Diode lasers for periodontal treatment

The story continues

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_Introduction

Lasers have been a part of the dental scene for over 25 years. Unfortunately, they used to be perceived as large, unwieldy, difficult-to-use, expensive machines and thus they were largely ignored. Affordable, effective, user-friendly diode lasers seem to have arrived on the scene only recently. In fact, the diode laser has proven itself to be the ideal soft-tissue handpiece in a considerably short time.

The diode laser functions as the essential handpiece for all soft-tissue procedures just as the dental handpiece is essential for all hard-tissue procedures. The advantages of the diode laser for soft-tissue applications include surgical precision, bloodless surgery, sterilisation 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] Since there is still so much confusion and controversy regarding the use of lasers in the treatment of periodontal disease today, clarification and simplicity seem to be needed.

First, as the term "laser-assisted periodontal therapy" implies, the laser is only one part of the treatment equation. Therefore, the laser should not be viewed as a stand-alone treatment for periodontal disease. Second, the laser may not be of any help in advanced cases of periodontal disease because these cases may require a surgical approach. Third, when discussing the benefits of laser-assisted periodontal therapy, 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 its affordability have made it the predominant laser in dentistry.

Fig. 1_Picasso diode laser.
Fig. 2_Picasso high energy tip (left and middle). Biostimulation tip (right).


Fig. 1

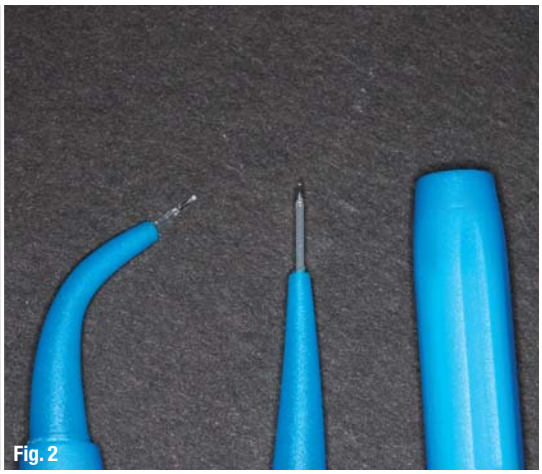
Fig. 2

_Diode lasers for periodontal treatment

Two types of diode lasers have been studied for their effects in laser-assisted periodontal therapy: (a) the diode laser, which emits high levels of light energy; and (b) 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 will produce significantly improved and longer-lasting results.[2] Scaling and root planing is the gold standard in non-surgical periodontal treatment.


Fig. 3

Low-level lasers have been used for biostimulation in medicine since the 1980s. The therapeutic effect is non-cutting and of low intensity, and covers a much wider area than the traditional laser. Low-level laser therapy is a treatment in which the light energy emitted by the laser elicits beneficial cellular and biological responses. At a cellular level, the metabolism is increased, stimulating the production of adenosine triphosphate, the fuel that powers the cell. This increase in energy is available to normalise 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 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 therapeutic effect of the low-level diode laser. 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 and in the general practice.

_The periodontal pocket

Periodontal disease is a chronic inflammatory disease caused by bacterial infection. The inflammation is the body's response, seeking to destroy, dilute or wall off the injurious agent.[5] If the situation remains chronic, this self-protective mechanism becomes destructive to the tissue. In periodontal disease, the periodontal pocket 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; and
3. an ulcerated, epithelial lining with granulation tissue and bacterial by-products.


Fig. 3_Picasso biostimulation tip.

Fig. 4_Ezlase biostimulation tip.

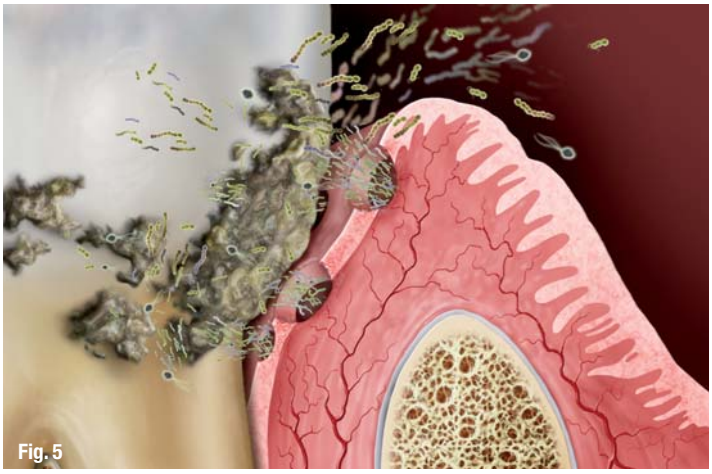

Fig. 5_The periodontal pocket containing calculus, bacteria and granulation tissue.

