JLAD

JOURNAL OF LASER-ASSISTED DENTISTRY

Focal Point

A periodontal protocol for the Er,Cr:YSGG laser transforms efficiency and clinical results.

Page 15

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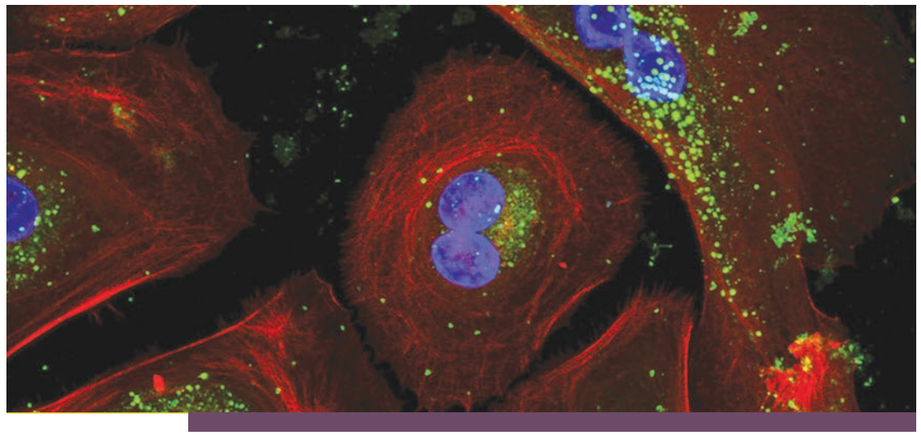


SUCCESSFUL MITOSIS

ABOVE: Three-dimensional confocal scanning fluorescence microscopy, originally conducted by Prof. Özlem Yilmaz, shows high numbers of intracellular P. gingivalis (green) undergoing successful mitosis after laser treatment.

Source: Microbiology. 2008 Oct;154(Pt 10): 2897-903. doi: 10.1099/mic.0.2008/021220-0.

FOCAL POINT

New Laser Protocol For Periodontology

For years, researchers, periodontists and general dentists have utilized Er,Cr:YSGG lasers as an adjunct to traditional periodontal treatment techniques. Now, with a definitive periodontal protocol in place, Er,Cr:YSGG laser owners have a guide for treating moderate to severe periodontitis with ideal clinical results.

SEE THE FULL STORY ON **PAGE 15**

RESEARCH

WCLI

RESONATING ON A GLOBAL SCALE

It was 14 years ago that a group of dental professionals, galvanized by the possibilities of dental lasers, came together to form the World Clinical Laser Institute (WCLI). Back in Y2K, dental laser technology was just emerging. Dental lasers showed exceptional promise, but protocols and clinical efficacy were not well defined – or accepted – by many in dentistry.

But the founders of the Institute were steadfast in their vision to advance dental care through the use of laser technology. And their message has resonated on a global scale. It is in no small part to their contributions that laser dentistry today is no longer considered new or experimental. Lasers are now being used by dentists all over the world, and the WCLI has grown into the largest group of its kind with members on six continents.

Despite the impressive growth of the use of lasers and our professional organization, I am continually surprised by the overall lack of general awareness about what our membership has understood for years: the very real clinical benefits of dental lasers in practice.

And that's why we created the *Journal of Laser-Assisted Dentistry* (JLAD). It is a new initiative by the WCLI to share the excitement and advancements taking place in laser dentistry with our peers. We have committed to publishing JLAD on a quarterly basis, and I am proud of the efforts of our Editorial Advisory Board, contributing editors and staff. We are a newly formed team!

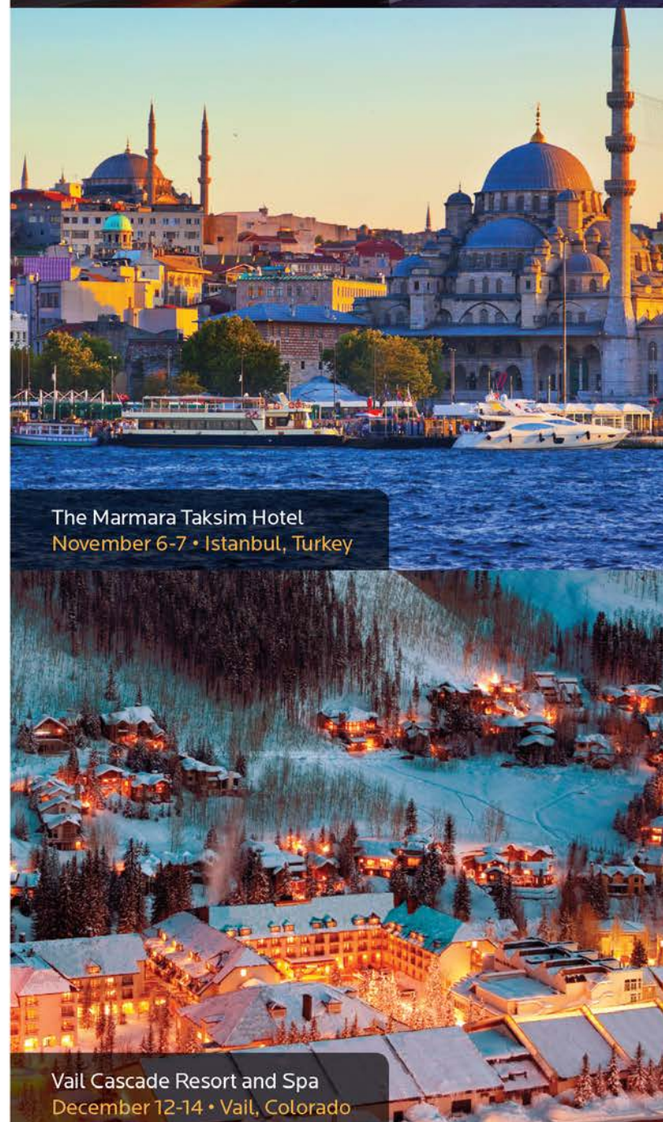
In this, our first issue, we've endeavored to create a balanced, peer-reviewed publication that combines noteworthy research, analyses and summaries of current research, along with practical advice and profiles of leaders in laser dentistry – including one of WCLI's founding members, Dr. Robert Miller.

We hope you enjoy our inaugural issue. If you have suggestions for improving our publication or would like to contribute in other ways, please contact me by email at chris@wcli.org.

Christopher J. Walinksi, DDS
EDITOR & EXECUTIVE DIRECTOR OF THE WCLI

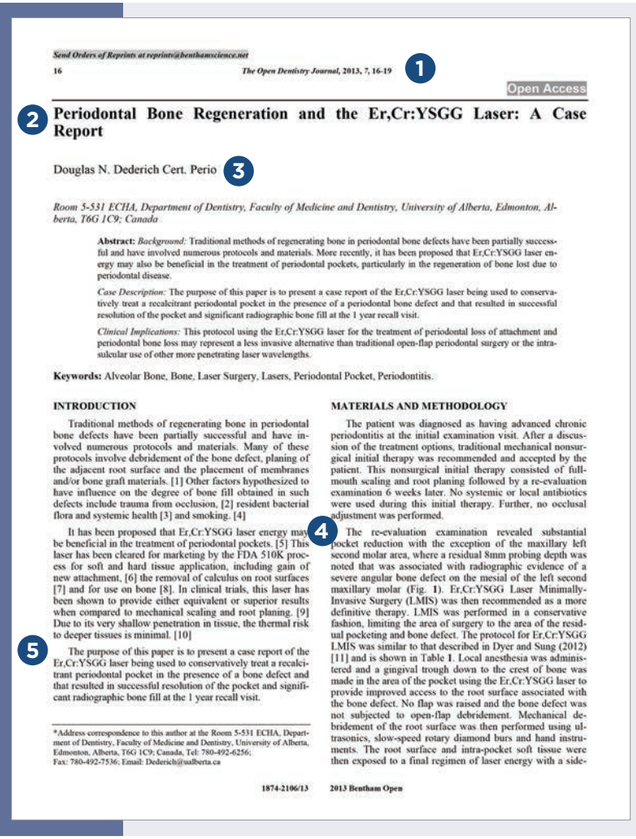
COVER IMAGE
The definitive periodontal protocol for the Er,Cr:YSGG laser represents a major step forward. Our cover art, an original by artist Gregory Dunn, represents the blending of new technology and clinical techniques that result in a dynamic new path for dental practitioners and the patients they serve.

CHRISTOPHER J. WALINSKI, DDS
EDITOR Dr. Walinski is a founder of the WCLI as well as an author, instructor and innovator in laser dentistry. He is currently the Executive Director of the WCLI.



CASE REPORT DEMONSTRATES EFFICACY FOR TREATING RECALCITRANT POCKETS DURING PERIODONTAL THERAPY

ONE QUESTION FOR MANY Er,Cr:YSGG LASER USERS is the wavelength's effect in periodontal therapy. With multiple studies already substantiating the effects of the Er,Cr:YSGG laser for perio, a recently published research paper is added to the list.



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Periodontal Bone Regeneration and the Er,Cr:YSGG Laser: A Case Report

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Abstract: *Background:* Traditional methods of regenerating bone in periodontal bone defects have been partially successful and have involved numerous protocols and materials. More recently, it has been proposed that Er,Cr:YSGG laser energy may also be beneficial in the treatment of periodontal pockets, particularly in the regeneration of bone lost due to periodontal disease.

Case Description: The purpose of this paper is to present a case report of the Er,Cr:YSGG laser being used to conservatively treat a recalcitrant periodontal pocket in the presence of a periodontal bone defect and that resulted in successful resolution of the pocket and significant radiographic bone fill at the 1 year recall visit.

Clinical Implications: This protocol using the Er,Cr:YSGG laser for the treatment of periodontal loss of attachment and periodontal bone loss may represent a less invasive alternative than traditional open-flap periodontal surgery or the intra-sulcular use of other more penetrating laser wavelengths.

Keywords: Alveolar Bone, Bone, Laser Surgery, Lasers, Periodontal Pocket, Periodontitis.

INTRODUCTION

Traditional methods of regenerating bone in periodontal bone defects have been partially successful and have involved numerous protocols and materials. Many of these protocols involve debridement of the bone defect, planing of the adjacent root surface and the placement of membranes and/or bone graft materials. [1] Other factors hypothesized to have influence on the degree of bone fill obtained in such defects include trauma from occlusion, [2] resident bacterial flora and systemic health [3] and smoking. [4]

It has been proposed that Er,Cr:YSGG laser energy may be beneficial in the treatment of periodontal pockets. [5] This laser has been cleared for marketing by the FDA 510K process for soft and hard tissue application, including gain of new attachment, [6] the removal of calculus on root surfaces [7] and for use on bone [8]. In clinical trials, this laser has been shown to provide either equivalent or superior results when compared to mechanical scaling and root planing. [9] Due to its very shallow penetration in tissue, the thermal risk to deeper tissues is minimal. [10]

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The purpose of this paper is to present a case report of the Er,Cr:YSGG laser being used to conservatively treat a recalcitrant periodontal pocket in the presence of a bone defect and that resulted in successful resolution of the pocket and significant radiographic bone fill at the 1 year recall visit.

