

New Technology for Periodontal Treatment

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From the Editor

In this issue of *Cases & Commentaries*, we are fortunate to have two reports presented by Catherine Fairfield, RDH. Catherine was one of the early adopters of Periowave™ photodisinfection into her Calgary practice. She has used this technology for over a year now, and we are pleased to share with our readers some of the early cases she has treated.

The science of photodisinfection has a fascinating history. Literature dates back to 1500 BC describing therapy involving the placement of certain kinds of seeds on the skin which were then exposed to sunlight. These seeds contained a psoralen compound, which has since been shown to be a photosensitizing compound. Since that time, there are numerous conditions which have been shown to benefit from the therapeutic effects of light, such as cutaneous tuberculosis, psoriasis, tumors, vascular disease, newborn jaundice, and macular degeneration. In the early 1990s, it was found that photosensitizers could be used in combination with light to kill microorganisms, and indeed bacteria, yeasts, and viruses can be inactivated in this way. Cationic sensitizers have been proven to kill both Gram-positive and Gram-negative bacteria in the presence of light.

Periowave is the first commercial application of this exciting new technology dedicated to the non-antibiotic treatment of oral infections. Periowave photodisinfection has been shown to be effective against a wide range of perio-pathogens, including *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia*, *Fusobacterium nucleatum*, and *Actinobacillus actinomycetemcomitans*. The use of light for the treatment of infections heralds a new therapeutic era against a variety of pathogens, including those associated with oral infections, wound infections, viral and fungal infections, and even the “superbug” infections like MRSA. By preserving the use of antibiotics for only those cases where they are truly needed, we diminish the potential for antibiotic resistance. Clearly, this is of great benefit to the patients we treat.

If you have any comments or questions regarding Periowave, or cases you would like to submit utilizing photodisinfection with Periowave, please feel free to contact me.

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In-Office Application of the Periowave™ Photodisinfection Technology – Two Cases of Chronic Periodontitis

The following Periowave clinical cases were submitted by our Guest Clinician **Catherine Fairfield, RDH**. Since 2001, Ms. Fairfield has been a part-time clinical educator in Graduate Periodontal Studies at the University of British Columbia, has lectured throughout Canada on non-surgical periodontal therapy, implant maintenance therapy, and advanced instrumentation, and was a participant in both the 2006 CDHA and Pacific Dental Conferences. She serves on the Continuing Competency Review Board of the Alberta College of Registered Dental Hygienists, and has maintained clinical positions in periodontal practices since 1989.



Introduction

Chronic periodontitis (formerly called *adult periodontitis*) is a reaction of the tissues surrounding a tooth to bacteria-laden biofilms (often termed *dental plaque*) on subgingival tooth surfaces. Bacteria and aspects of host immune response to bacterial infection contribute to the loss of the normal attachment apparatus between the tooth and the supporting alveolar bone.¹ This process may result in gingival recession on some teeth, but more often results in periodontal pocketing. If periodontal pocketing progresses, anatomic defects often develop in the adjacent alveolar bone that can lead to tooth loss. Also important, the biomedical literature reports links between periodontitis and serious systemic maladies, such as heart attack, stroke, diabetes, pneumonia, cardiovascular diseases, and premature birth.²

Mechanical removal of biofilms has been and remains a key component of conventional therapy for periodontitis. Various local and systemic antimicrobial regimens, combined with mechanical debridement, have been used as adjuncts to mechanical therapy. These have produced small, but statistically significant average improvements when compared with mechanical debridement alone.³ However, serious concerns remain regarding the emergence of host resistance whenever antibiotics are used.⁴

Recent years have seen extensive investigation into the antimicrobial activity of light-activated agents (photosensitizers) that selectively bind to periodontal bacteria.

Wilson first proposed the use of photosensitization as a tool for the treatment of periodontal diseases, and methylene blue was selected due to its century-long history of safe use in humans.⁵ Activated photosensitizing agents cause the production of highly reactive oxygen that is, in turn, responsible for killing the bacteria inhabiting periodontal pockets and proximate mucosa. Virulence factors associated with Gram-negative bacteria are also inactivated.⁶

The use of photosensitization for killing periodontal pathogens may provide important therapeutic benefits, including no antibiotic resistance, the ability to treat the full depth of periodontal pockets, the ability to inactivate bacterial virulence factors, as well as a high level of safety and ease of use. Indeed, a number of recently published studies support this therapeutic concept.⁷

Photodisinfection treatment is a straightforward, two-step clinical procedure. The first step is the irrigation of the affected periodontal site with the photosensitizing solution that selectively binds to bacteria. The second step consists of illuminating the site with the light-diffusing tip from a non-thermal diode laser of the appropriate wavelength (670 nm) for 60 seconds.

