Five-year retrospective study of laser-assisted periodontal therapy

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This article outlines a five-year retrospective study involving a diode dental laser used on periodontally infected teeth. The present study utilized a specific protocol: scaling and root planing, light ultrasonic scaling, and the use of a diode laser. In 80% of cases, pocket depth of 3 mm or less was maintained.

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The use of dental lasers for the treatment of periodontal disease is accepted in some areas of dentistry, while in others it is thought to be antidotal therapy.[1] This article seeks to show that laser-assisted periodontal therapy is a viable, noninvasive method for treating periodontal disease.

Periodontal disease is a chronic inflammatory disease caused by a bacterial infection. For this reason, the bactericidal and detoxifying effects of laser treatment are advantageous in periodontal therapy.[2] The effectiveness of this therapy involves suppressing certain bacteria such as *Aggregatibacter actinomycetemcomitans,* an invasive bacterium associated with aggressive forms of periodontal disease that cannot be treated readily with conventional scaling and root planing (SRP). This bacterium is present on diseased root surfaces; as a result, it can invade the adjacent soft tissues as well, making removal by mechanical instrumentation difficult.[3]

It is impossible to achieve success with traditional periodontal methods of treatment due to the great difficulty in terms of completely removing bacterial deposits and their endotoxins from deep areas of periodontal pockets.[4] In addition, antibiotics that are used to prevent bacterial colonization after periodontal treatment help to increase the resistance of the microorganism.[5] According to the literature, using diode lasers in conjunction with SRP accelerates and enhances wound healing, making it more comfortable, while decreasing gingival bleeding, inflammation, and pocket depths.[6]

A 2002 position paper from the American Academy of Periodontology stated that gingival curettage consistently fails to provide any advantage in treating chronic periodontitis compared to SRP alone.[7] The current article challenges this assertion by describing a five-year retrospective study that shows how laser technology made a consistent difference in the health of chronic periodontal patients. It is the authors' opinion that the biofilm attaches to the inner lining of the epithelium and bony walls exposed to the bacteria. That biofilm will continue to destroy sulcular and junctional epithelium if it is not eliminated.

Protocol

Patients with pockets of 5 mm or more and those with bleeding and/or suppuration were considered candidates for laser-assisted periodontal therapy. SRP was performed three months before the start of laser-assisted periodontal therapy, due to the maximum utilization of insurance for most patients.

Optimally, patients would return for a series of subsequent appointments to address every pocket that exceeded the healthy 3 mm. For example, a patient whose deepest pocket measured 7 mm would come in for a total of four appointments every 7–10 days. Each time the laser was used to treat that pocket, 1 mm of it would heal from the apical to the coronal.[5] Using this example, all 7-mm pockets would be treated first, while the 6-mm pockets would be treated at the second appointment (7–10 days later). This process would continue for each appointment until all pockets had a healthy depth of 3 mm.

Each appointment began with ultrasonic scaling at a low setting, applied to all pockets in a slow, sweeping motion. This technique is used to smooth the root surface, in addition to the regular cleaning or SRP that the patient had undergone previously. After ultrasonic scaling was completed, a strong topical anesthetic (Cetacaine, Cetylite Industries) was applied. Although the laser is virtually pain-free, some patients might feel an uncomfortable amount of heat. Dentists might also opt to use local anesthetics for patients who have lower pain tolerances.

Fig. 1. An example of an initiated fiber-optic tip.

Fig. 2. The laser at the gingival margin.

Fig. 3. Debris removed from the diseased pocket.

Fig. 4. The laser is used to coagulate the pocket.

Laser setup

To prevent it from stripping the epithelial attachment, the laser tip should be measured 1 mm less than the deepest pocket being treated. Before placing the tip into the pocket, the laser must be "initiated" with black articulating tape (Accufilm II, Parkell). This initiation pinpoints the laser energy to the end portion of the fiber-optic tip (Fig. 1), making it possible to emit laser energy only to the intended areas rather than laterally.

The diode laser should be set at the lowest possible setting. The laser's energy is directed to the margin of the infected pocket without actually entering the pocket. The margin will start to turn white, which indicates that the laser setting is correct; it might be necessary to adjust the laser in 0.1 W increments to achieve this result (Fig. 2). Once the correct wattage has been achieved, the clinician should move the laser into the pocket for 5–10 seconds at a time. Each time the laser is removed from the pocket, it might carry a small amount of debris; wet gauze will remove this debris from the fiber-optic tip (Fig. 3 and 4). The clinician should inspect the fiber-optic tip to make sure it is still initiated each time before entering the pocket. The clinician should continue until no more debris can be removed or fresh bleeding occurs (Fig. 5).

After treating the infected pocket, the margins of the pocket must coagulate to help the healing process, as going into the pocket repeatedly with the laser can leave the borders jagged. The clinician needs to return to the lowest possible setting with the initiated fiber-optic tip. The laser energy should be traced along the margins of the pocket (at a distance of 1–2 mm) for approximately 20 seconds (Fig. 6).

Finally, the diode laser is used for biostimulation to aid in healing the damaged cells that line the wall of the inner epithelium.[8-11] In the authors' experience, 6 J is the optimum setting for the diode laser

Fig. 5. Fresh bleeding in the pocket.

Fig. 6. The laser traces along the coagulated margin of the pocket.