MATERIALS AND METHODOLOGY

The patient was diagnosed as having advanced chronic periodontitis at the initial examination visit. After a discussion of the treatment options, traditional mechanical nonsurgical initial therapy was recommended and accepted by the patient. This nonsurgical initial therapy consisted of full-mouth scaling and root planing followed by a re-evaluation examination 6 weeks later. No systemic or local antibiotics were used during this initial therapy. Further, no occlusal adjustment was performed.

The re-evaluation examination revealed substantial pocket reduction with the exception of the maxillary left second molar area, where a residual 8mm probing depth was noted that was associated with radiographic evidence of a severe angular bone defect on the mesial of the left second maxillary molar (Fig. **1**). Er,Cr:YSGG Laser Minimally-Invasive Surgery (LMIS) was then recommended as a more definitive therapy. LMIS was performed in a conservative fashion, limiting the area of surgery to the area of the residual pocketing and bone defect. The protocol for Er,Cr:YSGG LMIS was similar to that described in Dyer and Sung (2012) [11] and is shown in Table **1**. Local anesthesia was administered and a gingival trough down to the crest of bone was made in the area of the pocket using the Er,Cr:YSGG laser to provide improved access to the root surface associated with the bone defect. No flap was raised and the bone defect was not subjected to open-flap debridement. Mechanical debridement of the root surface was then performed using ultrasonics, slow-speed rotary diamond burs and hand instruments. The root surface and intra-pocket soft tissue were then exposed to a final regimen of laser energy with a side-

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1. **INDEPENDENTLY** REVIEWED

This manuscript was originally published in July 2013 in *The Open Dentistry Journal*. ODJ is a peer-reviewed publication containing important and reliable current information on developments in the dental field. All submitted articles are subject to an extensive peer review in consultation with members of the Journal Editorial Board and independent external referees.

2. **ESTABLISHED** BENEFITS

Lasers have been established as having a positive effect on oral tissues. This peer-reviewed case report further substantiates some of the benefits of using an Er,Cr:YSGG laser to promote cementum-mediated periodontal ligament new-attachment to the root surface in the absence of long-junctional epithelium.

3. **RENOWNED** AUTHOR

Author Dr. Doug Dederich is currently a full professor in the Department of Dentistry at the University of Alberta. His clinical interests include implant, cosmetic and laser dentistry. He has served as a consultant on lasers in medicine and dentistry to the United States National Institute of Health, the American Academy of Periodontology and the American Dental Association. He has published over 60 articles and abstracts in refereed scientific journals and has made over 120 scientific presentations in North America and Europe.

4. **TREATMENT** AND FOLLOW UP

Researchers used an Er,Cr:YSGG laser to treat a recalcitrant periodontal pocket in the presence of a periodontal bone defect, with assessment at a 1-year follow-up appointment.

5. **LESS** INVASIVE

"This protocol using the Er,Cr:YSGG laser for the treatment of periodontal loss of attachment...may represent a less invasive alternative than traditional open-flap periodontal surgery or the intra-sulcular use of other more penetrating wavelengths..."

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"...the Er,Cr:YSGG laser may represent a less invasive modality than traditional periodontal surgery..."

CASE DESCRIPTION

"The purpose of this paper is to present a case report of the Er,Cr:YSGG laser being used to conservatively treat a recalcitrant periodontal pocket in the presence of a bone defect and that resulted in successful resolution of the pocket..."

This case report involves a dental patient who presents with advanced chronic periodontitis. Initial treatment was nonsurgical full-mouth scaling and root planing. Six weeks post-op, a re-evaluation of the patient's periodontal condition revealed pocket resolution in all areas except for the maxillary left quadrant. Despite scaling and root planing, an 8 mm pocket remained on the mesial of tooth #15. Radiographically, an angular defect was noted in this area.

Under local anesthesia, minimally invasive laser surgery was performed using the Er,Cr:YSGG wavelength only in the area of the pocketing and osseous defect. The protocol used was as follows:

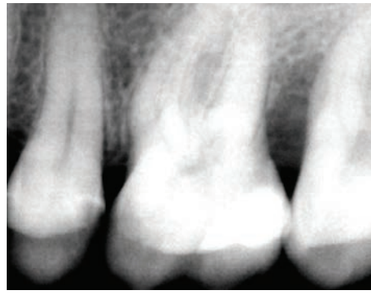
"A gingival trough down to the crest of bone was made in the area of the pocket using the Er,Cr:YSGG laser to provide improved access to the root surface associated with the bone defect. No flap was raised and the bone defect was not subjected to open-flap debridement. Mechanical debridement of the root surface was then performed using ultrasonics, slow-speed rotary diamond burs and hand instruments. The root surface and intra-pocket soft tissue were then exposed to a final regimen of laser energy with a side-firing tip that directed the majority of the energy in a direction radial to the long axis of the fiber. Finally, the soft tissue was gently pressed against the root surface and sealed with cyanoacrylate tissue adhesive."

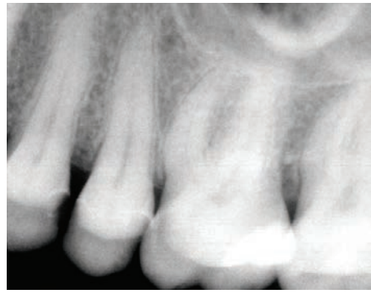
RESULTS

"At the 1-year re-evaluation examination, probing depths in the defect area had decreased from 8 mm to 2 mm. The periapical radiograph showed evidence of complete bone fill. The patient also reported being asymptomatic."

CONCLUSION

"Successful pocket reduction [was] achieved using Er,Cr:YSGG laser minimally invasive surgery. This protocol using the Er,Cr:YSGG may represent a less invasive modality than traditional periodontal surgery or the use of other more penetrating laser wavelengths (Nd:YAG and diode) for the intra-pocket treatment of periodontal disease." ■





PRE- AND POST-OP RADIOGRAPHS

TOP: A pre-operative radiograph demonstrates radiographic evidence of an angular bone defect on the mesial of the maxillary left second molar.
LOWER: One-year post-surgical radiograph showing complete clinical success on the mesial of the maxillary left second molar. Associated probing depths were 3 mm or less.

RESEARCHERS DETERMINE Er,Cr:YSGG LASER WAVELENGTH EFFECTIVE IN REMOVING BIOFILM FROM IMPLANT SURFACES

FOR YEARS, LASERS HAVE BEEN USED in uncovering submerged implants and other adjunctive implant procedures. Now, researchers examine the effects of using an Er,Cr:YSGG laser to treat the surfaces of contaminated implants.

1 Evaluation of Contaminated Implant Surfaces Irradiated by Er, Cr: YSGG Laser

2 Gizem Berk, DDS, MSc[1] • Rene Franzen, PhD[2] • Kubra Atici, DDS, PhD[3]
Sema S. Hakki, DDS, PhD[4] • Nuket Berk, DDS, PhD[5]
Norbert Gutknecht, DDS, PhD[6]

Abstract

Background: The aim of the study was to evaluate the efficiency of an Er,Cr:YSGG laser to remove the biofilm of the contaminated implant surfaces and to examine the possible alterations on the surface structure after laser irradiation.

3 **Methods:** Nine failed SLA surfaced dental implants were used for laser irradiation and one unused implant served as control. Of the nine contaminated implants, eight were marked vertically to create two sides on the same implant, and the ninth contaminated implant was kept as a control implant of the failed implant group. One side of the contaminated implants was treated with Er,Cr:YSGG laser while the other side remained untreated. The surfaces were irradiated with a pulsed Er,Cr:YSGG laser with a power setting of 1.5 W, 15 Hz, 140 µs pulse duration for 30 seconds per thread in the non-contact mode. After macroscopic picture evaluation, light microscopic evaluation and SEM analysis were performed subsequently.

Results: SEM and light microscopy images demonstrated that Er,Cr:YSGG laser treatment with predetermined settings for titanium surfaces was able to remove all the contaminants and debris from the implant surfaces without any surface alteration which was also noticeable in the macroscopic pictures.

Conclusion: It was concluded that the use of Er,Cr:YSGG laser with current settings was efficient to decontaminate implant surfaces and the results of this study suggested that Er,Cr:YSGG laser can be used safely in the clinics for the treatment of peri-implantitis for biofilm removal without damaging the implant surface.

4 **KEY WORDS:** Lasers, Biofilms, Dental Implants

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1. IMPLANTS ON THE RISE

Contaminated implant surfaces are the primary cause for peri-implantitis, a condition that is becoming more commonplace as implant placement by dental professionals significantly increases.

2. WORLDWIDE PANEL

Dr. Gizem Berk, a private practitioner and researcher based in Ankara, Turkey, headlines an all-star team of authors from around the world, including physicist Dr. Rene Franzen, periodontists Dr. Kubra Atici and Dr. Sema Hakki, aesthetic dentist Dr. Nuket Berk and restorative dentist and professor Dr. Norbert Gutknecht. The team of authors has collectively been credited with more than 200 peer-reviewed clinical articles published around the world.

3. CONTAMINATED IMPLANTS

Berk et al studied the effects of Er,Cr:YSGG laser energy on the surface of nine contaminated SLA titanium implant surfaces. Conservative laser settings were used. Evaluation was conducted through photographs, light microscopy and SEM analysis.

4. SAFE REMOVAL OF BIOFILM

Using correct settings, an Er,Cr:YSGG laser may be useful to remove biofilm from a contaminated implant surface.

5. AUTHORITATIVE

The *Journal of Implant & Advanced Clinical Dentistry* is published monthly. The publication "strives to provide the dental profession with peer-reviewed original research, authoritative reviews, clinical techniques and expert commentary."

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INTRODUCTION

Various types of dental lasers have been used for many years to uncover submerged implants and perform other minor, adjunctive soft tissue procedures. More recently, researchers have begun evaluating the efficacy of various wavelengths for treating peri-implantitis. The primary question facing research teams is whether or not lasers are safe for removing biofilm from a contaminated implant surface without harming the surface of the implant.

An international team of dental researchers, led by Ankara, Turkey-based dentist Dr. Gizem Berk, published a study in the *Journal of Implant and Advanced Clinical Dentistry*, which examines whether an Er,Cr:YSGG laser is safe and effective in removing biofilm from an implant surface without causing physical or thermal damage.

DESCRIPTION

This study focused on the effect of an Er,Cr:YSGG laser on the titanium surfaces of nine failed dental implants and one control. According to the study, "Nine failed SLA-surfaced dental implants were used for laser irradiation and one unused implant served as control. Of the nine contaminated implants, eight were marked vertically to create two sides on the same implant, and the ninth contaminated implant was kept as a control implant of the failed implant group. One side of the contaminated implants was treated with an Er,Cr:YSGG laser while the other side remained untreated. The surfaces were irradiated with a pulsed Er,Cr:YSGG laser with a power setting of 1.5 W, 15 Hz, 140 µs pulse duration for 30 seconds per thread in non-contact mode. After macroscopic picture evaluation, light microscopic evaluation and SEM analysis were performed subsequently."

