Laser Applications in Periodontal Therapy

Position Statement

Introduction

A significant technological advance in both medicine and dentistry has been the use of lasers. This position paper is a reflection of the use of lasers in periodontal therapy with specific emphasis on efficacy and treatment outcomes. As with any new technology or technique, it is important to compare treatment outcomes against those of existing traditional methods. An extensive search of the current literature by the AADC Positions Committee was conducted with emphasis on high level research involving randomized controlled trials and systematic literature reviews where available. The Committee also broadened the scope of the literature search by including current relevant studies and opinions of respected organizations such as the American Association of Periodontists (AAP), American Dental Association (ADA), and the Food and Drug Administration (FDA).

Background and Summary of Evidence

Two acronyms are found in the literature describing techniques designed to regenerate new periodontal attachment for patients with periodontal disease: Excisional New Attachment Procedure (ENAP) and Laser Assisted New Attachment Procedure (LANAP). It is purported that these procedures, either on their own or in conjunction with scaling and root planing (SRP), more effectively reduce loss of clinical attachment level (CAL) and/or create clinically significant new tissue attachment. When compared with traditional SRP or curettage, more complete removal of diseased epithelium and more effective reduction of bacterial load in the gingival sulcus have been proposed as the mechanisms by which laser therapy has been advocated to be more effective. An article by Goldstep states the following:

More recent studies have shown that instrumentation of the soft periodontal tissues with a diode laser leads to complete epithelium removal while instrumentation with conventional curettes leaves significant epithelial remnants.

There is very compelling evidence in the dental literature that the addition of diode laser treatment to SRP planing (the gold standard in non surgical periodontal treatment) will produce significant improved results.

There is significant proof that the addition of Laser Assisted Periodontal Therapy to conventional scaling and root planing improves outcomes.

This article by Goldstep is characteristic of a position paper and includes a bibliography of supporting articles and studies. It is also noted in Dr. Goldstep's credentials that she is a consultant to a number of dental companies. However, it is not specified whether her consulting duties exclude or include any laser manufacturers in order to establish a lack of bias or confirm any potential conflicts of interest.

An article by Moritz et al. describes the bactericidal effects of the diode laser used in conjunction with SRP which more effectively reduces inflammation when compared with SRP and rinsing with H_{2}O_{2}. This study divided patients into two groups: a study group consisting of 37 patients who underwent laser treatment in conjunction with SRP and a control group consisting of 13 patients who received SRP and follow-up rinsing with H_{2}O_{2}. Results demonstrated that patients who were treated with the laser along with SRP had significantly lower bacterial counts after 6 months.

While the Moritz et al. study may indeed demonstrate the bactericidal effects of laser treatment, it does not demonstrate long term effectiveness of therapy. Further, the Committee considers the study to be questionable. Specifically, the study demonstrates the following design deficiencies:

a. The published study indicates patients were randomly subdivided, but does not identify the randomization method.

b. Three of the study participants were not considered in the final evaluation because of inadequate hygiene. There were none removed from the control group for inadequate hygiene. It is possible that removal of participants from the study group could weaken the evidence in favor of laser therapy thereby creating a bias and skewing the results.

c. The study group received laser therapy at appointment 2, followed by another laser treatment at appointment 4 (less than 2 months after the first laser treatment) and once again at appointment 5 (2 months after the second laser treatment). A microscopic examination was performed 2 months after the third laser therapy session. The effectiveness of bacterial reduction after 2 months following 3 laser treatments completed within the previous 6 months does not, represent a significant finding of long term success.
Another article published by Yukna et al. reported histological treatment outcomes demonstrating that delivery of LANAP using a Nd:YAG laser reduced probing depths and increased clinical attachment gains in teeth affected by moderate to severe periodontal disease when compared to the outcomes of teeth treated with conventional SRP alone. The authors found that the teeth treated with adjunctive laser therapy showed new cementum growth and new connective tissue attachment. In contrast, the control group teeth (treated by conventional SRP alone) showed reattachment by long junctional epithelium only without evidence of regeneration of cementum or new connective tissue attachment. However, while the outcomes of this study may appear to support the clinical value of adjunctive laser therapy in managing periodontal disease, it is important to note that the study was of short duration (3 months), not double blinded, and the sample size was limited to the treatment of 6 subject teeth (treated with LANAP) and 6 control teeth (treated with SRP alone). In addition, the study was funded and supported by a laser manufacturer which may raise questions about potential bias.

