Effect of a Diode Laser on Actinobacillus actinomycescomitans

Lasers have been used in periodontics for the past two decades to débride periodontal pockets, as well as for a variety of other applications including gingivectomy, gingivoplasty, subepithelial curettage, frenectomy, biopsy removal of granulation tissue, exposure of dental implants, and hemostasis following surgical procedures. Accordingly, there is continuing interest in the efficacy of dental lasers in treating periodontal disease.

A recent study in 26 patients evaluated the effect of application of a diode laser (Odysey 810, Ivoclar, NA, Buffalo, NY, USA) on the oral microflora of periodontal pockets. One test and one control periodontal pocket 2.5 mm on posterior teeth were selected in 26 adults with generalized moderate chronic periodontitis. The control pocket was treated by scaling and root planing. The test pocket was treated both by scaling and root planing and by an AlGaAs diode laser for 30 seconds at 0.8 W. Periodontal indices including gingival index, plaque index, pocket depth, attachment level, and gingival recession were evaluated at baseline, 6 weeks, and 3 and 6 months. Subgingival plaque samples obtained before and after treatment and at 3 and 6 months after treatment were evaluated for bacterial cell counts, morphotypes, and specific periodontal pathogens. The results of the study showed that therapy with an AlGaAs diode laser plus scaling and root planing showed no adverse effects. On the contrary, there was more rapid gingival healing, and 70% of the patients reported less soft tissue discomfort and tooth sensitivity in sites treated with the diode laser. Diode laser–treated sites also exhibited significantly lower numbers and proportion of subgingival Actinobacillus actinomycescomitans.

Studies with a neodymium:yttrium-aluminum-garnet (Nd:YAG) laser have shown beneficial effects on reduction of periodontal pathogens.22 Diode lasers in which coherent light is produced from an electrical current passed through a semiconductor have also been studied for their efficacy in the treatment of periodontal pockets. Kreisler and colleagues reported that periodontal pockets treated both by AlGaAs scaling and root planing and a GaAIAs diode laser (809 nm) had significantly greater reductions in tooth mobility, pocket depth, and clinical attachment loss compared with those treated by scaling and root planing alone.23 Borrajo and colleagues found that periodontal pockets treated by an InGaAsP diode laser (980 nm) exhibited significantly lower papillary bleeding index and gingival index compared with periodontal pockets treated by scaling and root planing alone.24 Laser radiation offers several advantages over scaling and root planing in that it can be delivered to the apical extent of deep periodontal pockets or other areas such as furcations where scaling and root planing is less effective, and, as opposed to antibiotics, it does not engender bacterial resistance or systemic side effects.

In the diode laser study discussed in this article, the authors reported that reductions in plaque were similar around laser-treated teeth and non-laser-treated teeth. Therefore, the reduction of A. actinomycescomitans appeared not to be related to scaling and root planing but to scaling and root planing plus use of the laser. This finding suggests that the diode laser resulted in a "less pathogenic plaque, particularly in view of the finding that the gingival health improved more rapidly in the laser-treated group. In this study, a less pathogenic dental plaque could be the result of significant decreases in the numbers and proportion of A. actinomycescomitans in the laser-treated group. The improved wound healing noted in this study could also be due to the inhibition of inflammatory mediators such as prostaglandin E2 (PGE2), as previously reported following the use of diode lasers. For example, Sakurai and colleagues found that diode laser irradiation significantly inhibited cyclooxygenase gene expression and PGE2 production from lipopolysaccharide-challenged human gingival fibroblasts in vitro. Shimizu and colleagues reported that periodontal ligament cells mechanically stretched in vitro produced significantly less PGE2, and interleukin-1β following irradiation with a diode laser, compared with nonirradiated controls. Mizutani and colleagues reported that an 830 nm diode laser at 1 W resulted in a significant decrease in serum levels of PGE2, and analgesic effects in 67 of 83 (80.7%) orthopedic patients.25 These findings of the effect on A. actinomycescomitans have been reported by others using the diode laser in periodontal pockets.6,11 As noted in the study discussed above, diode laser treatment resulted in a significant reduction in the total number of colony-forming units and in the proportion of subgingival A. actinomycescomitans. A. actinomycescomitans causes certain forms of periodontal disease, such as aggressive periodontitis, and may also be important in systemic diseases. Haraszthy and colleagues demonstrated the presence of periodontal pathogens including A. actinomycescomitans in atherosclerotic plaques,26 and there are recent data suggesting that subgingival A. actinomycescomitans may be related to coronary heart disease. Further, a high percentage of periodontal pockets harbor A. actinomycescomitans that is resistant to antibiotics such as the tetracyclines.27

For all these reasons, the management of A. actinomycescomitans–infected periodontal pockets by local physical methods such as laser treatment is particularly attractive. Treating periodontal pockets infected with A. actinomycescomitans offers special challenges compared with treating periodontal pockets infected with other pathogens. Whereas many species of periodontal pathogens are susceptible to mechanical débridement during scal-
ing and root planing, A. actinomycetemcomitans can invade the pocket epitheli- 
num and subjacent connective tissue, making it especially difficult to 
 eradicate. Accordingly, the recommended treatment of A. actinomycetemcomi-
tans-associated periodontitis includes adjunctive antibiotic therapy to eliminate 
the bacteria not removed by mechanical débridement.

Therefore, the reduction of A. actinomycetemcomitans appeared not to 
be related to scaling and root planing but to scaling and root planing 
plus use of the laser.

Comment

A recent study using a diode laser in conjunction with scaling and root planing 
suggests that the application of the laser to periodontal pockets may have 
beneficial effects on the pocket microflora by reducing A. actinomycetemcomitans 
better than scaling and root planing alone. Since the 
treatment of A. actinomycetemcomitans—infected periodontal pockets frequently 
necessitates the use of adjunctive antibiotic therapy, the Odyssey 810 diode 
laser may offer a supplemental means of eliminating this pathogen from 
periodontal pockets.

Diode laser treatment resulted in a significant reduction in the total 
number of colony-forming units and in the proportion of subgingival 
A. actinomycetemcomitans.

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