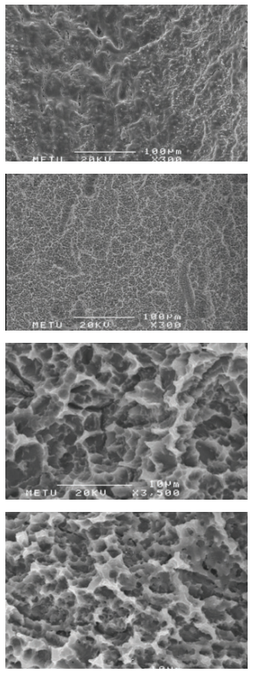
RESULTS

The researchers were able to determine the Er,Cr:YSGG laser is an effective method to remove surface contaminants without causing damage to the implant surface. "SEM and light microscopy images demonstrated that Er,Cr:YSGG laser treatment with pre-determined settings for titanium surfaces was able to remove all the contaminants and debris from the implant surfaces without any surface alteration, which was also noticeable in the macroscopic pictures."

CONCLUSION

"We concluded that using an Er,Cr:YSGG laser with 1.5W, 15Hz, 100 mJ pulse energy, 140 µs pulse duration (H mode), 65% air and 55% water is efficient for the removal of biofilm without damaging the implant surface. The Er,Cr:YSGG laser seems to be an effective tool for peri-implantitis treatment by means of removal of biofilm. However, further in vivo and in vitro studies are required to gain a better understanding of osteoblastic cell behavior on different types of contaminated implant surfaces and to confirm clinical applications and optimize its parameters."

When combined with the previously published findings of Miller[1] and Schwarz[2], et al, in regard to addressing peri-implantitis with an erbium-type laser, this study from JIACD further suggests that Er,Cr:YSGG laser technology may be effective for removing biofilm from an implant surface. ■



FIRST IMAGE: SEM evaluation of contaminated, non-irradiated failed implant #1 with 300x magnification.

SECOND IMAGE: SEM evaluation of non-irradiated control implant #2 with 300x magnification.

THIRD IMAGE: SEM evaluation of unused control implant #2 with 3500x magnification.

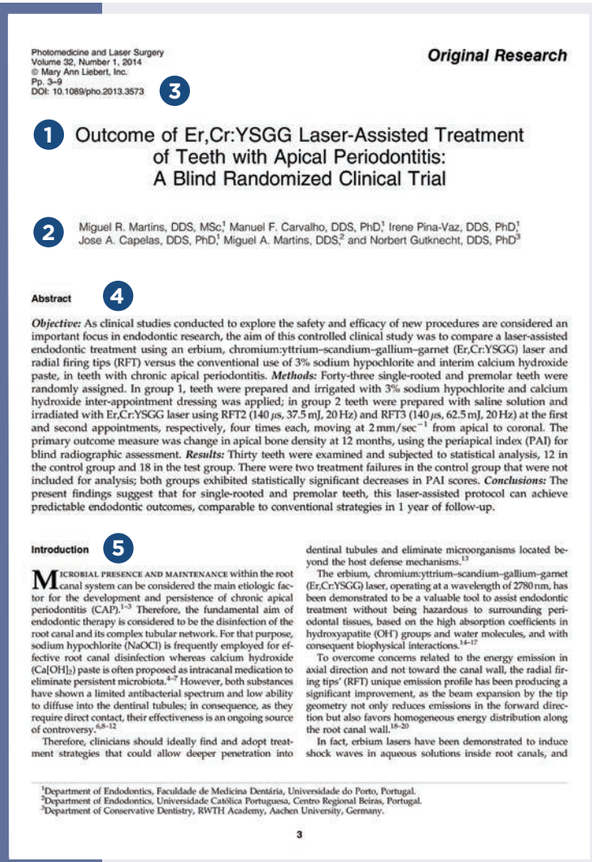
FOURTH IMAGE: SEM examination of the contaminated implant #7, laser cleaned part with 3500x magnification.

1. Miller RJ. Treatment of the contaminated implant surface using an Er,Cr:YSGG laser. Implant Dent 2004;13:165-170.

2. Schwartz F, Nuesry E, Bieling K, Sculean A, Becker J. Clinical and histological healing pattern of peri-implantitis lesions following non-surgical treatment with an Er:YAG laser. Laser Surg Med 2006;38:663-71.

BLIND CLINICAL TRIAL DEMONSTRATES NEW LASER-BASED METHOD FOR TREATING CHRONIC APICAL PERIODONTITIS

WITH THE SAFETY AND EFFICACY of new procedures a big focus for endodontic research, investigators conducted a controlled clinical study to compare laser-assisted endodontic treatment versus conventional methods.



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Original Research

3

1 Outcome of Er,Cr:YSGG Laser-Assisted Treatment of Teeth with Apical Periodontitis: A Blind Randomized Clinical Trial

2 Miguel R. Martins, DDS, MSc,[1] Manuel F. Carvalho, DDS, PhD,[1] Irene Pina-Vaz, DDS, PhD,[1] Jose A. Capelas, DDS, PhD,[1] Miguel A. Martins, DDS,[2] and Norbert Gutknecht, DDS, PhD[3]

4 Abstract

Objective: As clinical studies conducted to explore the safety and efficacy of new procedures are considered an important focus in endodontic research, the aim of this controlled clinical study was to compare a laser-assisted endodontic treatment using an erbium, chromium:yttrium–scandium–gallium–garnet (Er,Cr:YSGG) laser and radial firing tips (RFT) versus the conventional use of 3% sodium hypochlorite and interim calcium hydroxide paste, in teeth with chronic apical periodontitis. ***Methods:*** Forty-three single-rooted and premolar teeth were randomly assigned. In group 1, teeth were prepared and irrigated with 3% sodium hypochlorite and calcium hydroxide inter-appointment dressing was applied; in group 2 teeth were prepared with saline solution and irradiated with Er,Cr:YSGG laser using RFT2 (140 μs, 37.5 mJ, 20 Hz) and RFT3 (140 μs, 62.5 mJ, 20 Hz) at the first and second appointments, respectively, four times each, moving at 2 mm/sec^{-1} from apical to coronal. The primary outcome measure was change in apical bone density at 12 months, using the periapical index (PAI) for blind radiographic assessment. ***Results:*** Thirty teeth were examined and subjected to statistical analysis, 12 in the control group and 18 in the test group. There were two treatment failures in the control group that were not included for analysis; both groups exhibited statistically significant decreases in PAI scores. ***Conclusions:*** The present findings suggest that for single-rooted and premolar teeth, this laser-assisted protocol can achieve predictable endodontic outcomes, comparable to conventional strategies in 1 year of follow-up.

5 Introduction

MICROBIAL PRESENCE AND MAINTENANCE within the root canal system can be considered the main etiologic factor for the development and persistence of chronic apical periodontitis (CAP).[1–3] Therefore, the fundamental aim of endodontic therapy is considered to be the disinfection of the root canal and its complex tubular network. For that purpose, sodium hypochlorite (NaOCl) is frequently employed for effective root canal disinfection whereas calcium hydroxide ($Ca[OH]_2$) paste is often proposed as intracanal medication to eliminate persistent microbiota.[4–7] However, both substances have shown a limited antibacterial spectrum and low ability to diffuse into the dentinal tubules; in consequence, as they require direct contact, their effectiveness is an ongoing source of controversy.[6,8–12]

Therefore, clinicians should ideally find and adopt treatment strategies that could allow deeper penetration into dentinal tubules and eliminate microorganisms located beyond the host defense mechanisms.[13]

The erbium, chromium:yttrium–scandium–gallium–garnet (Er,Cr:YSGG) laser, operating at a wavelength of 2780 nm, has been demonstrated to be a valuable tool to assist endodontic treatment without being hazardous to surrounding periodontal tissues, based on the high absorption coefficients in hydroxyapatite (OH^-) groups and water molecules, and with consequent biophysical interactions.[14–17]

To overcome concerns related to the energy emission in axial direction and not toward the canal wall, the radial firing tips' (RFT) unique emission profile has been producing a significant improvement, as the beam expansion by the tip geometry not only reduces emissions in the forward direction but also favors homogeneous energy distribution along the root canal wall.[18–20]

In fact, erbium lasers have been demonstrated to induce shock waves in aqueous solutions inside root canals, and

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[3]Department of Conservative Dentistry, RWTH Academy, Aachen University, Germany.

1. BLIND TRIAL

Apical periodontitis is one of the most complicated dental procedures to address. Similarly, blind, randomized clinical trials are one of the most in-depth forms of research possible, requiring rigorous recruiting methods, data analysis and other exhaustive analyses to reach conclusions.

2. PRESTIGIOUS PANEL

Dr. Miguel Martins headlines a prestigious group of dentists and researchers from around the world who focused on outcomes of Er,Cr:YSGG endodontic laser treatment of apical periodontitis.

3. PRE-EMINENT

Photomedicine and Laser Surgery remains one of the pre-eminent publications for medical and dental laser research in the world.

4. BONE DENSITY

Forty-three single-rooted and premolar teeth were randomly assigned to four groups of varying treatments. The primary outcome measurement was change in apical bone density at 12 months' time, based upon blind radiographic assessment.

5. PREDICTABLE OUTCOMES

The present findings suggest that for single-rooted and premolar teeth, this laser-assisted protocol can achieve predictable endodontic outcomes comparable to conventional strategies in 1-year follow-up.

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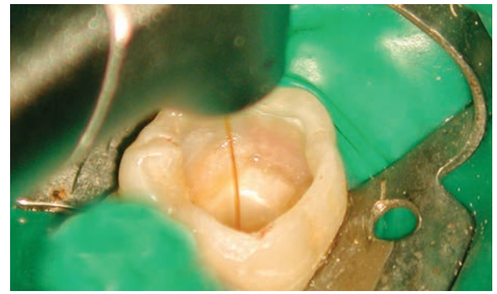
IT IS WELL KNOWN that microbial presence within the root canal system after endodontic therapy is the main etiology of chronic apical periodontitis. It stands to reason, then, that the primary goal of endodontic therapy is disinfection of the root canal. Traditional disinfection methods employ both sodium hypochlorite and calcium hydroxide. However, both medicaments present unique limitations in their ability to thoroughly disinfect the root canal and for this reason, alternative methods are being suggested.

One such suggestion is the use of an Er,Cr:YSGG laser prepared with a specially designed radial firing tip (RFT). Instead of directing laser energy directly apically, which might cause problems with the root end or apical stop, the RFT distributes laser radiation in a pattern laterally rather than apically. This feature, along with the activation of solutions within the canal space, induces primary and secondary cavitation effects. Cavitation is ideal for the removal of debris and smear layer, as well as the disruption of bacterial biofilm.

