

by Allen S. Honigman, DDS, MS

LASER-ASSISTED PERI-IMPLANTITIS PROCEDURE: Redefining the Treatment of Peri-implantitis

Unforeseen complications in dentistry can create uncomfortable and possibly irreversible conditions for patients who require difficult treatment planning for clinicians. Up to 80 percent of dental implant patients experience complications due to inflammation,¹ making the longevity of dental implants dependent on maintaining the healthy tissues around them.² When implants fail, a number of reasons could be to blame, including peri-implantitis.

Peri-implantitis is the progressive inflammation of peri-implant mucositis, an inflammatory disease involving bacterial contamination of the peri-implant surface.³ It presents around dental implants with clinically significant progressive crestal bone loss (CBL). Peri-mucositis may present clinically with increased probing depths and bleeding upon probing (BOP), although there is no correlation to marginal bone loss. If the presence of suppuration along with progressing CBL occurs, treatment is required. Patients might experience discomfort while in the acute phase, but suppuration on palpation may be present. The presence of gram-negative pathogens and the persistent presence of bacterial biofilm determine the progressive nature of peri-implantitis.

Several iatrogenic factors can cause peri-implant diseases and subsequent implant failure.⁴ Improperly seated or contoured restorations can also lead to peri-implantitis. Other iatrogenic factors include excess biomechanical stresses, overheating of the bone, implant fracture, surgical inexperience and poor undocumented implant systems. Besides the iatrogenic factors, other predisposing risks for peri-implantitis include smoking, genetic factors, periodontal disease history, poor oral hygiene and alcohol use.⁵

Various treatment protocols for peri-implantitis are described in the literature.⁶ However, there is no compelling evidence to suggest a superior surgical procedure for more advanced cases,⁷ and more evidence is needed to fully evaluate alternative light-activated disinfection (LAD).⁸ A frequent non-surgical treatment option for peri-implantitis is the use of antibiotics and antiseptics, but again, more clinical trials are necessary to fully understand the effects of antibiotics on peri-implantitis.⁹ Basic and complex interventions also have been reviewed, but no reliable evidence was found to suggest the most effective interventions for treatment.¹⁰

1. Zeza B, Pilloni A. Peri-implant mucositis treatments in humans: a systematic review. *Ann Stomatol (Roma)*. 2012;3(3-4):83-9.
2. Esposito M, Grusovin MG, Worthington HV. Interventions for replacing missing teeth: treatment of peri-implantitis. *Cochrane Database Syst Rev*. 2012 Jan 18;1:CD004970.
3. Dortbudak O, Haas R, Bernhart T, Mailath-Pokorny G. Lethal photosensitization for decontamination of implant surfaces in the treatment of peri-implantitis. *Clin Oral Implants Res*. 2001;12(20):104-8.
4. Shapoff CA, Lahey BJ. Crestal bone loss and the consequences of retained excess cement around dental implants. *Compend Contin Educ Dent*. 2012;33(2):94-6, 98-101; quiz 102, 112.
5. Heitz-Mayfield LJ. Peri-implant diseases: diagnosis and risk indicators. *J Clin Periodontol*. 2008;35(8 Suppl):292-304.
6. Nguyen-Hieu T, Borghetti A, Aboudharam G. Peri-implantitis: from diagnosis to therapeutics. *J Invest Clin Dent*. 2012;3(2):79-94.
7. Romanos GE, Weitz D. Therapy of peri-implant diseases. Where is the evidence? *J Evid Based Dent Pract*. 2012;12(3 Suppl):204-8.
8. De Angelis N, Felice P, Grusovin MG, Camurati A, Esposito M. The effectiveness of adjunctive light-activated disinfection (LAD) in the treatment of peri-implantitis: 4-month results from a multicenter pragmatic randomized controlled trial. *Eur J Oral Implantol*. 2012;5(4):321-31.
9. Van Winkelhoff AJ. Antibiotics in the treatment of peri-implantitis. *Eur J Oral Implantol*. 2012;5 Suppl:S43-50.
10. Esposito M, Grusovin MG, Worthington HV. Treatment of peri-implantitis: what interventions are effective? A Cochrane systematic review. *Eur J Oral Implantol*. 2012;5 Suppl:S21-41.

