Evolution of Comprehensive Care, Part 2

Hygiene and Periodontal Considerations

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Periodontal treatment has evolved considerably during the past 25 years, driven by both technology and the oral-systemic link. We now understand more about what causes periodontal issues and how this affects the total body. Plus, technological advancements have helped us to better treat those issues.

Gingivitis Versus Periodontitis
Treatment Planning Considerations

Gingival diseases are predominantly chronic and generalized, and associated with the plaque (biofilm) present. It may be more appropriate to term it plaque-induced gingival disease rather than chronic gingivitis. Clinically, gingivitis is not associated with bone loss, and the inflammatory process is limited to the soft tissue. Bone levels may be more appropriately checked via radiographs in relation to the cemento-enamel junction (CEJ) rather than probing depths. Inflammation associated with gingivitis may lead to surpacrestal movement of the gingival margin, giving a false reading when the sulcus is probed. Probing gives us data as to how deep the sulcus is in relation to the gingival margin, not where the sulcus is in relation to the crestal bone.

Further, if the conditions that modify the gingival disease (such as pregnancy, diabetes, smoking, endocrine-related or medication-influenced conditions) are also present, they should be mentioned in the diagnosis. Some of these contributing conditions may be modifiable (smoking, diabetes, etc), but others may need to be managed since they cannot be modified (hormone-related issues observed in pregnancy and adolescence). Gingivitis can typically be managed by improved home care and more frequent professional prophylaxis to control the plaque and associated biofilm causing the gingival inflammation and bleeding. Supplementation with oral rinses, used daily at home with fluoride or chlorhexidine, has been shown to improve gingival inflammation and limit bleeding aggravated by the biofilm.1,2

When bone loss has occurred, the condition has become periodontitis, and treatment required is more complex. Periodontal disease severity can be divided into mild (bone loss less than one third of the root surface), moderate (bone loss more than one third and less than two thirds of the root surface), and severe (bone loss more than two thirds of the root surface).3 Periodontitis can be localized or generalized in nature, and the general treatment is the same with both types. When localized periodontitis is present, occlusion should be checked on the affected tooth/teeth; also check for a possible vertical root fracture or foreign body lodged in the sulcus of the affected tooth. In cases of periodontitis, generalized treatment will require scaling to remove calculus at the sulcus/pocket depth, disruption of the biofilm, and curettage of the necrotic sulcus lining to eliminate the disease process and contributing factors. Supplementation with systemic or localized medicaments may also be indicated to control the disease and favor healing.

Ultrasonics
Magnetostriective and Piezoelectric

One of the main keys to scaling and chairside treatment, other than removal of hard deposits, is disruption of the biofilm. But what is the biofilm? The biofilm is a complex, well organized,
cooperating community of micro-organisms. Simply put, plaque is a biofilm that, when not removed via home care, becomes more organized throughout time, resulting in periodontal disease. Bacteria in the biofilm behave differently than free-floating bacteria. Within the biofilm, the bacteria are arranged in microcolonies with channels between the microcolonies with differing environments between the microcolonies, surrounded by a protective matrix. Microorganisms within the biofilm are resistant to antibiotics, antimicrobials, and the host response.

We must understand that, to achieve treatment success (the elimination of periodontal disease), we must disrupt the biofilm to allow the host system to aid in healing. Without disruption of the biofilm, healing cannot occur and the disease process continues. Disruption of the biofilm can be enhanced with ultrasonics during the in-office periodontal treatment as well as by the patient during home care.

Ultrasonics is now an important technology in periodontal treatment, and has supplanted much of hand scaling due to the improved patient comfort and efficiency, as compared to providing treatment strictly by hand. The 2 most common types of ultrasonics available are magnetostrictive and piezoelectric.

