

Use of the Carbon Dioxide Laser in Retarding Epithelial Migration: A Pilot Histological Human Study Utilizing Case Reports

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J Periodontol 1995 Mar;66(3):197-204

Predictable regeneration of tooth-supporting tissues lost to periodontal disease is the aim of periodontal therapy. Often the result of conventional treatment is healing with a long junctional epithelium along the root surface and little regeneration of the complete attachment apparatus. The purpose of this pilot study was to evaluate whether de-epithelialization with a CO₂ laser at the time of flap surgery and at 10-day intervals over the first 30 days of healing has the potential to enhance the formation of a connective tissue attachment. Six mandibular incisors in two patients were selected for the study. Each patient received oral hygiene instruction and initial therapy prior to surgery. The teeth were splinted together, open flap debridement was performed on all teeth, a notch was placed on the roots at the height of the crest of the alveolar bone, and the flaps were sutured in place. The test side received controlled de-epithelialization of the outer (oral) gingiva with the carbon dioxide laser, and the inner gingival flap. The de-epithelialization was repeated on the test side at 10, 20, and 30 days postsurgically. Controls received open debridement only. Block sections were taken at 90 days and processed for histologic analysis. The results showed that for both patients, junctional epithelium (JE) was formed on both test and control teeth. In all control teeth, the JE extended the entire length of the root to the base of the reference notch. On the test side (laser treated) in one patient, the notch was filled with connective tissue and limited repair cementum. This finding was not seen in any control teeth. This is the first reported observation of human histologic evaluation utilizing the CO₂ laser for de-epithelialization and may warrant further study.

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RESEARCH ABSTRACTS

Laser-Assisted Treatment of Patients with Type 2 Diabetes Mellitus and Periodontal Disease

In her clinical case "Laser-Assisted Periodontal Therapy with an 810-nm Diode Laser for a Diabetic Patient with Class III Periodontal Disease" (pages 38-54), Heather Gill describes a guarded long-term prognosis for a patient who had little interest in continuing his oral care.

Reports from the laser literature indicate varying degrees of success for laser-assisted periodontal therapy for patients with type 2 diabetes mellitus, compared to scaling and root planing treatment alone.

The Dengizek Eltas group studied 37 patients with chronic periodontitis and poorly controlled type 2 diabetes mellitus. Treatments consisted of scaling and root planing or scaling and root planing with laser. They used an 810-nm GaAlAs diode laser at 1 Watt power, in contact mode, along with a 400-µm fiber-optic tip. Laser treatment consisted of three sets of 15 seconds for each tooth if pocket depth was between 3 and 3.5 mm, and three sets of 20 seconds each per tooth if pocket depth was greater than 4 mm. The authors do not specify whether a continuous or pulsed emission mode was used. At 3 and 6 months post-treatment, laser-assisted treatment showed greater improvement in certain clinical parameters compared to scaling and root planing only; serum C-reactive protein levels and HbA1c levels were comparable for both groups. Their study is abstracted below.

Chandra and Shashikumar examined the effect of scaling and root planing alone vs. scaling and root planing following by diode laser irradiation in 40 patients with type 2 diabetes mellitus and chronic periodontitis. They utilized an 808-nm diode laser at power settings of 1.5 W-1.8 W in continuous, contact mode with a 320-micron fiber-optic cable. Duration of exposure in seconds corresponded to the depth of the periodontal pocket in millimeters. Results at 3 months

showed a statistically significant greater improvement in clinical and microbiological parameters for the laser-treated group than scaling and root planing alone. Glycated hemoglobin level (HbA1c) levels decreased, but the intergroup difference was not significant.