The Committee researched the counterbalance of literature and found a more extensive compilation of studies where the results demonstrate no significant benefit associated with the use of lasers in the treatment of periodontal disease. An article by Cobb concludes in part:

...there is limited evidence suggesting that lasers used in an adjunctive capacity to scaling and root planing may provide some additional benefit. Establishment of a sound evidence base for laser usage in treatment of chronic periodontitis will require randomized, blinded, controlled, longitudinal, clinical trials.

A subsequent systematic review by Karlsson, Lofgren, and Jansson rises to a higher level of evidence and concludes:

No consistent evidence supports the efficacy of laser treatment as an adjunct to non-surgical periodontal treatment in adults with chronic periodontitis. More randomized controlled clinical trials are needed.

A randomized controlled trial published by Ambrosini et al. demonstrated no additional advantage of laser application delivered in conjunction with SRP over SRP alone. While the study may be considered dated since it was published in 2005 and was limited to a sample size of 30, the overall study design is considered strong because it removed most confounding influences by using the same patient as both control and study group. In this study, patients were treated with SRP alone on one side of the mouth and SRP with adjunctive laser treatment on the other side.

Subsequent studies comparing SRP alone and SRP with adjunctive laser treatment confirmed the results of the Ambrosini et al. study. Tomasi, Schander, and Dahlen found a statistically significant difference in probing depth reduction and clinical attachment level gain using the Er:YAG laser over ultrasonic scaling alone one month following treatment. However, after 4 months, there was no statistically significant difference in either pocket depth (PD) or CAL. The study also found no significant differences in microbiologic composition at baseline, 2 days post intervention, and 30 days post intervention. They did observe less treatment discomfort with the laser treatment over the ultrasonic scaler. The authors concluded that the result of the trial failed to demonstrate any apparent advantage using the Er:YAG laser for subgingival debridement.

Lopes et al. published a study that resulted in similar conclusions to those found in previous studies. This study included 21 subjects with pocket depths ranging from 5 to 9 mm and used a split-mouth design that randomly allocated sites to SRP and laser, laser only, SRP only and no treatment. While bleeding on probing and probing depths improved in each of the treatment groups over the no treatment group, the CAL gain was significant for the SRP only group without similar CAL gains observed in the other treatment groups.

The AAP also published a statement regarding the use of dental lasers for ENAP in 1999 and concluded, in part, the following:

The Academy is not aware of any published data that indicates that the ENAP laser procedure is any more effective than traditional scaling and planing.

There are no published data that demonstrate that either curettage or ENAP are effective in periodontal regeneration. To the contrary, there is peer reviewed evidence, both in vivo and in vitro, that use of lasers for ENAP procedures and/or gingival curettage may place patients at risk for damage to root surfaces and subjacent alveolar bone that, in turn, could render these tissues incompatible to normal cell attachment and healing.

The Positions Committee is not aware of any changes or updates to the statement from the AAP. Additionally, Dederich and Bushick from the ADA Council on Scientific Affairs and Division of Science published an article discussing the different types of lasers currently used in dentistry, safety, efficacy and effectiveness, and clinical applications. Their conclusions include the following:

...many lasers now sold in the United States have a 510(k) clearance for marketing through the U.S. Food and Drug Administration, or FDA, but how many dentists understand what this clearance signifies? This clearance enables
companies to expedite the process of entry to the marketplace for products the FDA considers similar to devices already on the market. Often, this 510(k) clearance is misconstrued as FDA approval, which requires multiple-site testing to demonstrate safety and efficacy. To obtain 510(k) clearance, manufacturers must demonstrate only results equivalent to those of an existing, approved technology. From the scientific perspective, however, such an abbreviated process has significant limitations.