Magnetostrictive ultrasonic energy is driven by a metal stack inserted into a handpiece, along with a live coil inside the handpiece that generates an alternating electromagnetic field, leading to expansion and contraction of the metal stack. The resulting vibrations are conducted to the tip of the scaler, causing oscillations with an elliptical motion pattern at frequencies of 25,000 to 40,000 cycles per second (cps). These operate on a frequency of 25 or 30 kHz and inserts are not interchangeable, so the practitioner needs to know at which frequency his or her unit operates. The higher the frequency (> kHz), the more frictional heat is generated at the tip and the shorter active tip area. The scaler tip produces a hammering (or scrapping motion) pattern as the tip moves through the elliptical pattern, generating heat at the contact of the tip and tooth surface with, potentially, some patient discomfort. The most power is at the tip, with less as the user moves up the lateral surfaces of the tip toward the handle. The point of the tip should not be directed at the tooth, as this can damage the enamel or restorative material on the tooth. The tip can be placed on heavy calculus deposits to help shatter them, but should always be directed parallel to the tooth's surface (Figure 1).

Piezoelectric works on the principle of a reverse piezoelectric effect, in which aligned ceramic discs (quartz crystals), upon application of an alternating electric current, change dimension through alternating expansion and compression of the discs, resulting in vibrations at the tip. The oscillation that results at the piezoelectric scaler tip is linear in motion with frequencies of 20,000 to 45,000 cps. The mode of action of the tip is either of a tapping or scrapping nature, depending on the direction of the scaler tip toward the root surface. This scaler technology is more comfortable for the patient and less stressful to the practitioner's hand due to the lighter pressure needed. Given the linear motion of the tip, the tip's 2 lateral surfaces are most active, and a lighter touch is more effective with hard deposit removal. These units can be connected to the central water supply or are available with self-contained irrigation sources. The Pro-Select Platinum (DenMat) piezo unit provides 3 individual irrigation containers, allowing the practitioner to switch among the liquids using the foot control. This allows water (container one) for the bulk of scaling and calculus removal, fluoride solution (container 2) for bacterial control and desensitization, and chlorhexidine rinse (container 3) to complete the treatment visit for additional bacterial control delivered to the depth of the pockets. Additionally, the Pro-Select Platinum unit is the only piezo unit...
currently available that heats the irrigation solution to improve patient comfort. A light directed at the tip improves operator visualization.\(^\text{[Figure 2]}\).

With both magnetostrictive and piezoelectric ultrasonic scalers, the key to improved patient comfort is to keep the tip in motion and the lavage solution. Lavage refers to the flushing of the sulcus (causing disruption of the biofilm) and the removal of necrotic tissue and blood from the pockets. The vibrating tip causes cavitation, which is a formation of bubbles in the lavage solution that creates shock waves in the fluids. This leads to acoustic streaming that disrupts the biofilm in and around the teeth and gingiva, flushing the loosened calculus from the sulcus. Piezoelectric ultrasonic units generally use less water than magnetostrictive ultrasonic units. This enables better operator visibility, increased patient comfort, and a decreased need for suctioning while still providing the beneficial effects of lavage. A concern has been use of ultrasonics in patients with implantable cardiac devices (ICDs) (pacemakers and cardioverter defibrillators). Ultrasonic dental scalers have been suspected of electromagnetic interference with the normal functioning of ICDs, and the use of these on patients with these devices has been controversial. The results of a recent study suggest that the use of piezoelectric dental scalers does not interfere with the functioning of any of the tested ICDs.\(^\text{[10]}\)