In their investigation summarized below, Koçak *et al.* examined 60 patients with chronic periodontitis and type 2 diabetes mellitus. They compared scaling and root planing therapy to scaling and root planing followed by laser irradiation. They used a 940-nm indium-gallium-aluminum-phosphate diode laser equipped with a 300-µm fiber-optic delivery system at a setting of 1.5 W average power with a pulse interval of 20 ms and pulse length of 20 ms delivering 20 and 15 J/cm² of energy, respectively. The fiber was inserted into the periodontal pocket, oriented parallel with the root surface and slowly moved from apical to coronal in a sweeping motion, and the laser was activated for a total of 20 seconds for each tooth. After 3 months, clinical and glycemic outcomes were significantly better for the laser-assisted group than the scaling-and-root-planing-alone group.

Elavarasu *et al.* studied the effect of scaling and root planing alone compared to laser curettage as an adjunct to scaling and root planing on 10 patients with moderate chronic periodontitis and controlled type 2 diabetes mellitus. An 810-nm diode laser, set at 0.8 W in continuous mode, was used with an initiated fiber optic tip inserted into the periodontal pocket and

Evaluation of Long-Term Effects of Diode Laser Application in Periodontal Treatment of Poorly Controlled Type 2 Diabetic Patients with Chronic Periodontitis

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Int J Dent Hyg 2019 Jan 29. doi: 10.1111/idh.12384. [Epub ahead of print]

Purpose: This study aimed to investigate the effects of diode laser (DL) in addition to non-surgical periodontal treatment on periodontal parameters, systemic inflammatory response and serum haemoglobin A1c (HbA1c) level in patients with poorly controlled type 2 diabetes mellitus (T2DM) and chronic periodontitis.

Methods: Thirty-seven patients with poorly controlled T2DM and chronic periodontitis completed this study. The patients were divided into two groups. The individuals in the control group received placebo laser treatment in addition to scaling and root planing (SRP). The individuals in the study group received DL (1 watt) in addition to SRP. Clinical index measurements were performed before treatment (T0), 3 months after treatment (T1) and 6 months after treatment (T2). Plaque index, gingival index, bleeding on probing, clinical attachment level and probing depth were measured to determine periodontal status. HbA1c and C-reactive protein (CRP) levels were also analysed using blood samples.

Results: In both groups, clinical and laboratory parameters were significantly improved at T1 and T2 compared to baseline ($P < 0.05$). Gingival index, bleeding on probing and probing depth were more significantly reduced after treatment in the SRP+DL group than in the SRP group ($P < 0.05$). The serum CRP and HbA1c levels were similar between the groups ($P > 0.05$).

Conclusion: The use of DL in addition to SRP in periodontal treatment of T2DM individuals makes positive contribution to the reduction of local inflammation and to periodontal healing. On the other hand, it has no beneficial effects on systemic inflammatory response and glycaemic control.

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moved slowing in a apical direction until the bottom of the pocket was reached. Duration of laser irradiation was not specified. At 21 days, both treatments resulted in reductions in gingival inflammation and gains in clinical attachment level, and pocket depth reduction in the scaling and root planing + laser group showed significantly greater mean pocket depth reduction compared to the scaling-and-root-planing-alone group.

Javed and colleagues compared periodontal parameters (plaque index, bleeding on probing, and probing pocket depth) and hemoglobin A1c (HbA1c) levels in 22 patients with type 2 diabetes mellitus, periodontal inflammation, and at least 6 periodontal pockets 4 mm or greater in depth. Treatments included nonsurgical periodontal therapy (scaling and root planing), and scaling and root planing with adjunctive use of an Nd:YAG laser. They utilized a pulsed 1064-nm Nd:YAG laser, with an average output of 4 Watts, 80 mJ per pulse, 50 Hz repetition

rate, pulse duration of 350 ms, and a 600- μ m fiber. Laser treatment was accompanied by air and water cooling. Duration of laser exposure varied between 60 and 120 seconds, depending on accessibility. Laser energy was determined to be 240-480 J per treated site. After 3 months, improvements in clinical and glycemic outcomes were comparable for both groups.

