JLAD

JOURNAL OF LASER-ASSISTED DENTISTRY

Focal Point

Understanding Dental Analgesia for Laser Tooth Preparations

Page 13

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FOCAL POINT

Understanding Dental Analgesia

One of the keys to laser dentistry is successfully achieving laser analgesia so that procedures are comfortable and pain-free. In our Focal Point feature, Dr. John Hendy provides an overview of dental analgesia and explains how laser energy affects the behavior of neurons, which blocks pain signals to the brain.

SEE THE FULL STORY ON PAGE 13

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Dr. Glenn van As shares five tips for improving laser restorative predictability.

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MASTERING MINIMALLY INVASIVE HARD-TISSUE PROCEDURES

When I am out in the general population of dentists, I find that I get asked one question more than others: "What about lasers for hard tissue; are they ready yet?" It just fascinates me that the perception of lasers has advanced dramatically over the years; yet the question about hard-tissue use of lasers seems to persist. I don't know if that is because we have done a poor job communicating hard-tissue applications or that when dentists find out that using a laser for hard tissue is quite different than using a handpiece, some are reluctant to fully commit to acquiring the new skills to be successful. It is most likely a combination of both (but it is easier to blame it on the laser).

So in this, our second issue of *Journal of Laser-Assisted Dentistry* (JLAD) we wanted to put forth some of the latest information, research findings, techniques and tips about hard-tissue laser use, from Dr. John Hendy's article, "Understanding Dental Analgesia of Tooth Preparations" and Dr. Linda-Murzyn's "First Take" on research she is currently conducting at the Children's Hospital at the University of Colorado to expert techniques and tips from laser experts Drs. Glenn van As and Jose Marcano. This issue of JLAD is dedicated to communicating helpful information about hard-tissue laser dentistry.

In addition to our editorial focus on hard tissue, we've also included our regular features: WCLI news and events, profiles of two up-and-coming WCLI members and Maiman's Vault, where we sat down with a laser scientist to discuss his view on the future of lasers in dentistry and medicine. I think you'll find his predictions quite interesting and thought-provoking.

From the entire Editorial Board, we hope you enjoy the issue and we welcome your suggestions for improving the publication or for articles or research summaries that you would like to see in future issues. Here's to laser dentistry advancing dental care across the globe — and to a future with almost unlimited possibilities for you and your patients!

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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.

COVER IMAGE
Laser analgesia affects neurons that transmit pain signals to the brain. It is because of this effect that laser ablation is perceived as painless by the patient. Our cover represents the synergy of dental analgesia and hard-tissue ablation to create a more comfortable restorative dental experience.

PERIODONTITIS PROTOCOL
Step 3: De-epitheliaization
and retraction (JLAD, Vol. 1, No. 1)

LETTERS TO THE EDITOR

THE EDITORIAL STAFF OF THE JOURNAL OF LASER-ASSISTED DENTISTRY was pleased to receive positive feedback about the WCLI's inaugural issue of *Journal of Laser-Assisted Dentistry*. To those who wrote in or emailed us, thank you! We encourage readers to email us with their viewpoint, and will endeavor to cover topics that are of interest to you. Whether you are new to laser dentistry or a Master, we'd like to hear from you!

Christopher J. Walinski, DDS, Editor
chris@wcli.org

If you would like to contribute your comments or suggestions, please write to the *Journal of Laser-Assisted Dentistry* via email at:

info@wcli.org

I LOVE THE FIRST ISSUE OF JLAD! WELL DONE.

I think it is a great step for the WCLI to commit to providing laser dentists with a continuing stream of information about laser dentistry research, technique and WCLI news. Count me in as an interested and enthusiastic contributor.

Bruce L. Cassis, DDS
Fayetteville, West Virginia

Dr. Cassis,
Thank you so much for the uplifting words! We have received a good deal of positive feedback about our first issue. We are just getting started and hope to get better and better. We are striving to achieve a good balance of information for our readers, and we are committed to tapping into leading expertise — like yours! We look forward to collaborating with you and other willing contributors in upcoming issues.

SETTINGS WILL ALWAYS BE A CONTENTION.

Congratulations on the first issue of *Journal of Laser-Assisted Dentistry*. I think the publication looks great and I think it will help better inform BIOLASE laser dentists — helping to contribute to their success. As you publish technique articles, it will be interesting to read about the settings being used. Settings will always be a point of contention, but I'm eager to hear and learn about others' feedback.