A new clinical device (Periowave™, Ondine Biopharma, Vancouver, BC, Canada) for periodontal photodisinfection is now approved for use in Canada and the European Union. Below are two case reports utilizing photodisinfection technology with Periowave, followed by a brief discussion of the results observed in these patients.

Case # 1

Periodontal Defect in an Adolescent Unresolved by SRP and Oral Hygiene Instruction

Case Report

A 13-year-old, post-orthodontic female was referred to the periodontist for evaluation and treatment of an isolated periodontal defect on the mandibular left first molar. She was in good general health with no known allergies or medical concerns, and had been participating in routine oral hygiene maintenance therapy throughout her orthodontic treatment.

Clinical evaluation included a full periodontal and radiographic examination that revealed generalized gingivitis with an isolated periodontal defect on the mesial aspect of the mandibular left first molar (Figure 1.1). Probing depths⁸ (PD) of 7 mm and bleeding on probing (BOP) from both the mesiobuccal and mesiolingual aspects were noted. After evaluation of this site, the periodontist recommended full-mouth debridement and oral hygiene instruction (OHI), followed by a reevaluation at six to eight weeks.



Figure 1.1 – Pre-treatment radiograph (April 2004)

In May 2004, OHI, a full-mouth (manual and ultrasonic) scaling and root planing (SRP) was completed in two appointments utilizing local anesthesia for the mandibular left quadrant. At the initial reevaluation in July 2004, the PD and BOP were unchanged at the mesial aspect of the affected molar. In August 2004, the patient presented for the scheduled three-month periodontal maintenance (PM). PD and BOP continued

to remain unchanged at this site, despite improved oral hygiene (OH) and continued PM at three-month intervals. A systemic antibiotic regimen of amoxicillin (250 mg) and metronidazole (250 mg) three times daily (TID) for seven days was recommended by the periodontist at that time. In December 2004, the clinical findings remained unchanged. Localized SRP was performed at the site, followed by systemic antibiotic therapy using the same regimen of amoxicillin and metronidazole as before. Despite high-quality home-care, at subsequent quarterly PM appointments through February 2006, the PD remained 6-7 mm and BOP was noted. (Surgical treatment for the defect was declined by the patient and her parents.)

Treatment and Results

In March 2006, the patient presented for photodisinfection treatment. The mesial aspect of the mandibular left first molar was lightly debrided both supra- and subgingivally using a Gracey 11/12 rigid curette to remove the bulk of the subgingival biofilm. This was immediately followed by a single photodisinfection treatment using Periowave (Figures 1.2 and 1.3).



Figure 1.2 – Periowave irrigation of lower left first molar following light debridement in March 2006



Figure 1.3 – Periowave illumination of lower left first molar in March 2006

In May 2006, the eight-week clinical reevaluation found the PDs for the mesial aspects were reduced to 4 mm, with no BOP from either the buccal or lingual. Routine PM was performed utilizing manual and ultrasonic debridement, with no further Periowave treatment.

During the second three-month PM appointment in August 2006, clinical evaluation found this site free of clinical signs of infection and anatomically stable, with a maximal PD of 4 mm and no BOP. Routine SRP and OHI were performed at this appointment. The subsequent PM appointment did not take place due to scheduling difficulties. In late February 2007, as part of a PM appointment, clinical assessment revealed the site free of signs of clinical inflammation and anatomically stable, with improved PDs of 3 mm on the mesiobuccal and 4 mm on the mesiolingual with no BOP (Figure 1.4). In April 2007, a radiograph was made of the site (Figure 1.5). BOP consistent with gingivitis was noted at numerous other sites. Routine SRP and OHI were performed at this appointment. Self-care was re-emphasized, and a PM schedule of 4 times yearly was recommended to the patient and her parents.