**CHEMOTHERAPEUTIC IRRIGANTS**

Water is usually used with ultrasonic units as a coolant, and in addition, it has lavage effects. Chemotherapeutic irrigants used with ultrasonics offer lavage and cooling of the insert tip with the additional benefit of placing chemotherapeutic agents directly into the periodontal pocket during scaling. Various chemotherapeutic irrigation agents have been recommended, including chlorhexidine, fluoride, and sodium hypochlorite. One study comparing the use of a 0.12% chlorhexidine gluconate solution and water for lavage reported that chlorhexidine was beneficial in reducing clinical probing depth 14 and 28 days post-scaling in pockets that initially had 4 to 6 mm probing depths.\(^\text{[11]}\) Another study found that use of chlorhexidine resulted in significantly more sites with final probing depths of 1.0 to 3 mm.\(^\text{[12]}\) One study found that use of chlorhexidine or sodium hypochlorite in irrigants during scaling resulted in slightly more effective reduction in plaque index, gingival index, and bleeding; chlorhexidine being more effective than the sodium hypochlorite.\(^\text{[13]}\) It should be noted that the use of chemotherapeutics as irrigants during ultrasonic scaling is not a substitute for adjunctive antimicrobial treatment, such as locally delivered sustained release agents.

The authors recommend having the patient rinse with a chlorhexidine rinse (ProDenRx 0.12% Chlorhexidine Gluconate [DenMat]) to decrease bacterial levels prior to ultrasonic scaling. This reduces viable bacteria in the aerosol produced during scaling. Scaling is performed with piezoelectric ultrasonics using water as the lavage to remove the supragingival calculus. Once that is accomplished, irrigation is switched to a fluoride rinse (ProDenRx 2.0% Neutral Sodium Fluoride Rinse [DenMat]) to decrease post-treatment sensitivity, and then subgingival scaling is completed. Fluoride has been shown to have some antibacterial properties. Hand instruments are then used to verify complete removal of all supra- and subgingival deposits. A final irrigation with chlorhexidine solution is then performed using the piezo unit.

Patients who demonstrate moderate to more significant bleeding during scaling may be placed on home chlorhexidine rinses (used twice daily, after breakfast and before bedtime) with instructions to not rinse or eat for 30 minutes after use. Use of a toothbrush prior to spitting the rinse out helps deliver the chlorhexidine medicament into the areas interproximally and to the sulci. Alternative chlorhexidine rinses of 0.12% are Peridex (3M ESPE) and Periogard (Colgate). But a common problem with Peridex has been reported staining, which is less evident with Periogard. (Note: The authors have not seen this
with the chlorhexidiene from DenMat when used as a patient used daily rinse.) The presence of plaque increases the staining effects of 0.12% chlorhexidine. This supports the necessity of biofilm disruption prior to the start of chlorhexidine mouth rinses in order to reduce this effect.14 The authors warn patients that staining indicates areas that need more careful and thorough attention during their home care hygiene procedures.

Those patients with sensitivity, either prior to or following the scaling appointment, can be placed on a fluoride rinse (ProDenRx 0.2% Neutral Sodium Fluoride Rinse) dispensed from the office. As was recommended for home chlorhexidine rinse use, the home fluoride is used twice daily (after breakfast and before bedtime) with instructions to not rinse or eat for 30 minutes after use. As mentioned previously, the use of a toothbrush prior to spitting the rinse out assists delivery of the medicament into the areas interproximally and into the sulci. Fluoride rinses also have the added benefit of caries control for patients who have exposed roots or dry mouth issues that can increase decay issues. Additionally, patients with root exposure, due to recession resulting from periodontal disease prior to treatment or related to resolution of inflammation, are prone to sensitivity and root caries. These patients can benefit from the application of a fluoride varnish, ProDenRx 5% sodium fluoride varnish (DenMat); MI varnish (GC America); or Enamel Pro Varnish (Premier Dental Products). Fluoride varnish is applied in-office with a brush to the desired areas. Then, the patient is instructed to avoid brushing until the next day, and to eat a soft, nonabrasive diet for the next 24 hours. Following this, the patient can return to a normal diet and regular oral hygiene home care. Some varnishes are naturally sweetened with xylitol, which has been shown to be a caries inhibitor.

**LASERS AS AN ADJUNCT TO PERIO TREATMENT**

When we think of lasers, we initially think of instruments for cutting, specifically soft tissue. Diode lasers are efficient tools for cutting and surgically modifying soft tissue and have been in wide use for procedures such as soft-tissue crown lengthening, troughing for improved impressions, and gingivectomy to gain access to caries on the root as well as aesthetic recontouring. Aside from these mechanical/functional applications, lasers have also been proven to aid in periodontal treatment not only to improve healing, but also allow the host system to repair the damage from the periodontal disease.

