The use of lasers in periodontal treatment

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Fig. 1

_There are some dentists that embrace technology. Technology can improve the delivery of dentistry and also help traditional dental philosophies evolve. For example, a patient presents with an emergency; a broken cusp on an upper bicuspid, bellow the free gingival margin. Technology, lasers and CAD/CAM specifically, allows the clinician to provide endodontics, osseous crown lengthening, an adhesive core build up and a definitive porcelain restoration all in a single appointment.

The advantages to this type of treatment are obvious. However, the dentist must be willing to alter his/her current dental philosophy and many times make an initial financial investment that is larger than what the clinician is used to. The traditional way to provide treatment such as endodontics in 1–2 visits, a post and core, an elastomeric impression, provisional restoration, referral to a specialist, surgical healing time and then definitive cementation of the restoration currently is a valid and overwhelmingly used treatment sequence. Sometimes, however, newer technology can perform these tasks just as well if not better then traditional methods all the while improving the dental experience for the patient. Lasers have been used in dentistry for the removal of soft tissue for more than two decades. Carbon dioxide, Nd:YAG, and Diode lasers have been very predictable and successful for the removal of oral soft tissue. In the last decade, the erbium lasers have been used for soft tissue and for restorative, endodontic, and surgical procedures. Erbium lasers are efficient in removing enamel, dentin and bone. However, the last five years have seen a tremendous push by the laser manufacturers for the lowest cost and most portable diode lasers. Due to their more approachable price point, and an increasing number of U.S. jurisdictions allowing hygienists to use these tools, the diode lasers have had sort of a renaissance.


Fig. 2a

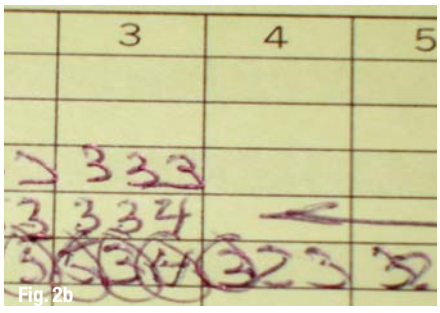


Fig. 2b

One of the most impacted areas of laser use in a general practice has been in the area of periodontal treatment. The treatment of periodontal disease is often a difficult arena for the general dentist to enter. As a chronic disease that so often relies on the host response for success, true treatment success is often never seen. Often times the general dentist chooses not to treat periodontal disease, referring patients to a specialist. As will be shown in subsequent paragraphs, this modality many times results in the patients never getting treated at all. Lasers have allowed me to treat many different periodontal cases. It has introduced patients to periodontal treatment in a minimally invasive way ensuring that almost all patients diagnosed with periodontal disease get treatment. Lasers have allowed me to increase the services that I provide in my practice by adding periodontal procedures that would have not been done before the integration of laser technology. Finally, introducing more and more patients to periodontal treatment has increased my referrals to periodontal specialists.

_The controversy: Science vs. Clinical results

I have always been an advocate of evidenced based dentistry. I rely on the results of science more than ever before. From endodontics to adhesive dentistry scientific evidence is important in formulating my treatment decisions and protocols. Periodontal disease has and continues to be researched heavily. Each year the systemic impact of periodontal disease is being uncovered and understood each day. The periodontal community aims to base its treatment decisions on the science. However, there is no absolute cure for periodontal disease. It is a complicated often chronic multi-factorial disease process. Bacteria are just one factor. However, one must also look at patient compliance, environmental factors including the patient's restorative history, and systemic issues. Thus, it is essential that clinicians in evaluating and treatment planning a patient for periodontal disease look at a wide spectrum of factors, many of which might conflict with the scientific literature. Lasers have been controversial because of the claims of the manufacturers that are not solidly backed up by science. There is no question that the lack of multi-center, double blind, and randomized trials inhibits the ability of lasers to gain widespread acceptance in the periodontal community. However, many times each and every day practitioners, general and specialists alike, practice dentistry based on anecdotal evidence. Relying on their own successes and failures to treat their patients. If we as clinicians only practice what and how science tells us to practice then we are many times doing a disservice to the patient. Dentistry is both a science and an art and the individual judgment of the clinician is often as important as a published research article. Thus, we can use lasers and the science that it available. As just one battalion in a large army against the fight against periodontal disease. Lasers provide advantages that traditional therapies do not. When used properly, laser therapy is a big weapon in this fight.