Todd J. Morton, DDS
Ballwin, Missouri

Dr. Morton,
We are also looking forward to hearing more about what the readers think about various techniques and the settings used. We have some good technique articles in this issue, so if you or anyone wants to provide feedback, we are happy to receive it. Send feedback to: chris@wcli.org.

SUPER! I'M LOOKING FORWARD TO MORE.

I just received my first issue of *Journal of Laser-Assisted Dentistry*. Super job! I am looking forward to more — and to contributing to the growing knowledge of laser users.

Stewart Rosenberg, DDS
Laurel, MD

Thank you Dr. Rosenberg. Coming from you that means the world to the editorial team. We thank you for your help and guidance and look forward to collaborating with you on an upcoming issue.

EXCITED TO PUT THE PERIO PROTOCOL TO WORK. CAN I FIND IT ONLINE?

I encounter a lot of perio cases in my general practice and the new protocol published in the first issue of JLAD will be very helpful for my patients. I have a few perio patients on my schedule next week. However, I cannot find my copy of JLAD anywhere! I want to read more on the protocol and investigate the best approach. Where can I get another copy of JLAD?

James Jesse, DDS
Colton, CA

Dr. Jesse, we are glad to hear you are excited about putting the new periodontal protocol to work in your practice. Let us know how your patients respond! In the meantime, if you've misplaced your issue of JLAD, *you can always access it online at: www.learnlasers.com/jlad*

REALLY INFORMATIVE. HOW DO I RECEIVE FUTURE PUBLICATIONS?

I just received the new publication, *Journal of Laser-Assisted Dentistry*. This is a much needed journal and I am excited to see that WCLI has launched it. I have already shared JLAD with a number of my laser customers and even non-laser customers, and they all responded as I do: "This is a journal we need. Really informative and great stuff. How do I continue to receive future publications?"

Kevin Tuckman
Territory Manager, Bay Area & Central CA
BIOLASE

Kevin,
We are excited that you are hearing positive things! As for how you receive future publications, the best way is to access JLAD *at wcli.org. It's free for anyone, so all members of the practice team — dentists, hygienists, assistants — can have access to* JLAD *information and articles at their fingertips.*

Make plans today to join the world's largest dental laser education organization at an international symposium to learn about the latest clinical techniques and experience laser technology hands-on.

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LASER EFFICACY FOR BONDING AND REDUCED MICROLEAKAGE

RESEARCHERS COMPARE Er,Cr:YSGG cavity preps with diamond bur preps to investigate bond strength and microleakage.

1. LEADING JOURNAL IN EUROPE

The *European Journal of Dentistry* (EJD) is the official quarterly journal of the Dental Investigations Society. EJD is a multidisciplinary peer-reviewed dental journal publishing articles in the field of general dentistry. The journal is indexed with the world's leading peer-reviewed journal indices, including PubMed, EBSCO and many others.

2. UNDERSTANDING BOND STRENGTH

Through the years some researchers have shown improved bond strengths for traditional composite restorations after using an Er,Cr:YSGG laser for tooth preparation. To confirm this, researchers set out to compare the microleakage and bond strength of Class V composite restorations prepared with a bur or with an Er,Cr:YSGG laser.

3. PROSTHODONTIST-LED RESEARCH TEAM

Dr. Faith M. Korkmaz, a prosthodontist at Karadeniz Technical University in Trabazon, Turkey, led the study research team. In journals worldwide Dr. Korkmaz has been named on many published studies related to advances in restorative and aesthetic dentistry. The study also included two other prosthodontists and two pediatric dentists, all hailing from the same Turkey-based university faculty.

4. MATERIALS AND METHODS

A total of 160 molar teeth were used for microleakage assessment and the shear bond strength test. The specimens were prepared using either diamond burs or the Er,Cr:YSGG laser at various power levels. All samples were subjected to traditional thermocycling methods. Microleakage was assessed using a 0.5% basic fuchsin solution. The bond strengths were determined using a microtensile tester at a crosshead speed of 0.5 mm/min. The Kruskal–Wallis test was used for the analysis of microleakage and a one-way analysis of variance test was used to analyze the shear bond strength.

5. EFFECTIVE VS. TRADITIONAL METHODS

Within the limitations of this in vitro study, the results showed that composite restorations prepared with the Er,Cr:YSGG laser at various power levels resulted in similar bond strength and microleakage compared to those that used a diamond bur.