Laser energy from the diode is absorbed by hemoglobin, melanin, pigmentation, and water. As dentin, enamel, and titanium do not contain these factors, but gingival tissue does, the diode has an effect on the soft tissue; however, it does not affect the hard materials. Benefits also include coagulation and enhanced sterilization within the soft tissue at the site of laser contact. Yet, there are other devices that also sterilize, coagulate, and cut soft tissue, such as the electro surge that has been in use for 40 years. The advantages of the lasers compared to electro surge include: more precise results due to significantly reduced zone of necrosis at the contact (diode laser = 3 to 5 cells deep, electro surge = 300 to 500 cells deep); shorter healing times.
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due to the lower number of cells affected; less tissue shrinkage upon healing (recession is virtually eliminated from healing); and elimination of tissue charring (common when electrosurge is utilized) (Figure 3).

When incorporating a diode laser into the periodontal treatment protocol, we need to understand the difference between an uninitiated tip and an initiated tip.

The tip as it is removed from the package is uninitiated; this refers to the tip being free of coating, allowing light from the tip to exit unimpeded. An uninitiated tip reduces bacteria in the sulcus, reduces the risk of bacteria entering the circulation via the necrotic sulcus lining, and improves the effectiveness of the laser-assisted periodontal treatment (LAPT).

Diode lasers are highly bactericidal against Porphyromonas gingivalis and Aggregatibacter actinomycetemcomitans, which are common occupants in the biofilm within the sulcus. Additionally, they are effective in removing lipopolysaccharides and other root surface endotoxins and initiate the host's immunological response accelerating healing. The diode's light energy acts directly on cellular structures, destroying cell walls, altering DNA, modifying metabolic processes, and ungluing the polysaccharide structure of the biofilm. Studies report a reduction in subgingival bacteria. Some have reported reduction of subgingival bacterial flora in vitro.

Whereas, an initiated tip has had a dark blocking medium applied so that the tip now is able to cut tissue and coagulate bleeding. With respect to LAPT, the initiated tip selectively removes the diseased epithelium in the sulcus (not affecting the healthy tissue) and allows healthy tissue to regenerate during healing. Long-term studies confirm that the adjunct of a diode laser to periodontal treatment shows an improvement in pocket reduction and should be considered as a clinically proven addition to scaling.

Laser-Assisted Periodontal Treatment Procedure
Following application of local anesthetic, a diode laser such as the NV Laser (DenMat), Picasso (AMD LASERS), or Precise LTM laser (CAO Group) with an uninitiated tip is set at 1.5 to 1.8 W in a pulsed mode and is walked around the sulcus of each tooth to be treated periodontially. This laser bacterial reduction step reduces the bacterial count within the sulcus and decreases the incidence of bacterial spread through the necrotic sulcus lining during the treatment.

Ultrasonic scaling is then performed using a piezoelectric unit with water to remove all calculus. After the calculus has been removed, and this has been verified with hand instruments, the piezo scaler tip is used again around all the teeth being treated, with fluoride as the irrigation solution to help decrease any postoperative root sensitivity.

The diode laser has the tip initiated by moving the tip while activated over a piece of black articulating paper. This acts to stop the laser energy from exiting the tip and heats the tip when activated to allow cutting of soft tissue. (Dr. Kurtzman has found an easier method of initiating the tip of the diode by coloring the end of the glass fiber with a black permanent marker.) The diode is set to 0.4 to 0.8 W in a continuous mode, and then the tip is walked around the sulcus of each tooth being treated. As debris accumulates on the diode's tip, it needs to be wiped off or sulcular debridement will be hampered. This laser curettage has been shown to decrease pocket depth following healing, as compared to nonuse of a laser during scaling treatment.

