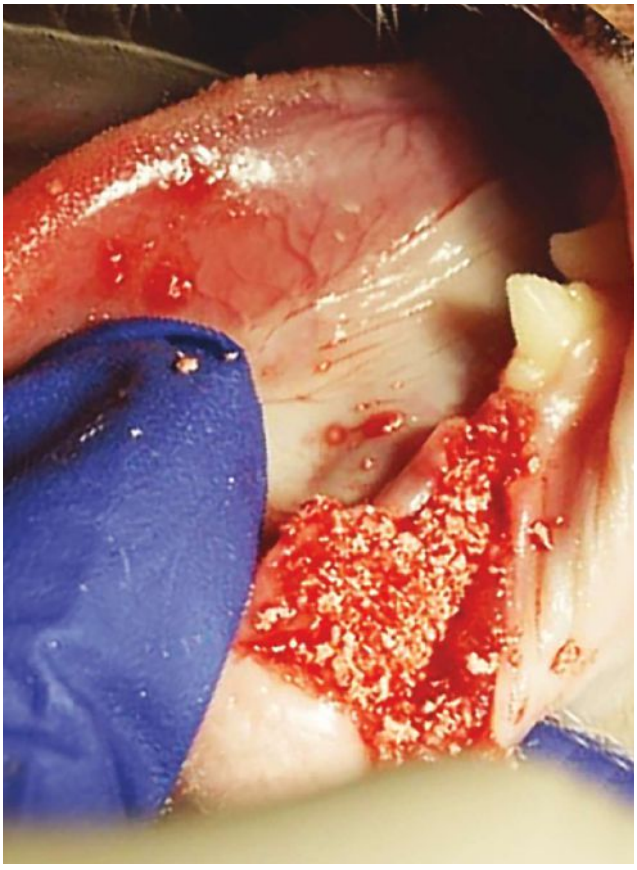

FIGURE 7. Allograft material placed after a feline mandibular canine extraction. *Image used by permission: Periomix and Synergy – Veterinary Transplant Services, Kent, WA*

FIGURE 8. Periodontal pocket treated with a synthetic bone graft particulate. *Courtesy of R. Michael Peak, DVM, DAVDC*

Xenografts are also commonly used in humans. Xenograft bone material and components come from different species. Bovine materials are most commonly used. These materials are osteoconductive but may also be osteoinductive.

Non-animal products are ceramic-based materials made of calcium phosphate, calcium sulfate, and bioactive glass. They are available in larger quantities, inexpensive, and osteoconductive; however, more fibrous connective tissue than bone may grow into the scaffold, making the repair somewhat weaker than bone.[11] These products can be used for regeneration of alveolar bone (FIGURE 8).

Preparation and Follow-Up

For regenerative therapy to be successful, all debris and granulation tissue must be removed to leave clean, healthy bone or tooth surface before any of the above materials are placed. Removal of any diseased marginal gingiva is also beneficial. The alveolar bone needs to be remodeled to allow the soft tissue flap to eventually attach to the underlying bone.[11] Rotary instruments such as carbide or diamond burs and hand instruments such as rongeurs, chisels, and interproximal files are used for remodeling. A full-thickness flap that includes attached gingiva may be necessary to close the lesion without tension. Pre- and postoperative radiographs should be taken.

Antibiotic and antiseptic therapy is crucial to the success of regenerative therapy. If the owner is unable to perform home care, regenerative therapy is likely to fail. The therapeutic site should be rechecked at 10 to 14 days with a follow-up cleaning, dental examination, and radiographs 3 to 4 months later.[3]

PERIODONTAL SPLINTING

Mobile teeth decrease the effectiveness of the guided tissue regeneration procedure, so splinting is used to temporarily stabilize teeth with mild or moderate disease and/or mobility while bone tissue regenerates.[11] However, it has been performed for long-term maintenance of a tooth; for example, in a show dog that needs full dentition to compete. This technique can also be used after a traumatic luxation or subluxation of a tooth.