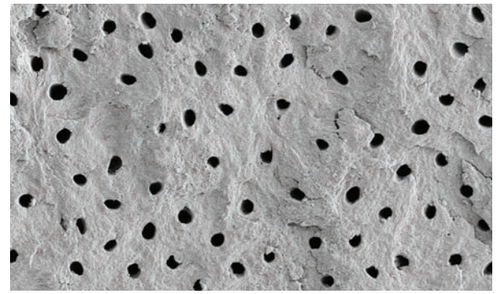
In this study, Martins et al identified 43 single-rooted and premolar teeth and randomly assigned them to two groups. The teeth in group 1 were prepared and irrigated with 3% sodium hypochlorite and calcium hydroxide dressing; the teeth in group 2 were prepared with saline solution and irradiated with an Er,Cr:YSGG laser using an RFT2 tip and RFT3 tip at the first and second appointments, four times each. The primary metric utilized by the researchers to determine evaluation was the change in apical bone density at 12 months.

The results at the 1-year follow-up suggested that a laser-assisted endodontic protocol can "achieve predictable endodontic outcomes, comparable to conventional strategies."

Furthermore, "after 1 year of follow-up, and in single-rooted and premolar teeth, the Er,Cr:YSGG laser has shown to be at least as effective as a conventional irrigation/medication regimen, reducing chronic apical periodontitis significantly. Within the same clinical protocol, it can also confirm previous in vitro findings, suggesting that radial firing tips could (1) remove smear layer in wet conditions and (2) achieve deep disinfection in dry conditions." ■



Flexible fiber tips are used with the Er,Cr:YSGG laser handpiece and inserted into the canal after cleaning and shaping to aid in the reduction of pathogens.



Studies have shown Er,Cr:YSGG laser radiation in the root canal reduced E. faecalis in the canal "2.86 times more effectively than sodium hypochlorite alone" (Christensen et al, 2007).

An SEM analysis of a single dentinal tubule shows an open channel for fluid transmission. No smear layer, debris or other contaminants are present.

AN ANALYSIS OF FACTORS DRIVING SOFT TISSUE LASER ADOPTION

SOFT TISSUE LASERS ARE NOW USED BY MORE THAN 35% of dental practices in the U.S. and 20% of dental practices around the world. What is driving the rapid adoption of this technology?

By Christopher J. Walinski, DDS

THE RECENT POPULARITY of soft tissue lasers is impressive and unprecedented and can be traced to several factors. First of all, the opportunities for dental laser education are becoming far more available than they were in the past; in fact, a handful of dental schools and residency programs now offer laser-related courses as part of their curriculum. These educational opportunities empower dentists and hygienists with an understanding of the clinical benefits of lasers in dentistry. Second, adding a laser to one's dental practice offers an advantage in the market for new patients who are seeking high-tech-savvy dental practices. Finally, the increased revenues that can be generated by the addition of a laser to the dental armamentarium can certainly justify the cost of the technology.

The factor that designates a particular laser as being hard tissue or soft tissue is the laser wavelength's absorptive properties. Just as visible light wavelengths are absorbed into various colors and produce the reds, blues and yellows that we can see, dental laser wavelengths are similarly absorbed into water, hydroxyapatite and pigmented tissues.

Those wavelengths which are absorbed into pigmented tissues are designated as soft tissue lasers since soft tissue typically contains pigmented components such as melanin and hemoglobin. Conversely, erbium laser wavelengths absorbed into water and hydroxy-apatite have the ability to ablate hard tissues such as dentin, enamel and bone, yet are surpisingly effective in soft tissue as well. This can be explained by the high percentage of water contained within soft tissues.

Table 1 lists various dental laser wavelengths and where their absorption peaks occur across the electromagnetic spectrum. Notice that the two erbium laser wavelengths are not well absorbed into pigmented tissue and are therefore not normally thought of as soft tissue wavelengths, although their unique interaction with water and ability to be used on hard and soft tissues with minimal thermal impact makes Erbium lasers surprisingly versatile.

Peer-reviewed journals devoted to cosmetic dentistry traditionally report the benefits of using various soft tissue wavelengths for precise gingival contouring in esthetic areas as opposed to using a scalpel or electrosurgical units. The benefits include minimal bleeding, no concern for orthodontic brackets or metallic restorations and, probably most important, the ability to take the final impression or digital scan at the time of surgery without marginal recession or rebound.

The three most popular soft tissue wavelengths used in dentistry are diode, Nd:YAG and carbon dioxide, with Er,Cr:YSGG and Er:YAG quickly closing ground because of their versatility and unique ability to cut soft tissues with minimal thermal impact.

Diode: Diode lasers are unique in that they are powered by a semiconductor chip rather than gas or a crystal like all other dental lasers. They can be operated in either continuous or gated/chopped mode. Diode lasers are the most affordable surgical laser on the market and as such they serve well as an entry-level laser and are most often used in the dental hygiene operatory. There are many choices of diode lasers on the market, from basic no-frills diode lasers to more sophisticated diodes that have additional power and features.

Nd:YAG: The active medium for the neodynium: yttrium aluminum garnet (Nd:YAG) laser is a solid state crystal. At 1064nm, the Nd:YAG falls very near diode lasers in the electromagnetic spectrum; however, because they employ a free-running pulsed mode, the clinical applications and results differ from diode lasers.

CO_2: At around 10,000nm, the carbon dioxide laser resides at the far end of the infrared region of the electromagnetic spectrum. This wavelength has the distinction of being well-absorbed by pigmented tisses. Recently, carbon dioxide lasers have been marketed as hard tissue lasers, but their wavelength is most ideal for soft tissue procedures since using a carbon dioxide laser around implants, orthodontic appliances and other reflective surfaces may be contraindicated. In addition, appropriate delivery systems do not exist for endodontic and periodontic treatment using a carbon dioxide laser, limiting its clinical applications.

Table 1: Laser Characteristics

Active Medium	Wavelength (nm)	Absorption Peaks	Type
Argon	488-515	Pigmented Tissue, Resin Catalyst	Soft
Diode	810-980	Pigmented Tissue, Water	Soft
Nd:YAG	1064	Pigmented Tissue, Water	Soft
Er,Cr:YSGG, Er:YAG	2780-2940	Hydroxyapatite, Water	Hard/Soft
Carbon Dioxide	9300-10600	Pigmented Tissue, Hydroxyapatite, Water	Hard/Soft

The most important benefit of utilizing a diode laser in lieu of traditional modalities is sealing blood vessels.

Sealing Blood Vessels: Since lasers target a chromophore such as hemoglobin rather than simply vaporizing interstitial fluids, less heat is generated than one might think. In fact, the zone of necrosis is far narrower with laser use than with an electrosurgical unit. A diode laser has the capability to perform surgical procedures with pulsed laser radiation, which minimizes lateral thermal damage and allows for thermal relaxation of the target tissue while still achieving coagulation.

While previously found in the armamentaria of only a select few specialists, soft tissue laser technology is rapidly making its way into high-tech dental practices across the country. Both the technology and the public's perception have advanced to the point that forward-thinking dentists are quickly understanding the benefits of adding a laser to their practice. The clinical advantages, as well as a healthy return on investment, seem to have satisfied not only tech-friendly dentists, but the mainstream. practitioners as well. ■

Table 2: Common Soft Tissue Procedures Completed with a Laser

Biopsy	Hemostasis/Coagulation
Esthetic Gingival Contouring	Implant Procedures
Excision/Incision	Incision and Drainage of Abscess
Exposure of Unerupted Teeth	Periodontal Pocket Elimination
Frenectomy	Soft Tissue Crown Lengthening
Gingivectomy/Gingivoplasty	Troughing Crown/Veneer Preparations

Scan to see videos of the most common soft tisse laser procedures or visit www.wcli.org/jlad

IN VITRO ANALYSIS OF RFPT5
TIP DURABILITY THROUGHOUT A STANDARD PERIODONTAL TREATMENT

By Alina Sivriver, M.S.

INTRODUCTION

The radial firing periodontal tapered (RFPT) tip is designed to deliver laser energy to the periodontal pocket walls and to the bottom of the periodontal pocket, treating both diseased soft tissues, root surface and infected bone simultaneously. Laser energy propagates from the tip's distal end in both a low diverging beam along the fiber axis and in a radial cone radiating at a 55° angle to the tip axis. This design allows the user to maximize treatment while cutting time, tip position and setting changes.

Surgical periodontal procedures are performed either on single sites or multiple sites as determined by the clinician and the patient's clinical condition. For this analysis, a new step-by-step periodontal protocol developed for use with an Er,Cr:YSGG laser was performed on a quadrant of teeth.

OBJECTIVE

The purpose of this study is to determine the durability of the RFPT5 500µm diameter tip throughout the recommended periodontal treatment for the WaterLase® laser for one quadrant and beyond. Halved upper porcine jaws were used in this in vitro study to mimic human dentition and gingival tissue. The protocol recommends substituting the MZ6 tip, a flat surgical tip that emits a diverging laser beam approximately 600µm in diameter, for the RFPT5 tip during the bone decortication step (step 5). The protocol was performed both without tip substitutions and as recommended, using both RFPT5 and MZ6 tips.

STEPS

The power output from each tip was tested before beginning the periodontal procedure and following each step. Two microscope images were taken of each tip before and after each step: a profile image of the tip and an image of the distal end of the tip. The condition of the aiming beam was also photographed.

Each step of the periodontal procedure was followed except for non-laser steps, which were omitted from this test. All laser steps except step 5 (bone decortication) were performed using an RFPT5 laser tip. This test was repeated five times with two trained operators.

RESULTS AND DISCUSSION

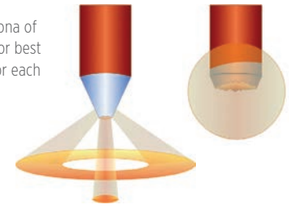
According to microscopic, visual and power measurement data, the RFPT5 tip degrades with each step of the protocol, with the most damage dealt in step 3, likely due to the eight-minute duration of this step, and in the extra bone decortication step. On average, the power output from the RFPT5 tips decreased by 27.1% from initial condition to step 6 (excluding the extra bone decortication step). The power output from the MZ6 tip decreased by an average of 13.4% during the decortication of one quadrant. The apex of the conical area of the RFPT5 tip is the most fragile and receives the most damage. Since the tip is submerged in the periodontal pocket, it is firing in contact with the hard and soft tissues in the pocket. The micro-explosions of the water within the confined space cavitate the tip's apex, slowly removing the tip's glass material along with the diseased tissue. The cavitation effect cannot be avoided, since the tip is submerged within a tissue pocket. However, it can be reduced by pointing the tip away from the hard tissue. The bone decortication step, where the tip is used to tap into the bone, creates extensive chipping at the tip surface, shown on both RFPT5 and flat MZ6 tips.

As the RFPT5 tip's apex degrades, the aiming beam slowly fills in and becomes less defined. The irregularity of the tip surface following the later steps scatters the aiming beam. Back-scattering energy following the decortication step is also possible. The laser can be reflected from the damaged surface of the tip back into the tip fiber, which may damage the mirror and the trunk fiber. Replacing the damaged tip following this last step of the procedure is important for treatment efficacy and laser maintenance.