The final step is to irrigate the pockets with the ultrasonic unit using chlorhexidine. Chlorhexidine gluconate is a chemotherapeutic agent that has been documented to exhibit antimicrobial capabilities against gram-negative and gram-positive bacteria as well as fungi. Reports also provide evidence that after scaling and application of chlorhexidine, the pockets diminish in depth by approximately 3.1 to 3.5 mm (Figure 4).

Lasers also provide biostimulation, enhancing healing through increasing circulation to the area being treated, increasing collagen and osteoblastic activity (bone-producing cells) and fibroblastic activity (connective tissue cells). Irradiation of the fibroblasts within the sulcus resulted in significant increase in cell metabolism compared with the nonirradiated group as has been reported in multiple studies.

M EDICAMENTS AS AN ADJUNCT DURING AND AFTER SCALING
Medicaments are good to use as an adjunct to periodontal therapy, both during treatment and as a preventative maintenance measure. These can be divided based on their area of effect: systemic and localized. Systemic medicaments are taken orally, extending effects throughout the body. Whereas localized medicaments are either confined to selected teeth or the entire oral cavity, and are without any significant (systemic) effects outside the oral environment.

When we think of systemic medicaments, we tend to think of antibiotics. Antibiotics are bactericidal and/or bacteriostatic, typically used for short periods of time, and with regard to periodontal disease, may only be indicated when severe infections are present with evidence of multiple sites of exudate. Tetracycline drugs (such as doxycycline) have shown a good affinity for periodontal infections and have been routinely used in these situations. However, research has documented clinical benefits when a subclinical dose of doxycycline is utilized. Subclinical
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would be defined as a dose that is below the bacteriocidal/bacteriostatic levels (subantimicrobial). A clinical dose of doxycycline is 100 mg administered once (or twice) daily for 10 to 14 days.

Subclinical dose doxycycline is used for treatment using very low doses (20 mg), available as Periostat (CollaGenex Pharmaceuticals). Periostat doses used are too low to affect bacteria; however, at these dose levels, the drug blocks matrix metalloproteinases, enzymes that destroy the connective tissues supporting the teeth.

Periostat is a systemically delivered collagenase inhibitor taken twice daily orally, consisting of a 20-mg capsule of doxycycline hyclate, an FDA-approved systemic drug for host modulation as an adjunct in the treatment of periodontitis to scaling and root planing (SRP). A study revealed statistically significant pocket depth reduction with adjunctive use of Periostat at 3, 6, and 9 months post-initial therapy and a gain of clinical attachment.31,32

The American Association of Periodontology suggests “when considering using Periostat or other adjuncts to SRP, clinicians must consider the expected results in view of the severity of the defects being treated. Furthermore, it should be noted that adjunctive procedures to enhance conventional therapies are not a substitute for meticulous home care, professional root planing, and appropriate treatment designed to minimize bacterial load and facilitate proper home care.”33

Localized medicaments would include those used as an oral rinse/toothbrush applied or professionally applied in the sulcus/sulci of one or more teeth. So we can divide these into practitioner applied verses patient applied (daily home care utilized).

PATIENT-APPLIED MEDICAMENTS

Two medicaments, when used daily, that have been proven to improve long-term periodontal health are chlorhexidine and fluoride. Both are used by the patient following routine toothbrushing and are recommended for use twice daily. Again, it is recommended that, after swishing with these chemotherapeutic medicaments, the patient use a toothbrush to better distribute the materials into the interproximal areas and sulcus before spitting them out.