_What do lasers have to offer?

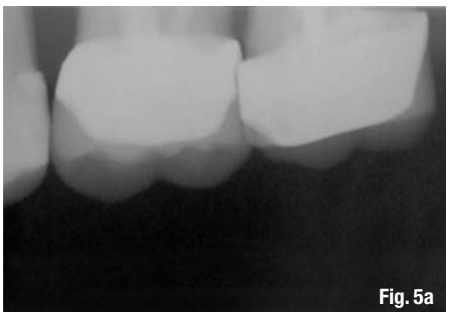
Lasers (Light Amplification by Stimulated Emission of Radiation) use light energy to have a clinical effect of oral tissue. This light energy can be converted to heat and that heat is used to remove tissue and destroy bacteria. However heat can have negative effects on tissue. Hard tissue burning or melting and possible soft tissue necrosis must be avoided or at least minimized. Other lasers use the potential energy of light and convert it to kinetic energy with another substance (e.g. water) to remove or ablate tissue. This allows the effective and efficient removal of infected epithelium and granulation tissue without the necrotic effects of heat. This provides less post-operative issues such as swelling and pain. Lasers are also effective in removing hard tissue including bone and calculus. In fact the U.S. Food and Drug Administration has approved a laser for calculus removal. Furthermore, because of the ability to collimate and bend light, lasers can access areas such as furcation and root anatomy that even surgical access with curettes and ultrasonics could not. Thus many procedures that were once absolute surgical cases can be treated non-surgically. The treatment of periodontal disease requires the proliferation of some cells while excluding other cells. To get re-attachment and regeneration, epithelial cells need to stay away from the healing site while fibroblasts and odontoblasts should be encouraged to enter. Lasers have the ability to assist in both areas.


Fig. 3

For exclusion, lasers can de-epithelialize the area, by removing the epithelium to the connective tissue, both on the internal pocket wall and the external pocket wall. The fast growing epithelium is retarded to allow the slower moving fibroblasts and os-


Fig. 4a


Fig. 4b


Fig. 5a

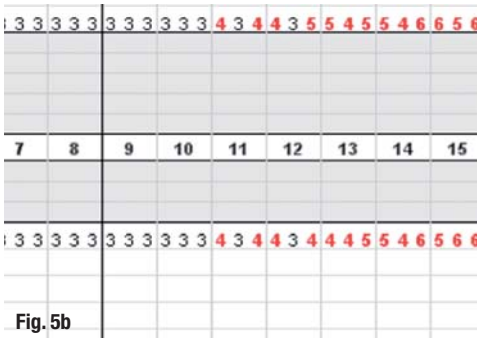


Fig. 5b

teoblasts to do their work. For proliferation and migration, lasers when introduced to the oral tissue at power levels too low to cut, have actually been shown to increase the proliferation and migration of the osteoblasts and fibroblasts. This is called photobiomoduation or low-level laser therapy (LLLT). The use of LLLT is ever expanding in medicine and dentistry. In dentistry, LLLT is used for pain relief, such as TMD and wound healing and to control inflammation, which is essential for the successful treatment of periodontal disease. Finally, the LLLT allows patients to heal from laser procedures faster and with fewer incidents by supporting the wound healing response and suppressing the inflammatory response.

_Laser assisted periodontal therapy: Clinical situations

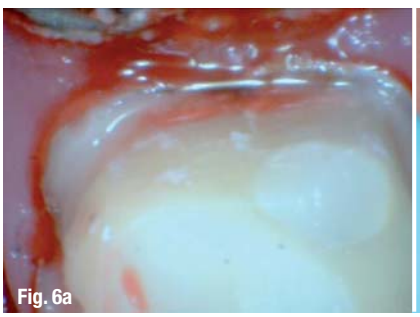
Treat General/Refer Specific

One of the biggest challenges in a general practice is getting patients to actually go to a periodontist once referred. Patients are consistently referred but many times but never follow through. If their condition goes untreated it affects their health, their mouth and does not allow me to go forward with other treatment such as prosthetics. Patients are more likely to follow through with treatment when it can be all accomplished within the general office. Often periodontal disease is not acutely painful and thus patients will prolong the treatment until there is an acute problem. A less expressed but as significant of a reason for patient's not to the specialist is fear. Periodontal surgery does not have a great reputation. Irrespective of the ability of the clinician. Patients hear stories of pain, swelling, bleeding and sensitivity. The last thing clinician's want are patients not going having treatment because of fear. However, when sent to specialists for specific procedures on a finite number of periodontal sites, the patient is more likely to seek treatment. Specifically, we have seen that a patient that is referred for the treatment of tooth #14 (maxillary left first molar) does not hesitate to go for treatment compared to a patient that is sent to that very same referral for the upper left quadrant.