Original Article

The effect of an erbium, chromium: yttrium-scandium-gallium-garnet laser on the microleakage and bond strength of silorane and micro-hybrid composite restorations

3 Fatih Mehmet Korkmaz[1], Ozgul Baygin[2], Tamer Tuzuner[2], Bora Bagis[3], Ipek Arslan[2]

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ABSTRACT

4 **Objective:** The aim of this *in vitro* study was to compare the microleakage and bond strength of Class V silorane-based and universal micro-hybrid composite restorations prepared either with diamond bur or with an erbium, chromium: yttrium-scandium-gallium-garnet (Er, Cr:YSGG) laser. **Materials and Methods:** A total of 160 molar teeth were used for microleakage assessment and shear bond strength (SBS) test. The specimens were prepared using either diamond bur or 3 W-, 4 W- and 5 W-20 Hz Er, Cr:YSGG laser irradiation. All specimens were subjected to thermocycling (500 times at 5 ± 2°C to 55 ± 2°C, dwell time 15 s and transfer time 10 s). Microleakage was assessed using a 0.5% basic-fuchsin solution. The bond strengths were determined using a microtensile tester at a crosshead speed of 0.5 mm/min. The Kruskal Wallis test was used for the analysis of microleakage and a one-way analysis of variance test was used to analyze the SBS ($P < 0.05$). **Results:** No statistically significant differences were found ($P > 0.05$) between Er, Cr:YSGG laser and bur preparation methods regarding microleakage and bond strength values. **Conclusion:** Irradiation with Er, Cr:YSGG laser was confirmed to be as effective as conventional methods for preparing cavities before adhesive restorations.

Key words: Diamond bur, erbium, chromium: yttrium-scandium-gallium-garnet laser, micro-hybrid composite, silorane

INTRODUCTION 2

Restorative composite resins have undergone continuous development during recent decades. Although the current composites exhibit excellent physical resistance and esthetic properties, there are still several problems related to shrinkage during polymerization and bacterial invasion.[1] Siloranes are popular restorative materials that have been synthesized to overcome the problems related to the polymerization shrinkage.[2-5] The manufacturer recommends this material to reduce the risk of post-operative sensitivity, cusp deflection and enamel cracks.[1,2,5]

5 In the field of dentistry, there has been growing interest in the use of lasers for various applications, including cavity preparation, due to their ability to efficiently remove dentin and enamel.[6-8] The erbium, chromium: yttrium-scandium-gallium-garnet (Er, Cr:YSGG) laser has been used in a clinical setting to prepare cavities; it provides the same clinical effectiveness compared with bur, but reduces pain and discomfort by eliminating pressure and intense vibration. Furthermore, the Er, Cr:YSGG laser provides a more conservative method for cavity preparation that is associated with minimal injury to the pulp, less noise and in most cases, a significantly reduced need for local anesthesia.[7,9-11]

How to cite this article: Korkmaz FM, Baygin O, Tuzuner T, Bagis B, Arslan I. The effect of an erbium, chromium: yttrium-scandium-gallium-garnet laser on the microleakage and bond strength of silorane and micro-hybrid composite restorations. Eur J Dent 2013;7:33-40.

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1

LASER SHOWS EFFICACY IN THE TREATMENT OF PERI-IMPLANTITIS

A RETROSPECTIVE CLINICAL ANALYSIS of implants using an Er,Cr:YSGG laser demonstrates statistically significant results.

1. THE OFFICIAL JOURNAL OF THE BRITISH DENTAL ASSOCIATION

According to the publication's website, the "role of the *British Dental Journal* is to inform its readers of ideas, opinions, developments and key issues in dentistry." All papers published in the BDJ are subject to rigorous peer review.

1 Treatment outcome following use of the erbium, chromium:yttrium, scandium, gallium, garnet laser in the non-surgical management of peri-implantitis: a case series

IN BRIEF
- Highlights that successful treatment of peri-implantitis is unpredictable and usually involves the need for surgery.
- Outlines a minimalistic treatment approach for peri-implantitis with promising results after six months.
- Suggests that the protocol described may be of use in a pilot study or controlled clinical trial.