Laser-Assisted Peri-Implantitis Procedure (LAPIP)

Several recent studies have found laser therapy a promising treatment of periodontal disease and now peri-implantitis. Specifically, pulsed neodymium:yttrium aluminum garnet laser irradiation (Nd:YAG) has been investigated and its efficacy determined for achieving bacterial ablation without damaging the surface properties of titanium implants.¹¹ Another study found that the use of an Nd:YAG laser was able to totally reduce contamination on irradiated implants.¹² Combined, this research suggests that the use of Nd:YAG lasers could be beneficial in treating patients with peri-implantitis.

Contributing to the positive effects that the Nd:YAG laser has on treating peri-implantitis are its ability to penetrate the soft tissue to achieve an effective kill of bacteria, and its ability to promote effective hemostasis.¹³ Whereas some lasers and their wavelengths (e.g., mid-infrared) only achieve surface effects on tissues, the Nd:YAG laser penetrates several mms into soft tissue¹⁴ and dentin.¹⁵ This is a significantly favorable and distinguishing characteristic of the Nd:YAG laser, since the great depth of penetration of the free running, pulsed laser energy allows for a greater kill rate of black pigmented bacteria and the ability of the laser energy to affect deeper blood vessels, creating excellent hemostasis.

The CO₂ and erbium lasers are not as well suited for the laser procedure. Both laser types have wavelengths that are highly absorbed by water and consequently very shallow penetration depths in tissues. Thus, they cannot access pathogens or affect hemostasis below the surface.

With the Nd:YAG laser, the amount of collateral thermal damage is directly proportional to the duration of irradiation. For a short pulse duration of 100 μ sec, the zone of thermal damage is slight (e.g., a few 10s of microns[μ]), compared to a "long" pulse of

650 μ sec, which creates a narrow zone of coagulation around the irradiation site affecting hemostasis. Significant thermal damage can result with even longer irradiation times, such as from the continuous irradiation mode of the diode laser.¹⁴ Therefore, the combined characteristics of the variable pulsed emission mode of the PerioLase Nd:YAG laser and its near-IR wavelength of 1064nm, affecting deep tissue penetration, make it specifically suited for a laser assisted peri-implantitis procedure (LAPIP).

The Nd:YAG laser (PerioLase MVP-7) is at the heart of the Laser-Assisted Peri-Implantitis Procedure (LAPIP) that is based on the successful LANAP (Laser-Assisted New Attachment Protocol) therapy. The LANAP therapy is an FDA-approved protocol that provides cementum-mediated new periodontal ligament attachment to root surfaces in the absence of long junctional epithelium. It treats the periodontal pocket walls to remove diseased epithelium, then seals them with a laser-generated blood clot. The therapy results in greater probing depth reduction and clinical probing attachment level gains, as well as induces periodontal regeneration.^{15,16}

The LAPIP technique is basically an implant-specific modification to the LANAP procedure. Both utilize an ablation step to remove inflamed sulcular tissue and decontaminate the root/implant surface, followed by a scaling step using an EMS piezo scaler. A laser-induced hemostasis step further decontaminates the tissue and causes the blood to clot, creating a closed system. This seals the area, preventing the downgrowth of the gingival epithelium and allowing the area to heal from the base of the defect coronally.