Therefore, our philosophy is to treat as much of the disease process in the general practice non-surgically, then upon re-evaluation send only the non-responsive areas to the periodontal specialist for surgical intervention. Introducing a laser into the non-surgical equation provides the patient with a minimally invasive non-surgical option. The laser provides something different, something new that most patients are not familiar with. Scaling therefore is not the primary therapy but an adjunct to laser therapy. Thus, the patient realizes that surgery will only be done after all non-surgical options are exhausted and that those treatments will not be painful and there is no reason to fear "gum" treatment. When surgical intervention is recommended, the patient understands the efforts made and that surgery must be accomplished in a localized area, minimizing the potential uncomfortable post-operative consequences. With this philosophy, we have seen a threefold increase in the number of patients referred to the periodontist that actually have the treatment completed within a reasonable time of referral. This is compared to referrals before lasers were introduced into the practice.

Site Specific Treatment –he recall patient

When a minimally invasive procedure is available to patients, it takes much less effort to educate a patient and get the patient to accept treatment. When a laser is placed inside the hygiene treatment room, a recall patient with an isolated periodontal pocket can be treated at the time of recall. In many jurisdictions in the United States, hygienists can use lasers for periodontal treatment. This allows the dentist to diagnose the condition on examination, instruct the hygienist what to do and leave the room and return to treating his own patients. Thus, a patient can not only have their cleaning and checkup but also take care of a dental issue without having to return until the next recall. Even in those States that do not allow a hygienist to use a laser (such as the author's) the laser in the hygiene room still allows for this but the dentist does the treatment with the laser. Moreover, site-specific treatment adds a new dimension to the treatment spectrum. Instead of just a scaling and root planing procedure, the dentist can perform, and thus bill a profitable and more definitive treatment with a laser. Figs. 1 & 2 illustrate a patient on a recall visit that exhibited a 5 mm pocket on the mesial of maxillary left first molar. Laser assisted site specific treatment was performed in the hygiene room with a Er, Cr:YSGG laser (Waterlase MD, Biolase Technology, Irvine, CA) and a 940 diode laser (EZlase, Biolase Technology). The perio charting shows initial and 3 and 6 mos recall probing depths.


Fig. 6a

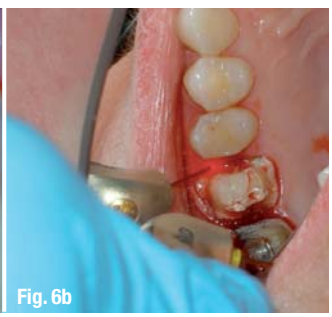
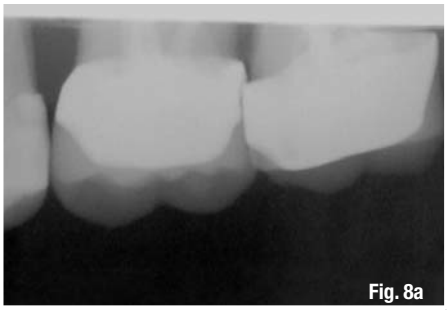
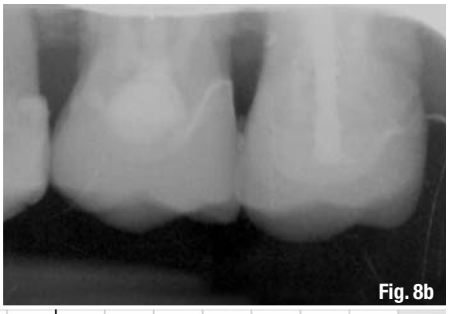