For U.S. readers, certain carbon dioxide, Nd:YAG, argon, Ho:YAG, Er:YAG, Nd:YAP, Er,Cr:YSGG, diode, and frequency-doubled Nd:YAG lasers have been cleared by the U.S. Food and Drug Administration for intraoral soft tissue surgery.

As always, clinicians are advised to review the specific indications for use of their lasers and to review their operator manuals for guidance on operating parameters before attempting similar techniques on their patients.

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Nonsurgical Periodontal Therapy with/without Diode Laser Modulates Metabolic Control of Type 2 Diabetics with Periodontitis: A Randomized Clinical Trial

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Lasers Med Sci 2016 Feb;31(2):343-353

In order to evaluate whether nonsurgical periodontal treatment with/without diode laser (DL) decontamination improves clinical parameters, the levels of IL-1 β , IL-6, IL-8, intercellular adhesion molecule (ICAM), and vascular cell adhesion molecule (VCAM) in gingival crevicular fluid and metabolic control (HbA1c) [were assessed] in chronic periodontitis (CP) patients with diabetes mellitus type 2 (DM2). Sixty patients with DM2 and CP were randomly assigned into two groups to receive scaling and root planing (SRP, n = 30) or SRP followed by diode laser application (SRP + DL, n = 30). Clinical periodontal and gingival crevicular fluid (GCF) parameters were assessed at baseline, 1, and 3 months after periodontal treatment. HbA1c levels were evaluated at baseline and 3 months post-therapy. Total amounts of cytokines and molecules were analyzed by ELISA. Nonsurgical periodontal treatment with/without DL appeared to improve clinical, biochemical parameters, and glycemic control in DM2 patients (BMI < 25 kg/m²) with CP. The SRP + DL group provided better reductions in probing depth (PD) and clinical attachment level (CAL) parameters compared to the SRP group ($P < 0.05$). Significant reductions were found in the total amounts of GCF levels of IL-1, IL-6, IL-8, ICAM, and VCAM after treatment ($P < 0.05$). HbA1c levels decreased significantly at 3 months after treatment ($P < 0.05$). SRP + DL reduced HbA1c levels more significantly compared to SRP alone (0.41 vs. 0.22 %, $P < 0.05$). SRP, especially in combination with DL, shows improvement of glycemic control for DM2 patients with CP.

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DENTAL EDUCATORS' CORNER

Academy of Laser Dentistry Dental Educators' Corner

A Call for Suggestions for Dental School Educators

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The Academy of Laser Dentistry and the American Dental Education Association (ADEA) have been working together to enhance awareness and education in the predoctoral student environment. We are looking for articles, clinical experiences, teaching tips, research and trends that have arisen in academia.

Through ADEA, the Lasers in Dentistry Special Interest Group has been discussing a myriad of aspects of laser education, clinical techniques, and clinical oversight. Over the last decade, the group has had many leaders in the laser arena help to guide educators and give them resources, including such things as educational teaching material (PDFs and PPTs), standards, rules, regulations, research, and names of regulatory agencies in the various states. We have discussed the types of lasers that could be used in a formal education setting, and types that might be problematic

We have a cadre of dentists that will be reviewing articles and adding content to the Educators Corner – individuals like Drs. Praveen Arany, Scott Benjamin, Juliana Barros, Shelly Patel, Sebastiano Andreanna, David Roshkind, and myself. I look forward to suggestions from the readership at large that would help in teaching and training the next generation of dentists. Ideas, suggestions, content, equipment, and clinical pearls would all be welcomed topics that could be disseminated to the great group of dental school educators that work daily with full-time dental and hygiene students. Please contact me with your ideas at bsmith@midwestern.edu.

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Disclosure: Dr. Smith is the Dean of the Midwestern University College of Dental Medicine Arizona. He has received a grant in kind from Convergent Dental, Inc., for research utilizing the Solea CO₂ dental laser. He has no other commercial financial affiliations. 

Smith