A critical review of the best available evidence, however, strongly indicates that there is no added benefit to the patient when this procedure (laser curettage) is performed after traditional mechanical scaling and root planing.

Proponents of laser curettage point to the ability of these lasers to kill microorganisms. Although the data indicates that this effect is possible albeit inconsistent, it has not been correlated with an improvement in periodontal attachment level.

With no demonstrable benefit and with a significant risk of collateral damage to the periodontium, laser curettage appears to be neither scientifically nor ethically justified.

Subsequent to the article by Dederich and Bushick, the ADA Council on Scientific Affairs published a statement in April 2009 on lasers in dentistry. The statement further addressed the safety and efficacy of lasers and clinical applications including treatment of periodontal disease. The conclusions drawn in the ADA statement remain largely unchanged from those previously cited by Dederich and Bushick. Some of the highlights of the ADA’s statement include the following:

All dental lasers currently available on the U.S. market have been issued 510(k) clearances by the FDA. 510(k) submissions are reviewed and processed by the Center for Devices and Radiological Health (CDRH) in the FDA.

Given the many factors that are appropriate to evaluate when using lasers in biological systems, the Council feels that the 510(k) process alone is not inherently sufficient to scientifically demonstrate safety, efficacy, or effectiveness for marketed dental laser applications in all cases. Properly designed preclinical and clinical studies are often needed to demonstrate safety, efficacy and clinical effectiveness for specific products and uses.

The Council encourages dental practitioners to cautiously consider claims of safety and efficacy that are purely based on the product having been cleared for market by the FDA through the 510(k) process. It is appropriate and prudent for the practitioner to request detailed information from the manufacturer about the scientific evidence that forms the basis for the marketed use.

There is little convincing clinical evidence that adjunctive laser curettage produces a result superior to adjunctive mechanical or chemical curettage, or even scaling and root planing alone. Current evidence suggests that therapies intended to arrest and control periodontitis depend primarily on effective root debridement.

Additional clinical data from properly designed clinical trials with adequate sample sizes are still required before it can be known to what extent LANAP is safe and effective across the spectrum of patients with chronic periodontitis. The Council therefore cautions clinicians to weigh the available evidence for LANAP when considering the options available for treatment of the periodontal diseases.

Lasers, as a group, have inconsistently demonstrated the ability to reduce microorganisms within a periodontal pocket. It appears from the literature that mechanical root debridement remains a priority to attain improvements in clinical attachment levels. However, limited new data suggest that clinical outcomes may be enhanced by the adjunctive use (following root debridement) of a bactericidal irrigant activated by a cold laser.

Position Statement

After reviewing the current scientific literature related to the use of lasers in the treatment of chronic periodontal disease, the AADC Positions Committee has concluded that the best available evidence-based studies do not support the adjunctive value of lasers for improving clinical outcomes when used alone or in conjunction with conventional surgical and non-surgical periodontal therapy. The Positions Committee acknowledges that more extensive research should continue in order to best assess the role of adjunctive laser therapy in the treatment of periodontal disease and ascertain any contributions to improving long term treatment outcomes.

References

1. Statement Regarding Use of Dental Lasers for Excisional New Attachment Procedure (ENAP); American Academy Of Periodontology, 1999


11. American Dental Association (Council On Scientific Affairs); Statement On Lasers In Dentistry. 2009


**AADC Positions Committee**

Dr. Jonathan Zucker (Chair)

Dr. Clay Pesillo (Principal Author)

Dr. George Koumaras

Dr. Robert Laurenzano (Founder)

Dr. Stephanie Laurenzano

Dr. Dick Portune

Dr. Ed Schooley

Dr. Cary Sun

Dr. Fred Tye

Dr. Michael Weisenfeld

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