Figure 1.4 – PD of 4 mm with absence of BOP in August 2006 (5 months post-Periowave tx)



Figure 1.5 – 13 months post-treatment with Periowave (April 2007)

Case # 2

Generalized Chronic Periodontitis

Case Report

A 39-year-old female was referred to the periodontist for a generalized periodontal assessment and treatment as required. She was in good general physical health with a known penicillin allergy. After smoking for 26 years, the patient had successfully quit 18 months prior to the initial examination. She had been appearing irregularly at her general dental office prior to the periodontal referral. Her chief complaint was poor smile esthetics because of “shifting” of her “front” teeth in recent years.

Clinical evaluation consisted of a full periodontal and radiographic examination that revealed generalized periodontitis that was assumed, in light of the patient's age, smoking history and lack of past periodontal records, to be *chronic periodontitis*. The gingival tissue showed generalized diffuse edema, erythema, and cyanosis. Both bleeding and suppuration were noted during probing. Radiographic examination revealed generalized severe vertical osseous defects. Prognosis for the entire dentition was considered guarded because of the extent of the generalized osseous defects and signs of ongoing infection. Initial treatment was recommended to consist of five visits for SRP with local anesthesia. Systemic antibiotic therapy and concomitant local photodisinfection treatment with Periowave were also recommended.

Treatment and Results

In August 2006, the patient presented for OHI and initial SRP, with local anesthesia for the maxillary centrals and laterals only. Probing depths ranged from 2-9 mm (Figure 2.1). Ultrasonic and hand scaling were performed, followed by photodisinfection with Periowave. Systemic metronidazole (250 mg TID for seven days) was prescribed by the periodontist.



Figure 2.1 – Initial therapy appointment Sept 2006 prior to Periowave tx



Figure 2.2 – Six days post initial therapy, Periowave tx and systemic metronidazole

Seven days later, the patient underwent SRP on the remaining upper and lower left quadrants. Examination revealed that signs of severe gingival inflammation in the areas of the maxillary central and laterals were dramatically reduced since the initial SRP and photodisinfection (Figure 2.2). PD was not measured at that time because of gingival tenderness. SRP of the remaining teeth was completed at subsequent appointments.

In January 2007, the patient presented for PM. Examination revealed probing depths (initially ranging up to 9 mm with generalized BOP and localized suppuration) reduced to a range of 2-5 mm with no BOP or suppuration. Continued PM was recommended consisting of SRP at three-month intervals, including the possibility of additional photodisinfection treatments.

Discussion

Initial assessment of the isolated periodontal defect in Case #1 suggested that standard non-surgical periodontal therapy would be adequate. However, signs of inflammation persisted following mechanical therapy, suggesting that additional treatment was needed to reduce the risk of further periodontal attachment loss and to limit risks to the adjacent tooth. Adjunctive therapies were considered because the patient and her parents declined surgical treatment. The simultaneous administration of systemic amoxicillin and metronidazole has been suggested as an adjunct to mechanical therapy to reduce residual periodontal pathogens in periodontitis patients.⁹ However, despite two rounds of combined therapy, deep PDs and BOP persisted. Therefore, regardless of the precise etiology of this refractory periodontal lesion, the use of photodisinfection appears to have facilitated a successful outcome.

In Case #2, both a systemic antibiotic and photodisinfection were utilized at the time of initial SRP in an attempt to arrest what appeared to be severe chronic periodontitis in a fairly young adult with numerous areas of moderate to severe bone loss. Five months after combined mechanical, antibiotic and photodisinfection therapy, the patient's periodontal health appeared substantially improved. However, in light of the multi-faceted approach used for this patient, it is not possible to determine the precise reason for this improvement.

Summary & Conclusions from the Guest Clinician

In Case #1, a single adjunctive treatment using photodisinfection with Periowave resulted in a dramatic clinical effect, as evidenced by a reduction in PD and BOP at a refractory periodontitis site. This site remained healthy and anatomically stable for at least 12 months post-therapy, despite the patient's failure to observe the recommended three-month PM schedule. In Case #2, a significant reduction in localized gingival inflammation was noted in a generalized chronic periodontitis case seven days after SRP, systemic metronidazole, and Periowave treatment were utilized. At six months post-treatment, PDs were substantially reduced. Furthermore, no BOP was noted despite irregular PM. Photodisinfection treatment may be an important therapeutic breakthrough in reducing or eliminating infection in patients with periodontal diseases.

Catherine Fairfield, RDH

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