The study shows that after treatment of one quadrant, there is significant wear to the RFPT5 tip surface and a significant decrease in power output from the tip. The results and observations lead to the recommendation to change both RFPT5 and MZ6 tips following the treatment of each quadrant. ■

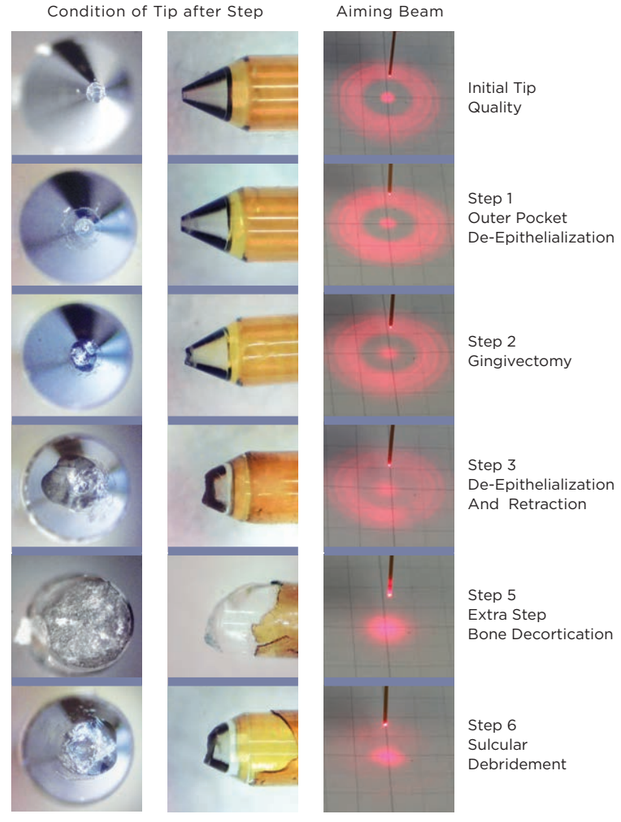
Table 1: Settings Used

Step	Description	Tip	Er,Cr:YSGG Settings Power (W)	Hz	Water (%)	Air (%)
1	Outer De-Epithelialization	RFPT5	1.5	30	50	40
2	Gingivectomy	RFPT5	1.5	30	50	40
3	Internal De-Epi. & Retraction	RFPT5	1.5	30	50	40
4	Scaling & Root Planing	-	-	-	-	-
5	Bone Decortication	MZ6	2.5	30	80	70
6	Sulcular Debridement	RFPT5	1.5	30	10	10



A new RFPT5 tip creates a corona of radiating laser energy (left). For best results, use a new RFPT5 tip for each quadrant treated.

Table 2: Condition of RFPT After Each Step in Periodontal Protocol



Note: Step 4 of the periodontal protocol not shown in Table 2 since no laser tips are used during this scaling and root planing step.

LASER DENTISTRY IN THE LITERATURE
& WHY IT MATTERS TO LASER DENTISTS

PEER-REVIEWED JOURNALS ANNUALLY PUBLISH HUNDREDS OF RESEARCH articles focused on lasers in dentistry. In each issue of JLAD, our editors will select and summarize the most noteworthy articles from the literature which address specific clinical areas of dentistry and why they matter.

PERIO

"Treatment of oral fibroma of the tongue using Er,Cr:YSGG laser: Report of two cases," By S. Arora, A.K. Lamba, et al. Published February 2014 in the *Journal of Periodontology*.

IN SUMMARY

"The Er,Cr:YSGG laser works at cellular levels and promotes tissue repair by photo modulation. It causes negligible bleeding and post-operative discomfort with minimal need for local anesthesia and better patient compliance. Therefore, the Er,Cr:YSGG laser may be considered a patient- and clinician-friendly tool."

WHY IT MATTERS

Fibromas are benign tumors composed of fibrous connective tissue. Using an Er,Cr:YSGG laser, the operator can provide their patients with a solution that offers benefits over traditional methods.

ENDODONTICS

"Effectiveness of a new method of disinfecting the root canal, using Er,Cr:YSGG laser to kill Enterococcus faecalis in an infected tooth model," By M.E. Licata, A. Albanese, et al. Published July 2013 in *Lasers in Medical Science*.

IN SUMMARY

"The use of the laser at 30 and 60 sec eliminated 92.3 and 100% of E. faecalis, respectively. It is the opinion of the paper's authors that an Er,Cr:YSGG laser constitutes a valid alternative to conventional treatment protocols. One reason is the greatly reduced time required for total disinfection, which was obtained by using a laser compared with the time spent during treatment using chemical-mechanical protocols; in our study, the same bactericidal potential was observed when the laser was used for 60 seconds and when irrigation was reduced in the root canals after a period of 30 minutes."

WHY IT MATTERS

Another research article substantiates the claim that an Er,Cr:YSGG laser posesses a bacterial effect, an especially important benefit when using the laser as an adjunct in an endodontic procedure.

IMPLANTS

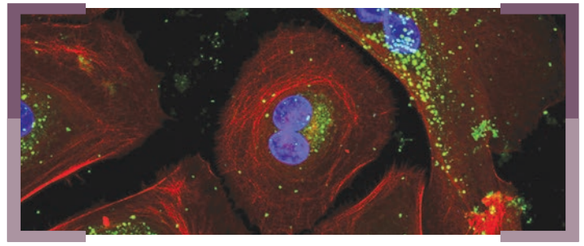
"Laser wavelengths and oral implantology," By G. Romanos, et al. Published May 2009 in *Laser Wavelengths and Oral Implantology*.

IN SUMMARY

"The application of Nd:YAG laser for treatment of peri-implantitis, hyperplastic mucositis and second-stage surgery of submerged implants is contraindicated, due to the significant increase in the temperature during laser irradiation, the extensive melting of the implant surface and the higher penetration depth of the laser beam."

WHY IT MATTERS

As laser use for the treatment of peri-implantitis continues to undergo scrutiny, it is important to know which lasers are being shown in the literature for safe and effective use around implants.



PERIODONTAL DISEASE, MEET YOUR NEW WORST ENEMY

***After years of clinical research** in the lab and in the field, **a new protocol for treating periodontal disease has emerged** for Er,Cr:YSGG laser dentists and periodontists.*

Periodontal disease remains one of the most prevalent oral health issues in the world today. According to the American Academy of Periodontology, nearly half of the U.S. population age 30 and older suffers from mild to severe periodontitis.

Research has shown that periodontal disease may be associated with other chronic inflammatory conditions, such as diabetes and cardiovascular disease. Additional reports link periodontitis to chronic illnesses, such as rheumatoid arthritis, Alzheimer's disease and even cancer.

Even with the link to various medical conditions, the number of patients affected with mild to severe periodontitis is growing. As a result, it is incumbent on all dental professionals to take a more active role in the treatment and prevention of the disease.

Dentists and researchers affiliated with the WCLI and other professional dental associations have conducted research on various laser wavelengths used in dentistry, including their efficacy in treating periodontitis. In recent years, a proliferation of published research and studies show that the Er,Cr:YSGG laser wavelength is an effective tool for treating periodontitis.

Using specially designed radial firing laser tips that create a corona of laser energy in the periodontal pocket, the Er,Cr:YSGG laser has been shown to be an especially effective instrument for the minimally invasive removal of both subgingival inflamed tissue and calculus deposits. This unique combination, as discussed in the literature, sets the Er,Cr:YSGG laser apart for treating periodontitis with a laser-based approach.

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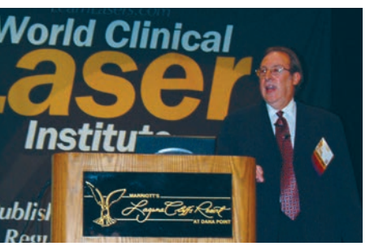
PERIO RESEARCH FROM THE PODUM

For more than 12 years, lecturers at WCLI symposia have delivered new research and developments on the use of Er,Cr:YSGG lasers in periodontics. Pictured from the top down, Prof. Nobert Gutknecht, Dr. Gilles Chaumanet, Dr. Larry Nurin and Dr. Stewart Rosenberg.



In 2009, the Er,Cr:YSGG laser was cleared by the U.S. Food and Drug Administration (FDA) for promoting "cementum-mediated periodontal ligament new-attachment to the root surface in the absence of long-junctional epithelium." Later that same year, the U.S. FDA cleared the Er,Cr:YSGG laser for "the removal of subgingival calculus in periodontal pockets with periodontitis by closed or open curettage."

Throughout the WCLI's history, the topic of treating periodontal disease using an Er,Cr:YSGG laser has been the focus of hundreds of clinical presentations and research papers presented to WCLI members. The development of a standard protocol for treating periodontal disease using an Er,Cr:YSGG laser has been a painstaking, detailed process led by prominent periodontists, general dentists and laser researchers. After years of lab tests, in vivo and in vitro examinations and field use by protocol developers, a standard Er,Cr:YSGG-based protocol is in place.

The WaterLase® Er,Cr:YSGG protocol for treating periodontitis combines a pre-surgical and surgical phase using an Er,Cr:YSGG laser with several key differences in comparative protocols associated with more limited laser wavelengths such as Nd:YAG, diode or CO_2 lasers.

The availability of this protocol ensures even greater clinical utility for Er,Cr:YSGG laser owners and provides opportunites for general dentists to reliably treat mild to severe periodontitis with a minimally invasive technique. ■

'DRAMATICALLY ADVANCING THE WAY WE TREAT PERIODONTITIS'

Dr. Samuel B. Low, is Professor Emeritus of Periodontology at the University of Florida. He is a past president of the American Academy of Periodontology and the Florida Dental Association. He was most recently appointed as an inaugural member of the Dental Professional Advisory Board at BIOLASE.

AFTER PRACTICING conventional periodontics for 20 years, I had made assessments on a daily basis of the core values necessary to achieve periodontal health with the possibility of a minimally invasive approach. As dental laser technology continued to improve, my investigation into this modality heightened. A decade ago, I immersed myself into lasers for periodontal management from periodontitis to enhancing the restorative product by manipulating tissue.

That fascination and immersion in lasers led me to become involved with a WCLI clinical team that developed and standardized the first-ever Er,Cr:YSGG laser-assisted periodontal protocol. The process to determine and validate laser settings, techniques and rationalize it against clinical evidence and results was a daunting task – but one I believe was met with vigor and care by all members of the WCLI research team.

Based on a series of basic steps that leverage the benefits and absorption characteristics of the Er,Cr:YSGG laser wavelength, this new periodontal protocol is straightforward, practical – and the results speak for themselves.

During this process, the team set out to determine the best settings, techniques, accessories to use, and other important criteria for use with the popular Er,Cr:YSGG laser. I am convinced the collective research efforts of the perio protocol team have resulted in a new laser perio protocol that will dramatically advance the use of Er,Cr:YSGG lasers in periodontal therapy. ■

WATERLASE® ER,CR:YSGG PERIODONTITIS PROTOCOL

THE WATERLASE® Er,Cr: YSGG PERIO PROTOCOL is the first definitive step-by-step protocol for using an Er,Cr:YSGG laser to assist in the management of early, moderate and severe chronic periodontitis. It is broken into three phases: pre-surgical, surgical and post-surgical.

