

Research and Publications

Keller DC and Buechel M. Direct medication delivery modifies the periodontal biofilm. *Oral Biol Dent.* 2017; 5:1. <http://dx.doi.org/10.7243/2053-5775-5-1>

This study indicates that direct medication delivery of medicaments with a custom formed tray modifies the biofilm from a more virulent anaerobic to a less virulent aerobic composition and reduces the number of pathogens. Fewer bacteria that are less virulent should provide better treatment results.

Keller DC, Buechel M. (2017) Periodontal Treatment with Direct Medication Delivery of Hydrogen Peroxide and Oxygen. *Oral health case Rep* 3: 133. doi:10.4172/2471-8726.1000133

In this case study the nature of the biofilm microenvironment was modified by delivering a 1.7% hydrogen peroxide gel, oxygen and Vibramycin into the patient's periodontal pockets using a direct medication delivery method (Perio Tray, Perio Protect LLC St. Louis, MO.). The hydrogen peroxide (Perio Gel, Perio Protect St. Louis, MO) has specific poloxamer and antimicrobial medicinal effects as it generates 5.7X oxygen concentration when hydrogen peroxide disassociates into water and oxygen within the medical device. The medicinal benefits of hydrogen peroxide, oxygen and Vibramycin help control the biofilm, altering the micro-environment of the patient's periodontal pockets from a more virulent to less virulent population. This decrease in biofilm virulence and a decrease in bacteria numbers is observed clinically as a decrease in bleeding upon probing and pocket probing depth.

Dunlap T. Prescribing Hydrogen Peroxide in the Treatment of Periodontal Disease. *Oral Health* 2016;Dec:64-68.

Antibiotics used for the treatment of periodontal disease have come under increasing scrutiny in recent years. One concern lies in the rise of bacteria resistant to antibiotics, complicating treatment and posing general health risks. Some patients want to avoid antibiotics and their side effects altogether. Many dentists have raised concerns about antibiotic long-term efficacy. An alternative antimicrobial to be used between office visits is a 1.7% hydrogen peroxide gel delivered into periodontal pockets with a sealed prescription tray. Hydrogen peroxide has a long and safe track record in dentistry and has been used in tray delivery for more than 10 years to treat periodontal disease. Classified in the United States as an oral debriding agent and an oral wound cleanser, peroxide is an effective antimicrobial for chronic oral wounds inducing periodontal disease.

Cochrane RB and Sindelar B. Case Series Report of 66 Refractory Maintenance Patients Evaluating the Effectiveness of Topical Oxidizing Agents. *The Journal of Clinical Dentistry* 2015;26:109-114. Case series data were analyzed from 66 failing periodontal maintenance patients who had exhausted treatment options before using prescription trays with a 1.7% hydrogen peroxide gel once or twice daily for two-and-a-half to five years. Data included pocket probing depths (PPD), bleeding on probing (BOP), smoking status, and compliance with tray usage. Data were collected prior to tray usage and after tray delivery at six months, one year, and annual intervals. A clinical and statistical reduction in BOP was maintained over the length of the study ($p \leq 0.01$). No differences were seen in patients who used trays two times or one time a day or in patients who smoked or did not smoke.

Keller D. Systemic Lp-PLA-2 cardiovascular marker response to direct medication delivery periodontal treatment. *Cardiovascular System* 2014;2(8):15 November 2014.

Periodontal disease has been associated as a co-contributor for cardiovascular disease. Inflammatory markers such as lipoprotein-associated phospholipase A2 (Lp-PLA-2) demonstrate an increased risk of heart attack and ischemic stroke. It is not known to what extent treating periodontal disease may affect changes in Lp-PLA-2 levels. This case report discussed treating patients' periodontal conditions with the Perio Protect Method (PPM) and evaluating systemic Lp-PLA-2 levels, before, during and after periodontal treatment. This pilot study demonstrates that treating the patient's periodontal conditions results in decreasing the periodontal markers and lowering the Lp-PLA-2 levels and these findings may be important as an adjunct of cardiovascular treatment.

Putt M, Mallatt M, Messmann L, and Proskin H. A 6-month clinical investigation of custom tray application of peroxide gel with or without doxycycline as adjuncts to scaling and root planing for treatment of periodontitis. American Journal of Dentistry. 2014;27:273-284. This study evaluates the 6-month clinical effects of one scaling and root planing (SRP) procedure alone or combined with local administration of hydrogen peroxide gel (with or without inclusion of doxycycline for 2 weeks) via Perio Trays® for treatment of subjects with chronic periodontitis. In the test groups, Perio Tray delivery started at baseline, SRP followed three weeks later, and daily Perio Tray usage continued throughout the trial. The control group received SRP at the same time as the test groups. BI and PPD data were collected one week before SRP, two weeks after SRP, and at 3 and 6 months. Results indicate that mean BI dropped significantly only for test groups before SRP. Two weeks post-SRP, BI reductions for test groups were significantly greater than the control, and remained so for most comparisons. Analysis of pockets >5 mm at baseline showed that mean PPD for both test groups significantly decreased from baseline before SRP. By 26 weeks, mean PPD decreased > 1.10 mm for both test groups compared to 0.38 mm for the SRP-only control (P< 0.001 for test versus control at all post-SRP comparisons). Analysis of pockets ≤ 5 mm at baseline showed the same relationship between groups (P< 0.001 for test versus control).