RESEARCH

2 R. Al-Falaki,*[1] M. Cronshaw[2] and F. J. Hughes[3]

VERIFIABLE CPD PAPER

3 **Aim** To date there is no consensus on the appropriate usage of lasers in the management of peri-implantitis. Our aim was to conduct a retrospective clinical analysis of a case series of implants treated using an erbium, chromium:yttrium, scandium, gallium, garnet laser. **Materials and methods** Twenty-eight implants with peri-implantitis in 11 patients were treated with an Er,Cr:YSGG laser (68 sites >4 mm), using a 14 mm, 500 µm diameter, 60º (85%) radial firing tip (1.5 W, 30 Hz, short (140 µs) pulse, 50 mJ/pulse, 50% water, 40% air). Probing depths were recorded at baseline after 2 months and 6 months, along with the presence of bleeding on probing. **Results** The age range was 27–69 years (mean 55.9); mean pocket depth at baseline was 6.64 ± SD 1.48 mm (range 5–12 mm),with a mean residual depth of 3.29 ± 1.02 mm (range 1–6 mm) after 2 months, and 2.97 ± 0.7 mm (range 1–9 mm) at 6 months. Reductions from baseline to both 2 and 6 months were highly statistically significant (P <0.001). Patient level reduction in bleeding from baseline to both 2 and 6 months were statistically significant (P <0.001). **Conclusion** In view of the positive findings in this pilot study, well-designed randomised controlled trials of the use of Er,Cr:YSGG laser in the non-surgical management of peri-implantitis are required to validate our clinical findings.

4 INTRODUCTION

Peri-implant mucositis and peri-implantitis are destructive inflammatory conditions that are mainly initiated by bacterial insult.[1] Pathogens form as a biofilm that activates inflammatory cells which then release cytokines and enzymes that are harmful to the surrounding tissues.[2] The role of plaque in the disease process is well documented.[3–7]

A number of studies have reported that the optimum outcome in the reduction of probing depth (PD), clinical attachment level (CAL) and bone levels in association with peri-implant osseous defects was achieved by surgery in conjunction with augmentative products including natural bone material and barrier membranes.[8,9] However, an ideal method to decontaminate the infected implant surface has not been determined.[10–12]

A variety of methods of implant decontamination have been proposed. There are many published studies showing the effective mechanical and bacterial debridement by laser application of contaminated titanium implant surfaces in *in vitro* studies.[12–14] Laser applications to debride contaminated implant surfaces in the erbium wavelengths of 2,940 nm and 2,780 nm have been subject to animal and a limited number of clinical studies.[15–20] Erbium laser energy of these wavelengths is capable of ablating and vaporising residual organic debris, including microbial plaque, and has been found to be able to disinfect and remove the peri-implant pocket's sulcular lining.[21]

To date, however, there is no consensus on the appropriate use of lasers in the management of peri-implantitis. A recent systematic review and meta-analysis of the ErYAG 2,940 nm laser concluded that the current evidence base supported the use of the ErYAG laser to reduce inflammation although there was no evidence to support a significant reduction in CAL or PD.[22] There are at present only a few clinical studies reporting on the efficacy of the 2,780 nm ErCrYSGG laser in the management of peri-implantitis.[23–25]

Surgical intervention to treat infrabony defects around implants may involve the use of regenerative materials and barrier membranes.[26] The difficulty of adequately debriding the contaminated implant surface, as well as the removal of associated granulation tissue, poses a serious problem which can result in treatment failure.[27,28] Recent reviews and meta-analyses of the evidence base on the adjunctive use of lasers in the non-surgical management of peri-implantitis have failed to show an advantage over other non-surgical approaches, and none over surgical approaches. Also the current consensus view is that the non-surgical management of peri-implantitis associated with and without infrabony defects is an unpredictable treatment modality.[8–10,22,29]

There are relatively few reports in the literature of the application of the ErCr:YSGG laser in the non-surgical and surgical management of periodontitis.[29–33] However, the studies on record to date demonstrate that pocket depths around infected teeth typically halve after a single application of the 2,780 nm laser in a non-surgical protocol.[30–32] This technique involves the removal of granulation tissue from the lining of the infected pocket, root surface debridement and de-epithelialisation, all achieved by the application of 500 µm diameter 60° zirconium radial firing periodontal tips (Biolase Technology, Inc., San Clemente, CA).

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2. GROWING TREND

The interest in various dental laser devices and wavelengths and their efficacy in treating peri-implantitis is a growing field of discussion and interest throughout the dental profession. The Er,Cr:YSGG laser, one of the most successful medical or dental lasers in terms of the number of devices in the field, is emerging in the research as an effective wavelength.