PRE-SURGICAL PHASE

All patients should have a comprehensive periodontal examination/evaluation including data collection of periodontal charting and radiographs, medical and dental history, and risk assessment. A phase I treatment is implemented for removal of supra- and subgingival biofilm and calculus through scaling and root planing (S/RP) and the initiation and evaluation of oral hygiene compliance. Occlusal assessment and treatment may be warranted in this phase. Splinting of teeth may be an option.

SURGICAL PHASE

A phase II surgical treatment plan is developed based on the re-evaluation of periodontal inflammation and oral hygiene compliance. The surgical plan can be for a single or multiple teeth sites, a quadrant or half-mouth depending on number of indicated sites. If desired, the half-mouth protocol is generally UR/LR followed by at least 2-3 weeks of post-operative management before treating the UL/LL areas.

1

OUTER POCKET DE-EPITHELIALIZATION

Outer pocket gingival epithelium is removed from the free gingival margin down to a width at least equal to the pocket depth.

Tip: RFTP5
Power: 1.5W
Air/Water: 40%/50%
Pulse rate: 30 Hz
H mode

2

GINGIVECTOMY (OPTIONAL)

A gingivectomy should only be performed if pseudo-pocketing is present. Ensure you do not compromise adequate attached gingivae.

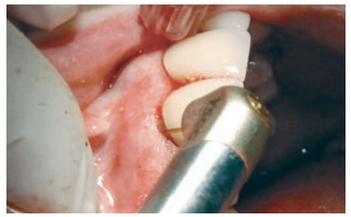
Tip: RFTP5
Power: 1.5W
Air/Water: 40%/50%
Pulse rate: 30 Hz
H mode

Scan to download the WaterLase® Perio Protocol (PDF) or visit www.wcli.org/jlad

WATERLASE® PERIO PROTOCOL CONTINUED

3 DE-EPITHELIALIZATION AND RETRACTION

The pocket epithelium should be removed and should be completed apically, down to bone. The gingival margin can be retracted as a mini flap for access.



Tip: RFPT5
Power: 1.5W
Air/Water: 40%/50%
Pulse rate: 30 Hz
H Mode

4 SCALING AND ROOT PLANING

Conventional treatment with ultrasonics and hand instruments to remove root surface accretions and/or calculus and to smooth cementum.

Laser not used

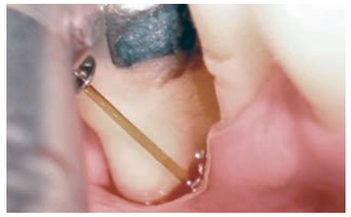
5 BONE DECORTICATION

Recontour osseous defects. Hold tip parallel to root surface and gently tap all the way down to and into bone, retracting slightly and repeating all the way around tooth. If necessary, change angle of the laser tip and treat into the walls of infrabony defects.

Tip: MZ6
Power: 2.5W
Air/Water: 70% / 80%
Pulse rate: 30 Hz
H mode

6 FINAL SULCULAR DEBRIDEMENT

Remove residual debris and induce blood coagulation.



Tip: RFPT5
Power: 1.5W
Air/Water: 10% / 10%
Pulse rate: 30 Hz
H mode

7 COMPRESS WITH 2X2

Compress surgical site with wet 2x2 for 5 minutes.

POST-SURGICAL PHASE

- IMMEDIATE POST-OPERATIVE: Brush teeth lightly with soft brush and use mouth rinse to supplement brushing if discomfort exists.
- ONE WEEK AFTER LASER TREATMENT: Gently clean between teeth using an interproximal brush dipped in mouthwash.
- NO PROBING for at least 3 months, at which time a supragingival scaling is completed.

THREE TIPS FOR MORE EFFECTIVE TISSUE RETRACTION & PREDICTABLE IMPRESSIONS USING YOUR ER,CR:YSGG LASER

ARE YOU WEARY OF 'RETAKES' AND 'REMAKES' with your dental restorations? It is well known that traditional troughing and tissue retraction techniques can be messy, unpredictable and difficult. With an Er,Cr:YSGG laser, you can bid farewell to your troughing hassles.

WaterLase® Er,Cr:YSGG tissue retraction seems pretty simple and straightforward. So why spend time discussing such a rudimentary subject? Without proper information, tissue retraction has the potential to be a frustrating, technique-sensitive procedure. However, once you perfect it, there is no returning to traditional retraction cord techniques for most cases.

In a perfect world, we soak retraction cord in a hemostatic agent and then pack it around our preparation. When we remove it, there is an ideal amount of space for our optical or polyvinyl siloxane impression material to accurately capture the details of the margins. Unfortunately, what happens in real life is often quite different. As soon as the retraction cord is removed, the sulcus quickly fills up with blood and any hopes of capturing accurate detail quickly disappear.

The WaterLase® laser allows you to gently coagulate the tissue around the preparation as well as create a trough, exposing sufficient ferrule for your impression. Troughing the preparation takes 30-40 seconds and can be completed comfortably whether or not the patient has been anesthetized, as in the case of an endodontically treated tooth.

It is easier to do this with a 9-mm-long laser tip (such as MZ6, MGGG or G6) since it allows better access interproximally. Place the laser tip just at tissue level rather than into the sulcus and activate the laser. Remember that lasers use end-cutting tips, any tissue next to the laser fiber will not be removed. Keep the side of the tip resting against the shoulder of the prep and make your way around the tooth. Do this with high speed suction close by to cool the area and eliminate the laser plume.

Story continued on page 22

FOLLOW THESE THREE EASY TIPS
FOR PREDICTABLE TISSUE TROUGHING

TIP 1

Use short, overlapping strokes about 2 mm wide as you make your way around the tooth.

TIP 2

Be aware that any tissue that has been thermally affected will become blanched or charred and will ultimately recede and expose that part of the margin. If this occurs, you need to adjust your margin.

TIP 3

Do not trough the tissue too deeply. Doing so will allow marginal tissue to collapse on to the sides of your preparation.

PRE-OP VIEW

PRE-OP VIEW, CROWNS REMOVED

PRE-OP VIEW, PRIOR TO TROUGHING

IMMEDIATE POST-OP VIEW, TROUGHING COMPLETE

FINAL IMPRESSION

IMMEDIATE POST-OP VIEW, ZOOMED IN

TROUGHING IT

Dr. Glenn van As, a practicing dentist and longtime laser educator, uses his Er,Cr:YSGG laser for troughing prior to taking impressions. He is routinely achieving precise, predictable results in a bloodless field, greatly simplifying a common dental procedure.

Photography courtesy of Dr. Glenn van As, Vancouver, British Columbia, Canada

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THE IMPORTANCE OF TIP INSPECTION IN ACHIEVING PEAK Er,Cr:YSGG LASER PERFORMANCE

INTRODUCTION

A typical Er,Cr:YSGG laser system utilizes glass or sapphire tips to transmit energy from the laser's delivery system to the target tissue. Installing a new tip on the Er,Cr:YSGG handpiece for every procedure is ideal; however, the reality is that some tips may be used a second time, or tips may become compromised from dust, mishandling or other circumstances.

The use of an uninspected Er,Cr:YSGG laser tip is one of the most common causes of compromised trunk fibers and damaged components within the laser system itself. A tip may collect contaminants such as dust or tissue during handling or use and may also have cracks. A compromised tip may potentially reflect laser energy back into the fiber delivery system, causing significant damage to the fiber or other laser components, resulting in downtime while service and repairs are executed – and frustration from the Er,Cr:YSGG laser owner because of a lack of access to the system.

Finally, a compromised laser tip will dramatically affect the tissue cutting efficiency of the Er,Cr:YSGG laser, resulting in much slower hard- and soft-tissue procedures, discomfort to the patient and an overall negative experience for all involved.

As a result, it is critically important to understand the basics of how to inspect an Er,Cr:YSGG laser tip before each use. By following the basic steps outlined in this article, Er,Cr:YSGG laser owners will benefit by more efficient tissue cutting, a more comfortable experience for the patient and fewer issues with maintenance or downtime.

Fortunately, every Er,Cr:YSGG system ships with the tools necessary to properly inspect a tip. These tools include a Tip Remover, a Tip Inspection Microscope and a Tip Test Adapter. Additional supplies are also required, including 99% isopropyl alcohol, cotton swabs and a pair of tweezers for tip handling.

Also, Er,Cr:YSGG laser owners should assign the responsibility of tip inspection to one member of the team, who can become the on-site "expert" at this critically important step. The best time for inspection is when an assistant or team member is setting up a procedure tray. Initially, the inspection process may take 2-3 minutes, which will reduce over time as the inspection process becomes more familiar.

When handling Er,Cr:YSGG laser tips, never touch the proximal end that connects into the handpiece. During inspection, handle laser tips with a pair of tweezers or the Tip Remover.

TIP INSPECTION INSTRUCTIONS

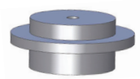
Remove the tip from the handpiece or tip storage container and insert the proximal (or input) end into the Tip Test Adapter using the Tip Remover supplied with the Er,Cr:YSGG system.

Insert the Tip Test Holder into the Test Adapter with the distal (or output) end toward the Tip Inspection Microscope.

Slide the adapter over the Tip Inspection Microscope to move the tip surface toward the focal point of the microscope. The focal point lies in the plane at the end of the clear tube of the Tip Inspection Microscope.

INSPECTION MICROSCOPE

A Tip Inspection Microscope is available in the Laser & Inspection Cleaning Kit (P/N 7200104) available from Er,Cr:YSGG laser manufacturer BIOLASE, Inc.



TIP TEST ADAPTER

The Tip Inspection Adapter is a component of the Inspection Microscope that holds the tip in place while examining.

TIP REMOVER

A Tip Remover (shown, with tip in place) is used to remove a tip from the handpiece and to insert it into the Tip Test Adapter.

CLINICAL TWEEZERS

Tweezers are important for handling the YSGG tips during the inspection.

COTTON SWABS

Remove debris, dust and other contaminants using a cotton swab dipped in 99.9% pure isopropyl alcohol.

ISOPROPYL ALCOHOL

Must be 99.9% pure isopropyl alcohol.

Implementing an Er,Cr:YSGG laser is a bold decision for any dental practice. Now you and your team can learn an essential trick to ensure your Er,Cr:YSGG laser operates at peak levels.

Turn on the Tip Inspection Microscope's built-in light by gently pulling apart the upper and lower tubes, or hold it up to another light source and bring the surface of the tip into focus using the thumb wheel. Examine the tip surface carefully for damage or contamination. To examine the proximal (or trunk fiber) end of the tip, remove the Adapter from the Tip Inspection Microscope and gently fit the other side of the test holder into the clear-end tube of the microscope. Refocus the Tip Inspection Microscope.

Finally, remove the tip from the Tip Test Holder using the Tip Remover. If the tip is contaminated at either end, try cleaning it as described in the Tip Cleaning Instructions below. If the tip is damaged or burned, dispose of it in a sharps container immediately. Do not re-use.