Case #1

An 84-year-old male patient presented on October 29, 2012, with inflammation and minimal attached tissue on the buccal aspect of implants at the #17 and #18 sites that had been placed



Fig. 1: Implants at 04/04/11, showing no bone loss noted around implants



Fig. 2: Implants at 10/29/12 showing bone loss to the sixth thread mesially and distally at #17, and to the third thread mesially and distally at #18



Fig. 3: At 19 weeks post-LAPIP therapy, radiographs confirmed maintenance of bone regeneration

11. Giannini R, Vassalli M, Chellini F, Polidori L, Dei R, Giannelli M. Neodymium:yttrium aluminum garnet laser irradiation with low pulse energy: a potential tool for the treatment of peri-implant disease. *Clin Oral Implants Res.* 2006 Dec;17(6):638-43.
12. Gonçalves F, Zanetti AL, Zanetti RV, Martelli FS, Avila-Campos MJ, Tomazinho LF, Granjeiro JM. Effectiveness of 980-nm diode and 1064-nm extra-long-pulse neodymium-doped yttrium aluminum garnet lasers in implant disinfection. *Photomed Laser Surg.* 2010 Apr;28(2):273-80.
13. Gillis TM, Strong MS. Surgical lasers and soft tissue interactions. *Otolaryngol Clin North Am.* 1983 Nov; 16(4):775-84.
14. Cobb CM. Lasers in periodontics: A review of the literature. *J Periodontol.* 2006 April; 77:545-564.
15. Nevins ML, Camelo M, Schupbach P, Kim S-W, Kim DM, Nevins M. Human clinical and histologic evaluation of laser-assisted new attachment procedure. *Int J Periodontics Restorative Dent.* 2012;32:497-507.
16. Harrel SK, Nunn ME. The association of occlusal contacts with the presence of increased periodontal probing depth. *J Clin Periodontol.* 2009;36(12):1035-42.

continued on page 84



Fig. 4: At 19 weeks post-LAPIP therapy, minimal, if any, tissue loss and no inflammation was observed



Fig. 5: At 33 weeks post-LAPIP therapy, radiographs confirmed maintenance of bone regeneration

more than five years earlier. The patient wore an implant-supported maxillary denture. The patient underwent regular hygiene maintenance approximately every three months, and no other treatment had been performed.

At #17, bone loss to the sixth thread was noted mesially and distally; at #18, bone loss to the third thread was noted mesially and distally. The patient had experienced little pain for a couple of months.

The patient's medical history included seasonal allergies, respiratory and sinus problems, glaucoma, bruxism and HBP. The patient was pre-diabetic (non-medicated) and used a CPAP. He had also undergone corneal transplants in both eyes. Medications included Zyrtec, Simvastatin, Lisinopril, aspirin, depot-testosterone, and vitamin B-12, with no known drug allergies.

Decreasing inflammation was the most important priority and, given the position of the implants, traditional surgical methods would have been difficult, especially with visualization. Therefore, the treatment plan recommended was LAPIP around implants #17 and #18 to reduce inflammation and regenerate bone support.

LAPIP was performed on November 5, 2012, utilizing the PerioLase MVP-7 Nd:YAG laser at 75J increments, with cooling

in between to prevent overheating of the implant. Removing the superstructure was deemed too difficult, might have caused unnecessary damage and possibly required remaking the entire fixed prosthesis. Therefore, the LAPIP therapy proceeded with laser ablation intersulcularly on #17 and #18, then scaling with the PS tip of an EMS piezo scaler utilizing a chlorhexidine irrigant to further decontaminate the implant surface. Hemostasis was achieved with the Nd:YAG laser (PerioLase MVP-7), followed by occlusal adjustment of the implants. The energy density for #17 was 15.1J/mm and for #18 was 11.8J/mm.

The patient was placed on amoxicillin (500) four stat, then one tab every eight hours until finished; Motrin (800) one tab every eight hours for three days, then PRN pain; and chlorhexidine rinse: twice a day for 30 seconds. The patient was evaluated post-operatively at one, three, six, 12, 19 and 33 weeks, with occlusion checked each time at each appointment. At 33 weeks, minimal, if any, tissue loss and no inflammation was observed. Radiographs confirmed bone regeneration/recalcification on both implants. Additionally, the patient reported no pain.