The teeth are cleaned and polished, and any debris or

FIGURE 9. Maxillary incisors being treated for advanced periodontal disease using periodontal splinting. *Courtesy of Jan Bellows, DVM, DAVDC*

granulation tissue is removed. A regenerative material is placed in the defect, which is sutured closed. A band of dental acrylic is placed around the teeth in the area of the defect, with a stable tooth on either side. The acrylic bonds the teeth together for stabilization (FIGURE 9).[10] Interdental wiring may also be used to provide additional strength and support (FIGURE 10). When wire is used, shallow grooves may need to be made in the enamel to keep the wire from slipping off the tooth.

Splinting has its drawbacks. It is not recommended for mandibular incisors across the symphysis. The splint is difficult to keep clean and can become a nidus for infection. The anchor teeth that hold the splint in place can also be damaged by the constant pulling.

The splinted area must be cleaned daily using rinses. A softened diet is required, and hard toys or treats must be avoided to prevent breakage of the acrylic. A regular recheck must follow the procedure, with a full oral examination and radiographs at 3 to 4 months.[11] If the radiographs show healing, the splint is gently cracked using calculus forceps and removed in small pieces using hand scalers and curettes.

CONCLUSION

For periodontal therapy to be successful, a complete physical examination, blood chemistry testing, and a full history are needed to assess the patient's suitability for anesthesia. Discussing all treatment options with the pet owner is crucial to determine if the owner is committed and able to provide home care. Doctors and staff must be trained and prepared to perform all necessary treatments or give the owner the option of referral to a veterinary dentist.

An itemized treatment plan needs to be presented and reviewed with the owner. Contact phone numbers must be collected the day of surgery in order to keep the owner updated. Finally, recheck examinations are needed to make sure healing is taking place and the owner is comfortable giving medications and providing home care. The owner should be able to contact staff by phone or e-mail with questions or problems. Extraction does not have to be the only option if all parties are prepared, committed, and equipped to provide the best therapies to achieve a successful outcome. ■

FIGURE 10. Avulsed mandibular canine tooth treated with an acrylic splint. Note the figure-8 wire around the canines (arrow).

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1. **True or false: Advanced periodontal therapies can be performed by all veterinarians.**

2. **Which of the following should rule out advanced periodontal therapy as an option?**
   a. Attachment loss >25%
   b. Inability of owner to provide home care
   c. Presence of an avulsed tooth
   d. Presence of stage 1 furcation involvement

3. **The gingival sulcus is the**
   a. crest or edge of the gingiva that is unattached.
   b. line that separates the attached gingiva from the alveolar mucosa.
   c. space between the tooth and the free gingiva.
   d. layer of bony tissue that covers the root.

4. **The two tools needed for staging periodontal disease are**
   a. dental elevators and curettes.
   b. periodontal probe and dental radiographs.
   c. periodontal probe and dental explorer.
   d. dental scalers and dental radiographs.

5. **In a cat, a periodontal pocket depth of _____ is considered normal.**
   a. 0–0.5 mm
   b. 0.5–3 mm
   c. 3–5 mm
   d. >5 mm

6. **What dental instrument is used to perform subgingival curettage?**
   a. Dental elevator
   b. Gracey curette
   c. Periodontal probe
   d. Dental explorer

7. **Flaps are used when**
   a. exposure of the tooth root is needed.
   b. maintenance of the attached gingiva is desired.
   c. gingival sutures are needed to treat the periodontal pocket.
   d. All of the above

8. **A successful outcome with regenerative therapy depends on**
   a. antibiotic and antiseptic therapy.
   b. owner compliance with home care.
   c. a properly cleaned and debrided surgical site.
   d. All of the above

9. **An allograft is made of**
   a. a nonanimal product that forms a scaffold for bone to grow around.
   b. freeze-dried material from cadavers of the same species as the patient.
   c. material taken directly from the patient, usually from the oral cavity.
   d. bone material and components from a different species than the patient.

10. **How do osteoconductive bone graft materials work?**
    a. Cells within the material cause synthesis of new bone.
    b. Surrounding stromal and progenitor cells are converted into osteoblasts.
    c. They provide a scaffold that allows bone to form around them.
    d. They surround the root and connect it to the alveolar bone.