TIP CLEANING INSTRUCTIONS

Hold the tip with a pair of tweezers. Moisten a cotton swab with 99% isopropyl alcohol. Push the contaminated tip into the moistened cotton swab. Twirl the cotton swab while maintaining slight pressure on the surface of the tip.

CONCLUSION

The process of inspecting Er,Cr:YSGG laser tips before use is one of the most important steps a laser owner can take for improving performance of their laser, as well as minimizing potential maintenance issues with fibers and other laser components. ■

Scan to download a Tip Inspection Guide (PDF) or visit www.wcli.org/jlad

FOUR TIP COMPONENTS

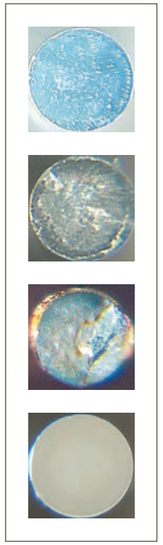
Er,Cr:YSGG laser tips have four components: Proximal (input) End, Distal (output) End, Plastic Ferrule and Shaft.

DISTAL (OUTPUT) END
The output end that emanates laser energy and ablates tissue.

SHAFT
The glass or sapphire component of the tips.

PLASTIC FERRULE
The plastic, cylinder-shaped component that locks the the tip into the handpiece.

PROXIMAL (INPUT) END
The end that connects to the laser handpiece.



MICROSCOPIC TIP IMAGES

There are four common conditions you might recognize on an Er,Cr:YSGG laser tip.

CONTAMINATED TIP
Specks of dust, debris or other particulates are visible on either the input or output end of the tip. Use cotton swabs dipped in 99% isopropyl alcohol to clean.

BURNED TIP
Evidence of overheating such as black charring are visible around the periphery of the tip. Discard tip.

BROKEN TIP
Chips or cracks in either end of the tip will be visible when a tip is broken. Discard tip.

GOOD TIP
A good tip should have no debris, specks, charring or chips.

WCLI MEMBERS GATHER AT 2014 SUPER SYMPOSIUM ON CALIFORNIA COAST

HUNTINGTON BEACH, CALIF., USA The World Clinical Laser Institute hosted more than 350 dental professionals from around the globe at its annual Super Symposium staged at the Regency Hyatt Resort, March 20-23, 2014.

The Super Symposium is traditionally the largest global event of the year for the WCLI – and the 2014 event was no exception. With attendees and speakers hailing from several dozen countries on five continents, the 2014 delegation was one of the most diverse yet!

This year's program included a wealth of clinical research from the largest panel of speakers ever. Keynote speaker, Dr. Story Musgrave, former NASA astronaut and accomplished physician, shared his process for achieving goals. Additional keynote speakers included renowned laser researcher Dr. Norbert Gutknecht and Dr. Yosef Krespi, a leading expert in the field of laser use for treating ENT conditions.

Several speakers focused on periodontal therapy using the Er,Cr:YSGG laser. Among these were Dr. Les Binkley, Dr. Rana Al-Falaki, Dr. Bret Dyer, Dr. Mark Schlesinger, Dr. Mark Cronshaw and Dr. Preedy Desai.

The Super Symposium also featured noteworthy presentations on laser endodontics, laser hygiene and soft tissue treatment, laser-assisted oral surgery and laser whitening. Hygienists and assistants in attendance had the opportunity to attend a full range of courses dedicated to laser adoption in the hygiene room.

With a growing number of exhibitors in attendance and a slate of evening activities, attendees had no shortage of opportunities to engage the growing tide of laser dentistry.

For a complete summary of the WCLI Super Symposium and details about 2015 dates, visit www.wcli.org. ■

LEARNING WITH LASERS
TOP & MIDDLE:
The Super Symposium features a one-of-a-kind learning lab with lasers and other technology available for personalized hands-on instruction.

DRS. MUSGRAVE AND ROSENBERG
LOWER: Dr. Story Musgrave, a former NASA astronaut, (pictured, right, with an original founder of the WCLI, Dr. Stewart Rosenberg), was featured as the Super Symposium's keynote speaker. Many attendees lined up to take photographs and get his autograph following his captivating presentation.

Scan to view all upcoming WCLI events and seminars, or visit www.wcli.org

HUNTINGTON BEACH The WCLI Super Symposium 2014 featured more than 350 attendees, six educational tracks, numerous exhibitors and renowned keynote speaker Dr. Story Musgrave. (Photo Courtesy: WCLI)

TAIPEI MEDICAL UNIVERSITY AND WCLI CELEBRATE FIRST ANNIVERSARY OF UNIQUE EDUCATIONAL PARTNERSHIP

TAIPEI, TAIWAN The WCLI and Taipei Medical University College of Oral Medicine (TMU) announced a formal partnership in late 2013 to provide higher education in dental laser technology – and now, almost a full year later, the program is proving to be a success for both parties.

Originally, TMU and the WCLI partnered to provide WCLI-based dental laser continuing education to TMU alumni and other dental professionals in the Asia-Pacific region. Courses and clinical content are taught by several of the WCLI's most prominent international educators. Participants in the courses become eligible for Mastership Certification within the organization. Each hour of coursework in laser education at TMU is eligible for dental continuing education credits.

"The partnership between the World Clinical Laser and Imaging Institute and Taipei Medical University has been a major step toward advancing laser education to dental professionals, both academically and in global stature. We have enjoyed a very productive relationship, which has been mutually beneficial and provided significant opportunities to both parties," said Dr. Walinski, Executive Director of the WCLI.

Future projects between TMU and WCLI include the creation of a graduate school program exclusively focused on laser dentistry, as well as joint programs intended to advance the field of dental laser research, education and clinical training.

In addition, TMU and WCLI will collaborate in the promotion of Fellowship and Mastership Certifications offered through the WCLI, as well as share appointments, titles and qualifications between the two organizations. ■

ASIA-PACIFIC PARTNERSHIP Leaders of Taipei Medical University and the WCLI met in Taipei, Taiwan, in late 2013 to finalize details of a unique partnership to provide dental laser education to dentists in the Asia-Pacific region. (Picture left to right: Mr. Meighen Hu, Dr. James Chih-Chen Lee, Dr. Chris Walinski, Prof. Keng-Liang Ou and Dr. His-jen Chaiang.

WCLI MEMBER DENTISTS COMPLETE STEPS TO EARN ADVANCED-LEVEL CERTIFICATION FROM THE WCLI

After completing an intensive series of continuing education requirements, hands-on trials and oral and written examinations, the WCLI has granted advanced certification opportunities to members of the Institute.

Most recently the following dental professionals have qualified for Fellowship or Mastership Certification:

FELLOWSHIP CERTIFICATION

Dr. Naresh Shetty
Dr. Lin Han-Ju
Dr. Chen Wei-Tsung
Dr. Liao Tsung Hsuan
Dr. Ying Ying Nin
Dr. Yang He
Ms. Jenny Head, RDH
Ms. Katrina Newton, RDH
Ms. Heidi Christopher, RDH
Dr. Jerry Paz
Dr. Ford Gatgens
Dr. Yuan-Kai Lin
Dr. Barry Applegate
Dr. James Duncan
Dr. Jinno Takayoshi

MASTERSHIP CERTIFICATION

Dr. Linda Murzyn-Dantzer
Dr. Christopher Mast
Dr. Jennifer Matthews

Congratulations! For more information on WCLI Associate Fellowship, Fellowship and Mastership Certification please visit wcli.org or contact the WCLI directly at 1-800-616-1553.

Congratulations!

A PROSTHODONTIST'S FOCUS ON HIGH-TECH DENTISTRY ENSURES HE IS A DENTIST FOR ALL PATIENTS

MEET DR. STEVEN D. SPITZ, a Boston-based prosthodontist whose journey as a laser dentist began in 2002 with his first Er,Cr:YSGG laser and continues today with two thriving Boston practices and an approach to dentistry that serves all patients.

Within a short time of adding his first Er,Cr:YSGG laser, Dr. Spitz began creating protocols for YSGG-assisted implant dentistry and prosthodontic procedures. Today, in addition to his private practice, he is the assistant treasurer for the Massachusetts Dental Society, Metropolitan District, as well as international editor for the *Alpha Omegan*. In 2013, he was awarded the Alpha Omegan Certificate of Merit, one of the most prestigious awards presented to a member for outstanding and exemplary service at the international or chapter level.

When it comes to offering the best and most technologically advanced dentistry possible to his patients in the greater Boston area, Dr. Spitz has set himself apart. His innovative application of dental technology has resulted in honors and recognition among his peers, appointments at various educational institutions and a vibrant community of loyal patients. Lately, however, his technology-oriented dental approach is creating a legion of happy patients in the animal kingdom as well.

Dr. Spitz is a graduate of Tufts University School of Dental Medicine. He received his prosthodontic certificate at the Harvard School of Dental Medicine and served eight years as clinical professor within the departments of undergraduate and post-graduate prosthodontics. He is also the founder and principal of Smileboston Cosmetic and Implant Dentistry with offices in Brookline and Pembroke, Mass.

In recent years, Dr. Spitz is part of a team of veterinarians and dentists that performs dental work in wildlife sanctuaries and zoos around the country, helping to treat animals that are in pain and in serious need of dental care. Dr. Spitz recently partnered with Zoo New England as the dentist on call for both the Franklin Park Zoo in Boston and Stone Zoo in Stoneham, Mass.

Dr. Spitz took time out of his busy schedule to sit down with the *Journal of Laser-Assisted Dentistry* to discuss his origins as a dental professional, his love for technology (especially his multiple Er,Cr:YSGG lasers) and those lions, tigers and bears.

Q. *What made you decide to become a dentist?*

A. As a kid, I had always wanted to be in medicine. I had thought of veterinary medicine as my future and studied animal science as my undergraduate major. I worked in the veterinary field and realized it was not for me. I was introduced to dentistry by my uncle and fell in love with it. I am still in love with dentistry today.

Q. *How long have you been a laser dentist?*

A. I have been working with lasers for 12 years and have been an active member of WCLI for most of that time. In that time, I have attained Master status.

Q. *What would you say is the specific clinical focus of your practice?*

A. Smileboston is multi-specialty practice. However, dental implants and full-mouth rehabilitation are the main focus of my practice; it is what I truly love to do. It is the addition of lasers in my practice that allows me to work the way I do and, as a prosthodontist, provide both the prosthetic and surgical aspects to our patients. Dental lasers are a necessary and a perfect accessory for me.

A DENTIST FOR ALL PATIENTS
WCLI member Dr. Steven D. Spitz began his journey as a laser dentist in 2002 with his first Er,Cr:YSGG system. Within a short time, he began creating protocols for Er,Cr:YSGG-assisted implant dentistry and prosthodontic procedures. Today, in addition to his busy private practice, he teaches at Harvard School of Dental Medicine and is on staff at Franciscan Children's Hospital in Brighton, Mass.

"We are having a blast at Smileboston, and our lasers are a big part of that enjoyment..."

Q. *You have been very involved in laser dentistry and education. What would you say is your most noteworthy accomplishment as a laser dentist and what are you working on now?*

A. I was part of creating the first protocol for surgically placing dental implants and using the laser to remove the soft tissue and the cortical plate before using a drill. I am currently using the laser to open windows for lateral sinus lifts.