3. REAL-WORLD RESEARCH

Dr. Rana Al-Falaki and Dr. Mark Cronshaw maintain private dental practices in the United Kingdom and performed the cases referenced in their report. Dr. Al-Falaki has previously published several papers and made significant contributions to numerous peri-implantitis research projects. Co-author Dr. F.J. Hughes hails from the Department of Periodontology at Kings College London Dental Institute.

4. MATERIALS AND METHODS

Twenty-eight implants with peri-implantitis in 11 patients were treated with an Er,Cr:YSGG laser (68 sites with probing depths greater than 4 mm), using a 14 mm, 500 µm diameter, 60° (85%) radial firing tip at settings of 30 hertz, 1.5 watts, 50% water, 40% air, short (140 µs) pulse and 50 mJ/pulse. Probing depths were recorded at baseline after 2 months and 6 months, along with the presence of bleeding on probing.

5. RESULTS

Age range was 27 to 69 (mean: 55.9). The mean pocket depth at baseline was 6.64 ± SD 1.48 mm (range 5-12 mm) with a mean residual depth of 3.29 ± 1.02 mm (range 1-6 mm) after 2 months and 2.97 ± 0.7 mm (range 1-9 mm) at 6 months. Reductions from baseline to both 2 and 6 months were highly statistically significant (P <0.001). Reduction in bleeding from baseline to both 2 and 6 months was statistically significant (P <0.001).

Continued on opposite page

OVERVIEW OF STUDY

The successful treatment of peri-implantitis is unpredictable and usually involves the need for surgical intervention as well as augmentative products such as grafting material and barrier membranes. To date, however, an ideal method to treat peri-implantitis has not been determined. As such, many proposed treatment methods have been employed.

One such treatment method involves the application of lasers to debride contaminated implant surfaces, specifically lasers in the erbium wavelength of 2,940 nm and 2,780 nm. These have the been the subject of animal studies as well as a limited number of clinical studies showing promising results.

This study reports on a clinical case series followed over 6 months and retrospectively analyzed. The 2,780 nm Er,Cr:YSGG laser was used in a minimally invasive approach using novel radial firing tips 500 microns in diameter and measuring 14 mm in length.

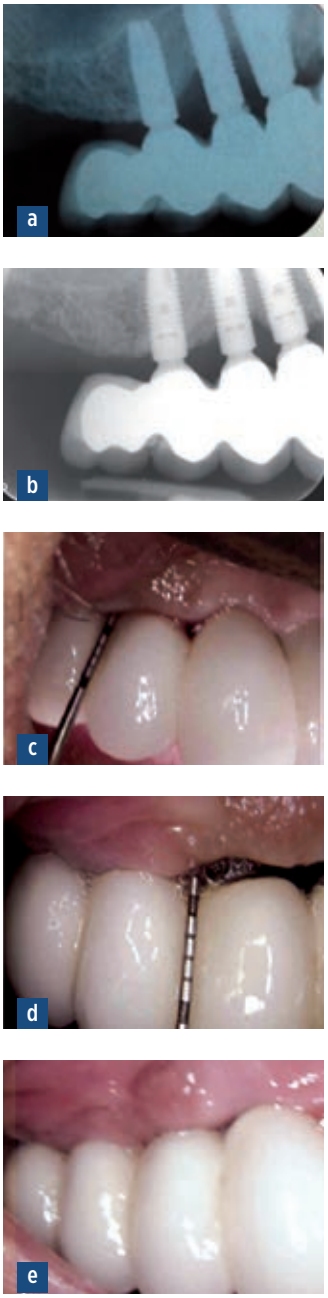
STUDY RESULTS

The case report states: "The results of this study demonstrate that treatment resulted in the resolution (<4 mm) of 91% of sites, and unresponsive outcomes in only 3 of 28 implants, none of the latter having keratinised tissue around them, which may have been a factor in affecting plaque control in these cases. In addition, by 6 months, 10% of total pockets were bleeding on probing."

The paper continues: "The use of Er,Cr:YSGG laser as a nonsurgical aid to the management of peri-implantitis seems to be effective in the majority of cases in this analysis, allowing for the limitations within the study. It is also of interest that sequential non-standardized radiographs suggest some infill of bone with fewer threads exposed, although this was quite minor and therefore possibly worthy of further study or follow-up over a longer period of time. In addition over a period of observation of 14 months, authors observed a degree of creeping reattachment (case 1), with less recession and implant exposure over time."

