Antibiotics are a staple in dental offices to counter bacterial infections. For the treatment of periodontal disease, antibiotics have been widely used to fight gingival infections and the resulting inflammatory responses, and the antibiotics can help. Efficacy is often short-lived, however, because periodontitis is a biofilm-based disease that, like other biofilm infections, is refractory to antibiotics. Nevertheless, the underlying problem is inflammation prompted from a bacterial infection, and we are taught that antibiotics are the right course. When they don’t work well or when the results are not long-lasting, we often think that we just need the right antibiotic.

What if antibiotics aren’t the best option? Paradigms that shape our views are often so ingrained that we don’t realize how they frame our thoughts—or our treatment approaches. It’s time to challenge the antibiotic treatment default for periodontal therapy. This means not that antibiotics shouldn’t be used but that they need to be used more judiciously. The underlying premise of the challenge: If our current mechanical, surgical and antibiotic treatments worked well, then 47 percent of American adults would not have chronic periodontitis. But they do, and millions more have gingivitis. We want to find fault with patients, and home care is a clear fault line where most patients

Disrupting Biofilm: Beyond Antibiotics

Hydrogen peroxide treatment demonstrates decrease in bacterial infections

by Milton Marshall, PhD, DABT, and Tanya Dunlap, PhD

Toxicologist and biochemist Milton Marshall, PhD, DABT, researched safety data on the use of hydrogen peroxide in dentistry, which was presented to the FDA and ADA. He has also worked to examine the biocompatibility and safety of dental materials.

Tanya Dunlap, PhD, is the managing director for Perio Protect, where she has worked since 2005. She coordinates clinical research involving prescription tray delivery. She also offers CE courses on the science behind prescription tray delivery and the important implications of the research data.
stumble; they need to be trained in home care technique, and that training often needs to be checked and retaught. But even with the best technique, it’s often not the patient’s fault. Toothbrushes, rinses and floss often don’t get deep enough into the periodontal pocket where bacteria proliferate. This is a biofilm problem.

**Beating biofilm**

The human mouth is the perfect environment for biofilm growth—it’s moist and warm, with an ample food supply and various concentrations of oxygen. In one study, biofilm colonized sterile carriers placed into 5–6mm pockets within 48 hours. The potential to form colonies is clearly strong in this environment.

The regular removal of biofilms from periodontal pockets via periodontal therapy is a benefit to treatment of this chronic disease, but the communities often just repopulate. This is why mechanical intervention has temporary benefits and dental professionals want adjunctive treatment options to supplement the mechanical removal.

Chlorine-based products and peroxides have potential to help. Unlike antibiotics, they cut through the slime matrix that covers and protects bacterial communities. And unlike antibiotics, bacteria are not known to develop resistances to these antimicrobials.

- **Chlorhexidine** disrupts bacterial cell walls and is widely used to treat gingivitis and as an antimicrobial irrigant. Its long-term uses in home care have been limited by staining.
- **Clorastan**, a stabilized chlorine dioxide and SnF₂, is used to treat dental-unit water lines and remove biofilm; it is...
effect. Sealed prescription trays provide effective delivery deep into periodontal pockets (up to 9mm) for concentrations of peroxide as low as 1.7 percent. The oxygenation of the periodontal pockets via a daily 10-minute tray application is hypothesized to modify the microenvironment of the periodontal pocket to modify biofilm regrowth.9 Chlorine-based products have not been used in the tray because of concerns for taste, staining and gingival irritation.

Prescription tray therapy

Clinical trials have shown that use of hydrogen peroxide, delivered in a sealed prescription tray as an adjunct to scaling, reduces bleeding and pocket depth better than scaling alone.10 Evaluations of refractory maintenance patients from a periodontal office tracked patients for up to five years demonstrating that the addition of sealed prescription tray therapy helped reduce inflammation by 75 percent more than

Fig. 1a–c: Pretreatment patient.

also used in dentifrices and mouth rinses to provide antimicrobial activity.6 Its limited shelf life created concerns for patients, but in recent years activated chlorine dioxide stored in dual chambers and mixed by the patient immediately before use as a rinse has overcome this problem.7

- Peroxides at low concentrations (≤ 3 percent) have long been recommended to reduce plaque and gingivitis with a good safety record. Disruption of the biofilm occurs after exposure to hydrogen peroxide—likely a combination of chemical and mechanical processes. The problem that researchers identified in using peroxide for the treatment of periodontal disease is mechanical access to the pocket.8 The rinsing and brushing just doesn’t reach deep enough for patients with pocketing greater than 3mm.

The challenge is not just getting medication deep into periodontal pockets, but also holding it there long enough for therapeutic effect. Sealed prescription trays provide effective delivery deep into periodontal pockets (up to 9mm) for concentrations of peroxide as low as 1.7 percent. The oxygenation of the periodontal pockets via a daily 10-minute tray application is hypothesized to modify the microenvironment of the periodontal pocket to modify biofilm regrowth. Chlorine-based products have not been used in the tray because of concerns for taste, staining and gingival irritation.
The key to successful reduction and modification in biofilm by hydrogen peroxide can be ascribed to the precise seal of the prescription tray. This tray allows oxygen released from the peroxide gel to penetrate deep into periodontal pockets over 10 minutes, and the exposed surface layer of the biofilm is debrided. Repeat applications of 10–15 minutes remove additional layers and also expose the periodontal pocket to oxygen as peroxide activates. The change in the microenvironment of the periodontal pocket, through the release of oxygen, creates a hostile environment for anaerobes and a favorable environment for healthier bacterial regrowth.

The benefits of this approach can be seen in a case study featuring a patient who wanted an implant. The patient presented requesting the implant, but the dental team explained that the infected tissues likely would not support the implant (Fig. 1), and refused to provide the implant without periodontal therapy first.

The patient left the office but later returned to ask for more information. He consented to periodontal therapy, which consisted of scaling and prescription tray delivery of 1.7 percent hydrogen peroxide gel (Perio Tray and Perio Gel, respectively). Within weeks of starting treatment, there was a 77 percent decrease in bleeding, less plaque, and much healthier gum tissue tone and color (Fig. 2). The healthier tissue should support the implant long into the future (Figs. 3 and 4).

This case illustrates points proven in clinical trials—that the regular delivery of a low concentration of peroxide via a sealed prescription tray as an adjunctive therapy offers significant patient benefit. Managing the bacterial

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Figs. 2a–b: Images for patient two weeks after first scaling procedure and prescription trays were started.
loads by managing the microenvironment of the periodontal pocket helps address the bacterial causes, deep in periodontal pockets. This helps solve a problem in treatment that clinicians and patients have faced for decades. The solution is an old and affordable drug. It just has a new and comfortable delivery that is easy for patients to use.

Case courtesy of Dr. James W.W. McCreight and Jessica Berthelson, RDH, from McCreight Progressive Dentistry, Steamboat Springs, Colorado

Endnotes
6  Sellers K and DiGangi P. Matching veneers to individuals. RDH 2014 March;34(3).