Q. *What is your favorite aspect of practicing dentistry?*

A. As cliché as it sounds, I like making a difference in my patients' lives. I know the treatment my team and I provide and the positive experience my patients have with dentistry in my office makes a difference.

Q. *In addition to your work on humans, we understand that you also take on some very special animal patients via your work with the Peter Emily International Veterinary Dental Foundation. Tell us more about that.*

A. Working with PEIVD is literally a dream come true. Early in my collegiate career, I contemplated attending either veterinary or dental school. In the end, I chose dental and it was absolutely the right decision for me. PEIVD allows me to use my dental knowledge and work in an amazing way for animals that need my expertise. I have performed dentistry on tigers, a bear, a kinkajou, a lemur, birds, an otter and a multitude of primates and other animals.

Q. *How have you applied laser dentistry to your work with animals?*

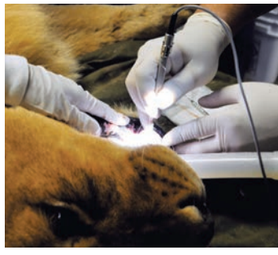
A. As BIOLASE gave me their veterinary laser prior to one of my trips, I became the first dentist to perform laser surgery on large animals. On a mission to the Exotic Feline Rescue Center in Indiana, one priority case was a lion that was in an extreme amount of pain with a vertical split in her tooth. The root was exposed and open to bacteria which could have quickly spread through the lion's entire body.

Treatment was painful for this animal and it was complicated surgery. However, the laser allowed for accurate treatment that would not have been possible in the same way without the laser. Finally, the financial difference has been huge because I am able to perform treatments more efficiently, which in turn frees up chair time at both of my practices, allowing me an opportunity to grow the number of patients I can treat. I am having a blast, and our lasers are a big part of that enjoyment.

Q. *How have lasers impacted your dental practice overall?*

A. Dental lasers have made a huge difference in my practice and have been a catalyst in making Smileboston the success it has become today. Lasers have allowed me to be more efficient and productive in performing treatment and to be kind to my patients, especially those with high fear. On top of that, the financial aspect is immeasurable as I am able to perform treatment much more efficiently. Utilizing the laser makes me more accurate, allows me to do more than one procedure due to the minimization of fluids and in the end reduces chair time, allowing me to increase the number of patients I can treat throughout the day, the week and the year. I love technology and enjoy dentistry every day. The technology of lasers and being part of expanding what lasers can accomplish are a big part of that enjoyment. ■

BOSTON-BASED PROSTHODONTIST HELPS A FEW FURRY FRIENDS
In his work with the Peter Emily Foundation, Dr. Spitz is part of a team of dentists and veterinarians who perform dentistry for animals in need at zoos and wildlife parks across the nation. Dr. Spitz was the first dentist to perform laser dental surgery on a captive tiger.



Courtesy Dr. Steven Spitz

SHOWING TEAM SPIRIT IN BOSTON
Dr. Spitz with Boston Red Sox slugger David Ortiz is currently the team dentist for the world champion Boston Red Sox, serving the dental needs of Red Sox players and personnel.

A MAN OF MANY FIRSTS IS BLAZING A TECHNOLOGY TRAIL IN SOUTH FLORIDA

MEET ROBERT MILLER, DDS, a pioneering dentist who deploys the latest technology to improve his practice of implantology and is often seen educating fellow dentists from the podium at laser and implant conferences worldwide.

AN EARLY ADOPTER OF MANY DENTAL TECHNOLOGIES

ABOVE: Founding WCLI member Dr. Robert Miller poses with the first-ever Er,Cr:YSGG laser in the U.S. and the first-ever Newtom 3D cone beam system in the U.S.

A LEADER IN DENTAL education, especially in the field of implantology, Dr. Robert Miller, has dedicated his life to the advancement of dentistry. And it suits him just fine. Dr. Miller openly shares that his life-long dedication to his profession has been an incredible and wonderful journey – and he's not done yet.

In addition to running his own practice, The Center for Advanced Aesthetic and Implant Dentistry in Delray Beach, Fla., Dr. Miller is Chairman of the Department of Oral Implantology at the Atlantic Coast Dental Research Clinic at Palm Beach State College. He is Board Certified by the American Board of Oral Implantology/Implant Dentistry (ABOI), a Diplomate of the International Congress of Oral Implantologists (ICOI), a Fellow of the Academy of Osseointegration (AO), an Honored Fellow of the American Academy of Implant Dentistry (AAID) and Fellow of the American College of Dentists (FACD). He has been named one of the Top 100 Leaders in Continuing Education by *Dentistry Today* magazine. Dr. Miller is a founding member of WCLI and one of its most sought after lecturers. As such, we felt that it was fitting to profile Dr. Miller for our inaugural issue of JLAD.

Q. *How long have you been a laser dentist?*

A. I completed my first accredited laser course using Nd:YAG at the Florida National Dental Congress in 1990 under the direction of Dr. Robert Pick. This year represents my 24th year as a laser clinician using multiple wavelengths.

Q. *What is your favorite aspect of practicing dentistry?*

A. While I am in general practice and enjoy many different aspects of our clinical endeavors, for the past 30 years I have maintained a particular emphasis in oral implantology. We have been at the forefront of helping to develop laser-assisted protocols in implant surgery and reconstruction.

Q. *What specific laser wavelengths have you used in daily private practice?*

A. The primary wavelength that I use clinically for both hard and soft tissue is 2780nm. However, I also utilize 810nm, 940nm, and 1064nm lasers for specific soft tissue procedures.

"We are leaving the era of mechanical manipulation of tissue and entering the era of biologics."

Q. *Please list a few noteworthy accomplishments as a laser dentist?*

A. A specific example of how lasers save time in my practice is during impression-taking for both implants and natural teeth. On occasion, a patient may present with bleeding or hyperplastic tissue at the impression appointment. Rather than reappointing them, I prefer to use either the erbium or diode laser to remove the hyperplastic tissue and achieve outstanding hemostasis, allowing us to complete the procedure in a timely fashion.

Q. *What is your favorite part of being a member of the* WCLI?

A. Without question being able to interact with some of the finest laser clinicians in the world is certainly the most rewarding. Much of the brainstorming for new laser protocols comes from sharing information from our practices and collating data from our procedural base. Much of this information has become the foundation for FDA clearances for most of the laser procedures we perform today.

Q. *Why do you believe lasers are a breakthrough tool for dentistry?*

A. We are leaving the era of mechanical manipulation of tissue and entering the era of biologics. Part of our paradigm of treatment is to not only complete procedures in a more minimally invasive manner, but to also compress treatment time and to prevent infections from interfering with our clinical outcomes.

Q. *How have lasers impacted your dental practice overall?*

A. Laser surgery has become an effective validator of the high-tech vision for my practice. My clinical outcomes, the comfort experienced by my patients post-operatively and the patient's impression that we are at the cutting edge in our profession is fundamentally the most rewarding part of a decision made years ago when we incorporated this technology.

Q. *What is your current favorite laser procedure?*

A. Currently the laser procedure I use most often is debridement of the infected extraction site at the time of implant placement. I find this to be an incredibly effective protocol for removing granulomatous tissue apical cysts, remnants of periodontal ligament and achieving good decortication of bone – absolute requirements for successful implant outcomes.

Q. *What are your hobbies and interests outside of dentistry?*

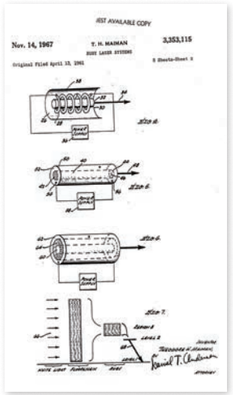
A. When I am not practicing dentistry, you can find me at my second home in Colorado, where I am an avid hiker, skier, biker and mountaineer. However, when the sun goes down it's time to play my guitar and perform with my musician friends. In fact, one of my personal highlights of WCLI meetings is playing in the WCLI band, The Hydrophotonics. We have performed all over the world at WCLI meetings and I am constantly amazed at how talented our members are. ■

FROM PODIUM TO WHEATIES BOX

TOP: Dr. Robert Miller is regularly featured as a speaker at implant, technology and dental conferences around the world.

LOWER: In 2010, William Brown, then Executive Director of the WCLI, presents Dr. Miller a personalized box of the Breakfast of Champions at an awards ceremony.

INTRODUCING THEODORE MAIMAN
THE FATHER OF MODERN LASERS IN DENTISTRY



WITH A STRONG DESIRE TO PROVE HIS COLLEAGUES WRONG, a California scientist designs a laser that emits mankind's first coherent light in 1960.

THEODORE MAIMAN may not be a household name to most dentists – but the American engineer and physicist is credited with the invention of the first working laser. His trailblazing work led to the 1960 breakthrough design of a synthetic ruby crystal that emitted the first-ever instance of coherent light, with rays all the same wavelength and fully in phase.

Maiman was born in Los Angeles, Calif. After serving in the navy at the end of World War II, he began his collegiate journey, earning an undergraduate degree from University of Colorado. He then pursued graduate studies, capping a four-year run at Stanford where he earned a master's of science in Electrical Engineering and a PhD in Physics.

From 1955 to 1958 he worked for Hughes Research Laboratories in California, where he led the ruby MASER design project for the U.S. Army Signal Corps. His task? Reducing a 2.5 ton cryogenic device to 4 pounds while improving its performance.

In 1958, while Maiman was still working at Hughes, a group scientists who had been focusing on further MASER innovation published a paper that documented a new type of system using potassium vapor excited by a potassium lamp.

Maiman's ingenuity and success with his MASER project set him up to obtain funding in 1959 to support a research project on a new "LASER" device. Maiman received $50,000 of government backing to develop his own solid-state LASER design. Maiman's new laser required the fabrication of a synthetic ruby crystal which would be used as the light source in lieu of a potassium lamp. Fellow scientists discounted Maiman's efforts and did not believe he would be successful. Later that year, however, Maiman astonished his critics and proved them wrong when he published his invention and documented its practical applications in N*ature* magazine in late 1959.

Even though Maiman's work did not begin in earnest on his ruby laser project until 1959, he had been filling notebooks with sketches and ideas for years. His work focused on moving the microwave frequency of MASERS up the electromagnetic spectrum, which required him to find a workable lasing medium and method of excitation and to design the overall system itself. According to records, other major research groups at IBM, Bell Labs, MIT, Westinghouse, RCA and Columbia University were also pursuing similar laser projects.

Today, more than 50 years later, Maiman's work has been recognized as one of the most important inventions of the last 100 years. Many academic competitions, foundations and other organized bodies celebrate Maiman's invention on an annual basis. In fact, the 50th anniversary of Maiman's invention is celebrated as LaserFest with numerous celebratory events staged around the world by major scientific and photonics organizations.

Dr. Maiman's work has had a major impact on dentistry, with lasers continuing to advance patient comfort, minimally invasive surgery and enhanced clinical results. ▯

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