

Diode Lasers

for Periodontal Treatment: The Story Continues

by Fay Goldstep, DDS, FACD, FADFE

Lasers have been a part of the dental scene for more than 25 years. Unfortunately, they have tended to be big, clunky, hard-to-use, expensive machines that were largely ignored. Affordable, effective, user-friendly diode lasers have only recently arrived on the scene. In fact, the diode laser, in a very short time, has proven itself to be the ideal “soft-tissue hand piece.”

The diode laser functions as the essential hand piece for all soft tissue procedures just as the dental hand piece is essential for all hard tissue procedures. The advantages of the diode laser for soft tissue applications include: surgical precision, bloodless surgery, sterilization of the surgical site, minimal swelling and scarring, minimal suturing, and virtually no pain during and after surgery.

What about using the diode laser for the treatment of periodontal disease (Laser Assisted Periodontal Treatment)? An early version of the diode laser was used effectively in the treatment of periodontal pockets in 1998.¹ So why is there so much confusion and controversy regarding the use of lasers in the treatment of periodontal disease today? There is need for clarification and simplicity.

First, as the name *Laser Assisted Periodontal Therapy* (LAPT) implies, the laser is only part of the treatment equation. The laser should not be viewed as a stand-alone treatment for periodontal disease.

Second, the laser may not be of any help in very advanced cases of periodontal disease. These cases may require a surgical approach.

Third, when discussing the benefits of LAPT, we must specify the particular type of laser used. Several categories of lasers have shown positive results. For the sake of clarity and simplicity, the following discussion will deal exclusively with the diode laser, since its ease of use and affordability have made it the predominant laser in dentistry.

Diode Lasers for Periodontal Treatment

Two types of diode lasers have been studied for their effects in LAPT: the diode laser (which emits high levels of light energy), and the low level diode laser (which emits low intensity light energy).

There is very compelling evidence in the dental literature that the addition of diode laser treatment to Scaling and Root Planing (SRP) will produce significantly improved and longer lasting results.² SRP is the gold standard in non surgical periodontal treatment.

Low-level lasers for biostimulation have been used in medicine since the 1980s. The therapeutic effect is non-cutting and low intensity, and covers a much wider area than the traditional laser. Low Level Laser Therapy (LLLT) is treatment where the light energy emitted by the laser elicits beneficial cellular and biological responses. On a cellular level, metabolism is increased, stimulating the production of ATP (adenosine triphosphate), the fuel that powers the cell. This increase in energy is available to normalize cell function and promote tissue healing.^{3,4}

The functions of the diode and low-level diode laser have remained separate until recently. With the introduction of the



Figure 1: Picasso diode laser

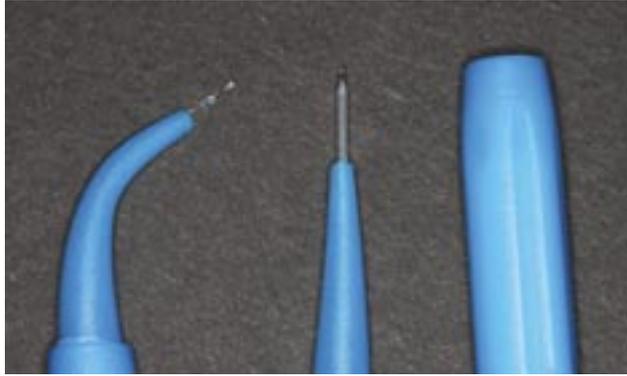


Figure 2: Picasso high energy tip (left & middle). Biostimulation tip (right)



Figure 3: Picasso biostimulation tip



Figure 4: EZLase biostimulation tip

biostimulation delivery tip, the diode laser is able to provide both cutting *and* therapeutic effects. When the low-level tip is used, the laser energy is delivered over a wider area, decreasing the energy level, and producing the low level therapeutic effect. Two laser companies have made these auxiliary tips available (Figs. 1-4).

Used together, these two laser treatment modalities provide benefits that help to heal the chronic inflammatory response in the periodontal pocket. This works well in treating mild to moderate periodontitis. Patients can be treated in a minimally invasive way, without surgery, in the general practice. There is time to try the surgical approach, if needed, at a later date.