Fig. 6b


Fig. 7


Fig. 8a


Fig. 8b

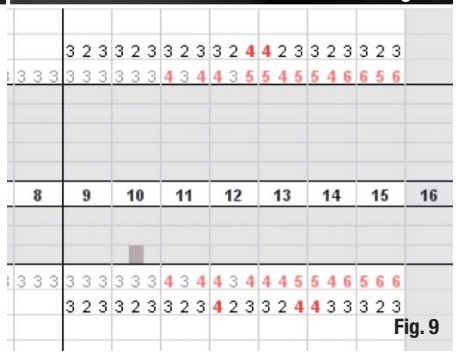


Fig. 9

Management of the hopeless periodontal patient

Many times a patient presents to the office with the following history: Patient has a history of periodontal disease with significant bone loss and periodontal pocketing. The patient had four quadrants of periodontal surgery to treat this condition many years ago. Upon examination, the periodontal pocketing is still present or has returned and the clinician recommends periodontal surgery again. However, the patient tells you that he/she will "never go through that again." The patient had a bad experience with surgical intervention will not entertain the idea of referral to a periodontist. Thus, the past never has the treatment recommended. Furthermore, there are patients where through everyone's best efforts the treatment is never successful. These patients are referred to as "refractory" cases. These patients are particularly difficult since they have spent much money and time and do not see results. Many times they need significant extractions and implants, but at the present time refuse this treatment due to financial or emotional obstacles. Every dental practice has these patients. Laser therapy provides an opportunity to manage, stabilize or treat these patients at reasonable cost and minimal intervention compared to surgical therapy or extractions. Refractory cases will not be "cured" with laser therapy but if we can stabilize the disease process then we provide an invaluable service to the patient. Laser treatment might occur every recall visit or with increased frequency depending on the extent of the disease process. Often we can maintain a patient with his or her own teeth longer than originally thought. This is an area of laser dentistry that was unexpected but has become one of the most rewarding. The figures bellow illustrates a typical hopeless case. Patient is 48 with a long history of periodontal treatment including numerous SC/RP visits and surgery. Patient's hopeless maxillary anterior was restored with implants. The lower arch was treated with laser therapy and scaling. Though there is no evidence of regeneration, the change in the marginal bone is evident three years later. This patient is now five years post treatment with stable periodontal tissues (Figs. 3 & 4). Patient is compliant with 3 mos recall.

Prosthetic replacement: Marriage of technologies

Patients with crown and bridge often present with periodontal pocketing and inflammation. Often, the prosthetics either invades biologic width or the crowns are under-contoured bellow the gingival margin. Treatment of this situation would include replacement of the crowns and treatment of the soft tissue. If there is biologic width invasion then a crown lengthening procedure is needed to adjust the height of the alveolar bone. This condition is often caused by the fundamental need of mechanical retention of the crowns. Due to caries, fracture and short clinical crown heights, the crown preparation needs to be placed significantly under the free gingival margin in order for the crown to stay on. Technological advances in ceramics and adhesion allow for posterior restorations to be adhesively bonded to the tooth allowing for equi- and supra-gingival restorations. These restorations coupled with laser therapy can resolve a periodontal pocket within weeks without surgery and more trauma to the root surfaces. If biological with correction is needed, then the use of a laser to incise the attachment and remove the bone can often be accomplished without flap reflection. This minimizes post-operative pain, swelling and leads to more patient acceptance and profitable treatment for the dental practice. Figs. 4–9 illustrate pocketing and inflammation associated with crowns on the maxillary left first and second molars. The crowns were removed and laser assisted periodontal debridement and curettage was performed. Fig. 7 shows 14 day healing prior to cementation. Fig. 8 are the adhesively bonded ceramic crowns (eMAX, Ivoclar Vivadent, Amherst, NY). Fig. 9 shows the initial and 3 mos recall periodontal charting.

This article is designed to introduce the dental community to lasers and their use in periodontal treatment in a general dental practice. The use of lasers does not eliminate the need for surgery, and especially the wonderful work of periodontal specialists. However, when a philosophy of minimally invasive treatment is employed, then patient and dentist work together to help the patient accomplish their periodontal treatment goals. There will be an increase in periodontal treatment plan acceptance and an increase in periodontal referrals that actually result in treatment._

Editorial note: The literature list can be requested from the editorial office.

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