Fig. 7. The laser is used for biostimulation of the pocket.

Fig. 8. Vitamin E is applied to the pockets.

when it is approximately 4–5 mm from the treated area (Fig. 7). (This is the minimum distance to ensure that the laser energy is diffused sufficiently so that it provides biostimulation only and does no cutting.) Using a microbrush, the clinician should apply liquid vitamin E to the treated pockets (Fig. 8). (The efficacy of vitamin E has not been validated in the literature, but the authors have experienced positive tissue response with its use.)

Patients were instructed to avoid certain foods for at least 24 hours, including crunchy or spicy foods, foods with tiny seeds, and foods that might become lodged in the space created by the procedure. Patients were asked to avoid smoking for at least 24 hours, rinse with warm salt water at least twice daily for three days post-treatment, and avoid flossing and hard brushing for 48 hours post-treatment. If the patient experienced discomfort after the procedure was complete, ibuprofen or a similar pain reliever could be used, but typically this was not necessary. After the initial 48 hours, patients could brush and floss according to their normal routine.

Patients should return three months after the last appointment so that the dentist can determine the progress of pocket healing. Since periodontal disease is a lifelong struggle for most patients, this procedure might need to be repeated every 3–24 months, depending on the patient's home care regimen.

Materials and methods

This study examined the use of diode lasers on periodontal pockets to determine their bactericidal attributes and their ability to improve periodontal conditions.

A total of 70 non-smoking patients with no implants needed SRP, and had been under care for periodontal disease continuously for at least five years. Using the protocol described above, 810 nm and 940 nm diode lasers (Biolase Technology, Inc.) were used. As described previ-

ously, the cases were rescaled at the time of laser treatment using a light stroke and the lowest setting. Some cases were retreated to maintain healthy pockets. In all cases, 400 µ fiber-optic tips were used. As a starting point for tissue interaction, the lasers were set at 0.5 W in continuous wave mode.

Fiber-optic tips were cleaved (that is, the tip was cut to get a straight fiber) and used for 810 nm lasers and both 810 nm and 940 nm lasers were initiated. Each tooth had six measurable pockets (that is, mesial facial, center facial, distal facial, mesial lingual, center lingual, and distal lingual) and teeth were treated in all four quadrants. Four hygienists performed the treatments and did probing readings, while another hygienist did only probing readings.

Results

A total of 2,103 pockets were treated among the 70 patients. Of the 2,103 pockets, 1,278 were found in molars, 556 in premolars, and 269 in anterior teeth. Of the 1,278 molar pockets, 973 (76%) had been restored to a healthy pocket depth of 3 mm after five years of treatment. Of the 556 premolar pockets, 466 (84%) had been restored to a healthy pocket depth of 3 mm after five years of treatment. Of the 267 pockets in the anterior teeth, 240 (90%) had been restored to a healthy pocket depth of 3 mm after five years of treatment.

Conclusion

In all, 80% of the pockets treated using the diode laser were restored to a healthy pocket depth of 3 mm. These results suggest that this treatment modality should become an adjunct for treating periodontal infections.

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References

1. Dyer B, Sung E. Minimally invasive periodontal treatment using the Er,Cr:YSGG laser: A 2-year retrospective preliminary clinical study. Open Dent J 2012;6:74-78.
2. Gutierrez T. Diode laser for bacterial reduction and coagulation: An adjunctive treatment for periodontal disease. Contemp Oral Hyg 2005; 5(12):20-21.
3. Moritz A, Schoop U, Goharkhay K, Schauer P, Doertbudak O, Wernisch J, Sperr W. Treatment of periodontal pockets with a diode laser. Lasers Surg Med 1998;22(5):302-311.
4. Li J, Helmerhorst EJ, Leone CW, Troxler RF, Yaskell T, Haffajee AD, Socransky SS, Oppenheim FG. Identification of early microbial colonizers in human dental biofilm. J Appl Microbiol 2004; 97(6):1311-1318.
5. Andreana S. The use of diode lasers in periodontal therapy: Literature review and suggested technique. Dent Today 2005;24(11);130, 132-135.
6. Gregg RH 2nd, McCarthy D. Laser periodontal therapy for bone regeneration. Dent Today 2002; 21(5):54-59.
7. American Academy of Periodontology. The American Academy of Periodontology statement regarding gingival curettage. J Periodontol 2002; 73(10)1229-1230.
8. Hamajima S, Hiratsuka K, Kiyama-Kishikawa M, Tagawa T, Kawahara M, Ohta M, Sasahara H, Abiko Y. Effect of low-level laser irradiation on osteoglycin gene expression in osteoblasts. Lasers Med Sci 2003;18(2):78-82.
9. Trelles MA, Mayayo E. Bone fracture consolidates faster with low-power laser. Lasers Surg Med 1987;7(1):36-45.
10. Takeda Y. Irradiation effect of low-energy laser on alveolar bone after tooth extraction. Experimental study in rats. Int J Oral Maxillofac Surg 1988;17(6):388-391.
11. Dortbudak O, Haas R, Mallath-Pokorny G. Biostimulation of bone marrow cells with a diode soft laser. Clin Oral Implants Res 2000;11(6): 540-545.

Manufacturers

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888.424.6527, www.biolase.com

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Parkell, Edgewod, NY
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