The Periodontal Pocket

Periodontal disease is a chronic inflammatory disease caused by bacterial infection. The inflammation is the body's response to destroy, dilute or wall off the injurious agent.⁵ Unfortunately, if the situation remains chronic, this protective mechanism of the body to defend itself against injury, becomes destructive to the tissues.

The periodontal pocket, in periodontal disease, contains several substances that contribute to the continuation of the unhealthy condition (Fig. 5):

1. Calculus and plaque on the tooth surface
2. Pathogenic bacteria
3. An ulcerated, epithelial lining with granulation tissue and bacterial by-products

What do we need for healing of the pocket?

1. SRP: Elimination of calculus, plaque and other debris on the tooth to create a totally clean surface
2. Decontamination: Elimination of all pathogenic bacteria dispersed through the pocket
3. Curettage: Elimination of granulation tissue, bacterial products, and ulcerated areas to create a clean, even epithelial lining without tissue tags (epithelial remnants)
4. Biostimulation: To kick-start the healing process

The following is a sequence to show how this can be easily accomplished in a minimally invasive, non-surgical way:

1. Calculus is removed with SRP. This procedure has been well documented throughout the dental literature as the gold standard of care for non-surgical periodontal treatment.

The diode laser and the low level diode laser are ideal for the remaining steps:

2. Since a bacterial infection is the initiator of the chronic inflammatory response of periodontitis, the bactericidal and detoxifying effect of laser treatment is advantageous.⁶ The diode laser's bactericidal efficacy, particularly against specific periopathogens has been well-documented.^{7,8,9,10} Moreover, there is a significant suppression of *A. Actinomycetemcomitans*, an invasive bacterium that is not easily treated with conventional scaling and root planing. *A. A.*, as it is generally called, is not only present on the diseased root surface, but also invades the adjacent soft tissue, making it virtually impossible to remove with mechanical means alone.^{11,12,13}

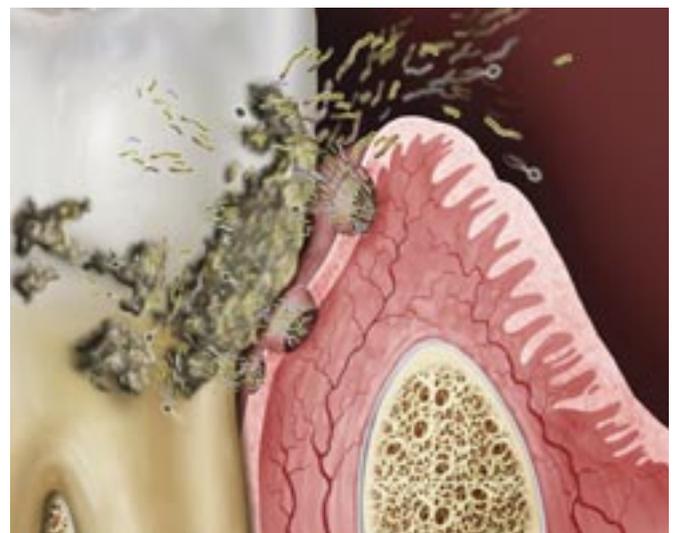


Figure 5: The periodontal pocket containing calculus, bacteria and granulation tissue

continued on page 56



Fig. 6



Fig. 7



Fig. 8



Fig. 9



Fig. 10

Figure 6: Scaling and Root Planing are performed first

Figure 7: The diode laser tip is placed into the pocket

Figure 8: Laser energy is applied into the pocket to decontaminate and coagulate the soft tissue

Figure 9: The biostimulation tip is applied at right angles to the external surface of the pocket

Figure 10: Pocket depth is measured pre treatment and three months post treatment

The diode laser energy is able to penetrate into the soft tissue to eliminate this pathogen.

3. The diode laser is a specific instrument well suited in dealing with diseased soft tissue. The diode laser energy is well absorbed by melanin, haemoglobin and other chromophores that are present in periodontal disease.¹⁴

The 2002 American Academy of Periodontology statement regarding gingival curettage¹⁵ proposes that “gingival curettage, by whatever method performed, should be considered as a procedure that has no additional benefit to SRP alone in the treatment of chronic periodontitis.” However, the diode *specifically* targets unhealthy gingival tissues performing an effective curettage that produces a clean, even epithelial lining without tissue tags.