Chlorhexidine gluconate is a safe and frequently used chemotherapeutic in the treatment of periodontitis and gingivitis, exhibiting an action against gram-negative and gram-positive bacteria and fungi.34

Studies have demonstrated less plaque accumulation, gingival bleeding, bleeding on probing, and a greater reduction in attachment level and probing depth when chlorhexidine was added to home care following scaling treatment.35 This is supported by significant reductions in plaque and gingivitis scores, but with increases in surface staining.36,37 The authors warn patients at the start that the chlorhexidine stains plaque on the teeth and, if any staining presents, that indicates areas that are not brushing well, and better attention needs to be paid to those areas. We have observed less or no staining in those patients using site-specific electric toothbrushes (such as Rotadent [DenMat]). Chlorhexidine rinses (such as ProDenRx Chlorhexidine Rinse [DenMat]) are a 0.12% used twice daily. It is recommended that the patient avoid eating or drinking anything for at least 30 minutes following use to allow the medicament to exert its full and intended action.

Fluoride has not only anticaries effects; it also inhibits biofilm development when utilized for home care following dental periodontal treatment.38,39 This helps keep bacteria from organizing in the biofilm. Lower bacteria and less organized microflora equal less inflammation and better long-term periodontal health. Neutral sodium fluoride rinses are recommended for daily use, as they do not have any negative effects on the tooth surface or composite restorations such as mild etching that may be seen with stannous fluoride products. Concentrations of 0.2% are appropriate for home use (example: ProDenRx Neutral Sodium Fluoride Rinse) and 2% rinse is more appropriate for in-office use.

Next: Evolution of Comprehensive Care, Part 3: Periodontal Treatment Continues to Evolve

References

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POST EXAMINATION QUESTIONS

1. Clinically, gingivitis is almost always associated with bone loss and the inflammatory process is not limited to the soft tissue.
   a. True    b. False

2. Supplementation with oral rinses, used daily at home with fluoride or chlorhexidine, has been shown to improve gingival inflammation and limit bleeding aggravated by the biofilm.
   a. True    b. False

3. Plaque is a biofilm that, when not removed via home care, becomes more organized throughout time, resulting in periodontal disease.
   a. True    b. False

4. The 2 most common types of ultrasonics available are magnetostrictive and piezoelectric.
   a. True    b. False

5. The piezoelectric scaler is a great new technology; however, it is less comfortable for the patient and more stressful to the practitioner’s hand due to the heavier pressure needed.
   a. True    b. False

6. With both magnetostrictive and piezoelectric ultrasonic scalers, the key to improved patient comfort is to keep the tip in motion and the lavage solution.
   a. True    b. False

7. One study comparing the use of a 0.12% chlorhexidine gluconate solution and water for lavage reported that chlorhexidine was beneficial in reducing clinical probing depth 14 and 28 days post-scaling in pockets that initially had 4 to 6 mm probing depths.
   a. True    b. False
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8. The authors do not recommend having the patient rinse with a chlorhexidine rinse to decrease bacterial levels prior to ultrasonic scaling.
   a. True  b. False

9. An initiated tip reduces bacteria in the sulcus, reduces the risk of bacteria entering the circulation via the necrotic sulcus lining, and improves the effectiveness of the Laser-Assisted Periodontal Treatment.
   a. True  b. False

10. Lasers provide biostimulation enhancing healing through increasing circulation to the area being treated, increasing collagen and osteoblastic activity (bone producing cells) and fibroblastic activity (connective tissue cells).
    a. True  b. False

11. A study revealed statistically significant pocket depth reduction with adjunctive use of Periostat at 3, 6, and 9 months post-initial therapy and a gain of clinical attachment.
    a. True  b. False

12. The authors warn patients that chlorhexidine stains plaque on the teeth and, if any staining presents, that indicates areas that are not brushing well and better attention needs to be paid to those areas.
    a. True  b. False
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Please check the correct box for each question below.

1.  ☐ a. True  ☐ b. False
2.  ☐ a. True  ☐ b. False
3.  ☐ a. True  ☐ b. False
4.  ☐ a. True  ☐ b. False
5.  ☐ a. True  ☐ b. False
6.  ☐ a. True  ☐ b. False
7.  ☐ a. True  ☐ b. False
8.  ☐ a. True  ☐ b. False
9.  ☐ a. True  ☐ b. False
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