What do we need for healing of the pocket?

1. scaling and root planing to eliminate calculus, plaque and other debris on the tooth to create a completely clean surface;
2. decontamination to eliminate any pathogenic bacteria dispersed through the pocket;
3. curettage to eliminate granulation tissue, bacterial products, and ulcerated areas to create a clean, even epithelial lining without tissue tags (epithelial remnants); and
4. biostimulation to kick-start the healing process.

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

1. Calculus is removed with scaling and root planing. 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 perio-pathogens, has been well documented.[7–10] Moreover, there is a significant suppression of *Aggregatibacter actinomycetemcomitans*, an invasive bacterium that is not easily treated with conventional scaling and root planing. This bacterium is present on the diseased root surface and invades the adjacent soft tissue, making it virtually impossible to remove with mechanical means alone.[11–13] The diode laser energy is able to penetrate the soft tissue to eliminate this pathogen.
3. The diode laser is an instrument well suited to dealing with diseased soft tissue. Its energy is well absorbed by melanin, haemoglobin and other chromophores present in periodontal disease.[14] The 2002 American Academy of Periodontology statement regarding gingival curettage proposes that "gingival curettage, by whatever method performed, should be considered as a procedure that has no additional benefit to scaling and root planing alone in the treatment of chronic periodontitis".[15] However, the diode specifically targets unhealthy gingival tissue, performing an effective curettage that produces a clean, even epithelial lining without tissue tags. It is also stated 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".[15] This was the state of the art in 2002. To date, this statement has not been updated. Studies have demonstrated that instrumentation of the soft tissue 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 mechanical instrumentation with a curette.
4. This step requires the low-level laser tip. Studies have demonstrated that low-level laser light affects damaged and not healthy tissue. Laser biostimulation normalises 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 immune response, pain relief and wound healing.[4]

Fig. 6_Scaling and root planing is performed first.
Fig. 7_The diode laser tip is placed into the pocket.
Fig. 8_Laser energy is applied to the pocket to decontaminate and coagulate the soft tissue.


Fig. 9


Fig. 10

Fig. 9_The biostimulation tip is applied at right angles to the external surface of the pocket.
Fig. 10_Pocket depth is measured pretreatment and three months post-treatment.

Studies have demonstrated that low-level laser therapy performed in conjunction with scaling and root planing on patients with both mild periodontitis[18] and chronic advanced periodontitis[19] can significantly improve treatment outcomes and the long-term stability of periodontal health parameters. The above four steps create an ideal environment in the periodontal pocket for healing. Lasers are an adjunct to scaling and root planing, not a stand-alone procedure. Scaling and root planing too is not a stand-alone procedure. We need all the pieces of the puzzle to create health.

_The protocol so far

The protocol must incorporate the four steps discussed above to establish the ideal environment for periodontal healing: a clean, calculus-free hard-tissue surface; no pathogenic bacteria; a smooth, clean soft-tissue surface; and biostimulation. Biostimulation tips, which help prepare the final step, are at present only available for two diode lasers, the Picasso (AMD LASERS) and EZLASE (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 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 pocket (Figs. 7 & 8).[14] The laser fibre is measured to a distance of 1 mm short of the depth of the pocket. The fibre 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 fibre tip is cleaned frequently with 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 for biostimulation (Fig. 9).
4. Reprobing of the treated sites should be performed no earlier than three months after treatment to allow for adequate healing (Fig. 10), as the tissue remains fragile for this period.

The power settings and duration are determined by the particular laser used. The manufacturers should be consulted in order to apply 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 regulatory organisation in the geographic location of the dental practice.

_Conclusion: The implication 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 surgery. We need to treat their disease before it spirals out of control, especially when considering the periodontal health or the systemic health link. There is significant proof that the addition of laser-assisted periodontal therapy to scaling and root planing improves outcomes in cases of mild to moderate periodontitis, thus contributing to general health. The treatment is comfortable and not invasive. 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?_

_contact laser

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