Putt M and Proskin H. Custom Tray Application of Peroxide Gel as an Adjunct to Scaling and Root Planing in the Treatment of Periodontitis: Results of a Randomized, Controlled Trial after 6 Months. The Journal of Clinical Dentistry. 2013;24:100-107. When compared with SRP alone, clinical improvements in PPD (*e.g.* ~1.0 mm for pockets >5 mm at baseline) were maintained for up to 6 months after SRP with adjunctive use of 1.7% hydrogen peroxide gel, locally administered using prescription, customized trays in the treatment of subjects with moderate to advanced periodontitis.

Putt M and Proskin H. Custom Tray Application of Peroxide Gel as an Adjunct to Scaling and Root Planing in the Treatment of Periodontitis: A Randomized, Controlled Three-Month Clinical Trial. The Journal of Clinical Dentistry. 2012;23(2):48-56. A three-month clinical trial comparing scaling and root planing (SRP) alone to custom tray application of peroxide gel in conjunction with SRP shows that the adjunctive use of 1.7% hydrogen peroxide gel in the treatment of subjects with moderate to advanced periodontitis demonstrated statistically significant clinical improvements in pocket depths and bleeding when compared with SRP alone.

Dunlap T, Keller D, Marshall M, Costerton J, Schaudinn C, Sindelar B, and Cotton J. Subgingival Delivery of Oral Debriding Agents: A Proof of Concept. The Journal of Clinical Dentistry. 2011 Nov;XXII(5):149-158. A demonstration that the prescription Perio Tray® effectively places medication subgingivally. Mathematical modeling indicates Perio Tray® placement of hydrogen peroxide gel in periodontal pockets with depths up to 9 mm. Pathology reports reveal reductions in subgingival bacterial loads and improvements in pretreatment pocket depths of up to 8 mm after 1.7% hydrogen peroxide and Vibramycin syrup were prescribed for use with the Perio Tray®.

Keller, D. How to Manage Oral Biofilm Using Perio Protect as a minimally invasive method for lasting oral health. DPR 2010 July;44(7):54-55. This case study follows one patient with advanced periodontal disease for four years. Photos, radiographs, and charting indicate significantly improved health with significant bone gains and pocket depth reductions.

Schaudinn C, Gorur A, Sedghizadeh P, Costerton J, and Keller D. Manipulation of the microbial ecology of the periodontal pocket. WorldDental 2010 Feb-Mar;2(1):14-18. This article explains the “biofilm potential” method to assess the ecological status of periodontal sulci with respect to the health and spreading tendencies of the biofilm communities growing in them. The data suggest that the biofilm potential is an accurate indicator of microbiological health of the sulcus and that oxidative chemical strategies such as those used with the Perio Protect Method® are effective for periodontitis.

Schaudinn, C. Gorur A, Keller D, Sedghizadeh PP, Costerton JW. Center for Biofilms, School of Dentistry, University of Southern California, Los Angeles, CA 90089, USA. Periodontitis: An Archetypical Biofilm Disease. J Am Dent Assoc. 2009 Aug;140(8):978-86. This cover story discusses biofilms and the science behind the prescription tray delivery of peroxides to adversely affect the viability or growth of the biofilms in the sulcus as observed and measured with the biofilm potential technique.

Perio Protect-A Conservative Periodontal Therapy Adjunct. Clinicians Report. March 2009;2(3)1,3-4. Independent evaluation of the Perio Protect Method® documents 98% of doctors surveyed reported reduced bleeding for patients following the Perio Protect Method®. 95% also reported reduced inflammation, and 90% reported decreased pocket depths. In the majority of cases these results were apparent in 2 weeks time.

Keller, D.C. Managing Periodontal Disease In A Patient Suffering From Renal Failure. Dentistry Today. July 2008;27(7)144-47. This case study report examines the results of the Perio Protect Method® to help successfully manage the periodontal conditions of a patient during renal failure, when systemic calcium levels are often related to an increased incidence of periodontal disease.

Costerton J. W., Keller, D.C. Oral Periopathogens and Systemic Effects. J Acad Gen Dent 2007;55(3):210-25. Demonstration of the associations between the oral pathogens and the systemic diseases to which they have been related.

Collins, F. and Veis, R. Periodontal Treatment: The Delivery and Role of Locally Applied Therapeutics. Continuing Dental Education Digest. Sept;2006:14-21. Presentation of the efficacy of the Perio Protect Method®: pocket probing depths went from 5.7mm to 3mm, bleeding went from 20.7 to 2.7 sites.

Keller, D.C. Management of Periodontitis for HIV-AIDS Patients. Dentistry Today. June 2006;25(6):110-3. Patients with HIV-AIDS are reported to have higher incidences and severity of periodontal disease. This case study report demonstrates that a patient with HIV-AIDS who had an initial severe periodontal problem successfully managed the disease for more than 4 years by following the Perio Protect Method®.

Research Abstracts and Poster Presentations

Preliminary Data on Periodontal Disease Treatment Using Topical Oxidizing Agents. Keller et al. J Dent Res. 2010, Special Issues. Poster presentation at AADR (March 3-6, 2010), Washington DC.

SEM Results of Periopathogenic Control with the Perio Protect Method, Keller et al. J Dent Res 86(A): 1186, 2007. Poster presentation at IADR/AADR/CADR (March 21-24, 2007), New Orleans.

C-Reactive Protein Changes During Perio Protect Treatment Of Periodontal Disease, Steele et al. J Dent Res 86(A): 1195, 2007. Poster presentation at IADR/AADR/CADR (March 21-24, 2007), New Orleans.

Initial Study of the Perio Protect™ Treatment for Periodontal Disease, Wentz et al. J Dent Res 85(A): 1164, 2006. Poster presentation at ADEA/AADR/CADR (March 8-11, 2006) Orlando, Florida.