Case #2

A 37-year-old female patient presented on June 15, 2012, with an implant at the #3 site that had been placed three years ago. It had become infected two weeks earlier. The patient had seen another periodontist who recommended a surgical treatment approach with grafting.

Fig. 6: Pre-treatment radiograph of a female patient showing bone loss at the #3 implant site
Fig. 7: Pre-treatment buccal view showing extent of inflammation and suppuration from peri-implantitis

Fig. 8: View immediately following LAPIP therapy

Fig. 9: #3P showing extent of bleeding and pocket depth pre-LAPIP



continued on page 86



Upon examination, suppuration was noted on palpation on the buccal aspect. Additionally, the tissue was very inflamed and the crown margin was subgingival. The implant was non-mobile. Vertical bone loss was noted on the distal of #3 but was deeper on the mesial. The MP on #3 was >13 mm. Probing depths on the buccal were, from mesial to distal: 6mm, 10mm, 7mm; and from the palatal: 13mm, 6mm, 5mm.

At the time of presentation, the patient indicated a history of seasonal allergies and breast feeding. Medications included multi-vitamins and ibuprofen, and there were no known drug allergies.

The LAPIP procedure was recommended due to the amount of inflammation and suppuration surrounding the implant. Treatment, as described in Case 1, was performed on June 18, 2012. The energy density was 14.5J/mm. Additionally, the patient was placed on amoxicillin (500) four stat, then one tab every eight hours until finished; Motrin (800) one tab every eight hours for three days, then PRN pain; and chlorhexidine rinse: twice a day for 30 seconds.

The patient was checked at one week, three weeks, three months, 7.5 months, and 10 months post-operative, with occlusion checked at each appointment. Bone regeneration was noted on both the mesial and distal aspects. Probing depths taken at three months showed a significant decrease in pocket depths, with no suppuration or tissue loss.

Fig. 10: One-week post-operative view demonstrating significant tissue healing

Fig. 11: Radiograph taken at 7.5 months post-operative showing improvement in bone levels

Fig. 12: At 10 months post-LAPIP treatment, probing depths showed a significant decrease in pocket depths

Fig. 13: At 10 months post-LAPIP therapy, probing depths decreased to maintainable levels

Fig. 14: Buccal view of the patient's tissue at the #3 site 10 months post-LAPIP therapy

Fig. 15: Palatal view at 10 months post-LAPIP showing tissue health, non-inflammation and no loss of tissue

Fig. 16: Radiograph taken at 10 months post-operative demonstrating bone regeneration

The LAPIP procedure was chosen as a first-line treatment in these cases based on the proven success of the LANAP protocol, which has been shown to decrease inflammation, the main priority when treating peri-implantitis. Because the therapy is a tissue-sparing procedure, it is less invasive and can regenerate bone, all with minimal tissue loss and trauma to the patient. The results in these cases demonstrated show a complete decrease in inflammation and regeneration of the bone, which should continue until an intact lamina dura is developed. If, however, the results were not what were anticipated, retreatment can be accomplished with either LAPIP again, the use of traditional surgical peri-implantitis treatments, or in severe bone loss cases, implant removal. As a first-line treatment, LAPIP gives practitioners more options in the long run than other surgical interventions. ■

Author's Bio

Dr. Allen S. Honigman received his dental training at UTHSCSA in 1991. He previously graduated with a Bachelor of Science Degree in Biochemistry from the University of Ottawa, an Honors Diploma in Genetics from the University of Western Ontario, as well as a Masters Degree in Microbiology and Immunology from Idaho State University. Dr. Honigman completed his periodontics residency through UCLA and served as the Pre-doctoral Perio Director at CWRU from 1999-2001. He is an active member of AAP and was the first periodontist in Phoenix to perform LANAP in 2006. He has been a certified LANAP instructor since 2009.