Also stated is that all the methods devised for curettage (including lasers) “have the same goal, which is the complete removal of the epithelium” and “none of these alternative methods has a clinical or microbial advantage over the mechanical instrumentation with a curette.”

This was the science in 2002. We are now in 2010 and this AAP statement has not been updated. Studies have shown that instrumentation of the soft tissues in the diseased periodontal pocket with the diode laser leads to complete epithelial removal while conventional instrumentation with curettes leaves significant epithelial remnants.¹⁶ Thus, in fact, the diode laser *does* have a clinical advantage over the mechanical instrumentation with a curette.

4. This step requires the low-level laser tip. Studies have shown that low level laser light affects damaged but not healthy tissue. Laser biostimulation normalizes cell function and promotes healing and repair.¹⁷

Secondary effects include increased lymphatic flow, production of endorphins, increased microcirculation, increased collagen formation and stimulation of fibroblasts, osteoblasts and odontoblasts. This stimulates the immune response, pain relief and wound healing.⁴

Studies have shown that LLLT performed in conjunction with SRP on patients with both mild periodontitis¹⁸ and chronic advanced periodontitis¹⁹ can significantly improve treatment outcomes and the long-term stability of periodontal health parameters.

The above four steps create the ideal environment in the periodontal pocket for healing to take place.

Lasers are an adjunct to SRP, not a stand-alone procedure. On the other hand, SRP is not a stand-alone procedure. We need all the pieces of the puzzle to create health.

The Protocol So Far

Now that we know what we need, how do we achieve it?

The protocol must incorporate the four steps discussed above to create the ideal environment for periodontal healing to occur: a clean calculus-free hard tissue surface, no pathogenic bacteria, a smooth, clean soft tissue surface and biostimulation.

Biostimulation tips are at present only available for two diode lasers: the Picasso by AMD and the EZLase by Biolase.

Individual parameters vary depending on the clinician and the particular diode laser used. However, most protocols follow a simple formula:

1. The hard tissue side of the pocket is first debrided with ultrasonic scalers and hand instruments (Fig. 6).
2. This is followed by laser bacterial reduction and coagulation of the soft tissue side of the pocket¹⁴ (Figs. 7 & 8). The laser fiber is measured to a distance of one mm short

continued on page 58

of the depth of the pocket. The fiber is used in light contact with a sweeping motion that covers the entire epithelial lining, starting from the base of the pocket and moving upward.²⁰ The fiber tip is cleaned frequently with a damp gauze to prevent debris build up.

3. The low level laser tip is applied at right angles and with direct contact to the external surface of the pocket (*Fig. 9*) for biostimulation.
4. Re-probing of the treated sites should be performed no earlier than three months after treatment to allow for adequate healing (*Fig. 10*). The tissue remains fragile for this period of time.

The power settings and duration are determined by the particular laser used. The manufacturers should be consulted for the proper parameters to achieve the best results. With experience, the user will feel comfortable enough to adapt the protocol to his or her particular practice.

This protocol may be performed by the dentist and/or hygienist as determined by the regulating organization in the geographic location of the dental practice.

The Diode Laser and Periodontal Treatment: The Story is Clear

Many of our patients have periodontal disease, but they

want to be treated in a minimally invasive way. They are not rushing out to the periodontist to have “gum surgery.” We need to treat their disease before it spirals out of control, especially when considering the periodontal health/systemic health link.

There is significant proof that the addition of LAPT to scaling and root planing improves outcomes in mild to moderate periodontitis. The treatment is not invasive. It is not uncomfortable.

We now have the tools and protocol to treat our periodontal patients with an effective procedure that they are ready to accept. What are we waiting for? ■

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Author's Bio

Dr. Fay Goldstep sits on the Oral Health Editorial Board (Healing/Preventive Dentistry), has served on the teaching faculties of the Post-graduate Programs in Esthetic Dentistry at SUNY Buffalo, the Universities of Florida (Gainesville), Minnesota (Minneapolis), and has been a former speaker in the ADA Seminar Series. She has lectured nationally and internationally on Healing Dentistry, Innovations in Hygiene, Dentist Health Issues and Office Design, and has published several articles, on these topics. Dr. Goldstep is a consultant to a number of dental companies, and maintains a private practice in Markham, Canada and can be reached at goldstep@epdot.com.