STUDY CONCLUSION

The results of this study are impressive and are sufficiently supported by statistical analysis to form the basis of a solid hypothesis. In view of the "excellent results gained in this pilot study," well-designed randomized controlled trials of the use of Er,Cr:YSGG laser in the nonsurgical management of peri-implantitis would be beneficial in order to validate the clinical findings of this research paper. ■



PRE- AND POST-RADIOGRAPHS

RIGHT: One of the 11 cases analyzed for this study is representative of the study's overall conclusions. Radiographs taken before (**a**) and after 14 months (**b**) suggest bone fill of 2 threads on distal and 2 threads on mesial aspect of #12 implant. (**c**) An intraoral photograph showing 8 mm pocket on distal of #14 implant before treatment, and (**d**) 3 mm probing depth two months later, along with recession. (**e**) Creep back of tissues 14 months later with less recession in region of #14.

LASER IRRADIATION IMPROVES ACID RESISTANCE OF ROOT DENTIN

RESEARCHERS BREAK NEW GROUND with a study in the *Journal of Applied Oral Science*.

1. PEER-REVIEWED PUBLICATION

The *Journal of Applied Oral Science* is published every two months by the prestigious Bauru School of Dentistry at the University of Sao Paulo in Brazil. The goal of the journal is to "publish results from original research as well as invited case reports and invited reviews in the field of dentistry and related sciences areas."

www.scielo.br/jaos
http://dx.doi.org/10.1590/1678-775720130570

The combined use of Er,Cr:YSGG laser and fluoride to prevent root dentin demineralization

3 **Vinicius Rangel GERALDO-MARTINS[1], Cesar Penazzo LEPRI[1], Juliana Jendiroba FARAONI-ROMANO[2], Regina Guenka PALMA-DIBB[2]**

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Submitted: October 31, 2013 - Modification: June 27, 2014 - Accepted: July 2, 2014

ABSTRACT

2 The use of erbium lasers to prevent caries in enamel has shown positive results. However, it is not known if Er,Cr:YSGG laser can also be used to increase acid resistance of root dentine, which is another dental tissue susceptible to the action of cariogenic bacteria. Objective: To analyze the effects of the Er,Cr:YSGG laser (λ=2.78 µm, 20 Hz) irradiation associated with 2% neutral sodium fluoride (NaF) to prevent root dentin demineralization. Material and Methods: One hundred human root dentin samples were divided into 10 groups (G) and treated as follows: G1: no treatment; G2: NaF; G3: laser (4.64 J/cm²) with water cooling (WC=5.4 mL/min); G4: laser (4.64 J/cm²) without WC; G5: laser (8.92 J/cm²) with WC; G6: laser (8.92 J/cm²) without WC; G7: laser (4.64 J/cm²) with WC and NaF; G8: laser (4.64 J/cm²) without WC and NaF; G9: laser (8.92 J/cm²) with WC and NaF; G10: laser (8.92 J/cm²) without WC and NaF. The NaF gel was applied alone or after 4 min of irradiation. After 14 days of acid challenge, the samples were sectioned and the Knoop microhardness (KHN) test was done at different depths (30, 60, 90 and 120 µm) from the outer dentin surface. Data were analyzed by one-way ANOVA and Fisher's test (α=5%). Results: The results showed that G8 and G10 presented higher KHN than the G1 for the depths of 30 and 60 µm, indicating an increase of the acid resistance of the dentin in up to 35% (p<0.05). Conclusions: The use of Er,Cr:YSGG laser irradiation at 4.64 J/cm² and 8.92 J/cm² without water cooling and associated with 2% NaF can increase the acid resistance of human root dentin.

4

Keywords: Lasers. Fluorides. Hardness. Dentin.

INTRODUCTION

The increase in lifespan associated with the development and application of preventive dentistry concepts have contributed to the maintenance of the teeth in the oral cavity of elderly population. This dental longevity is accompanied by an increasing frequency of exposed root surfaces as a result of periodontal diseases, mechanical injury and/or surgical treatments. When dentin exposition is combined with some situations common to senility, such as reduced salivary flow due to diseases or drugs and the inability to have proper oral hygiene, associated with biofilm accumulation on tooth surfaces, increase the risk of root caries occurrence[4]. Epidemiological studies have shown that the incidence and prevalence of root caries in elders are high. Recent studies pointed out that almost half of the community-dwelling elders had root caries, which indicates the need of preventing this disease in this population[7].

Since root caries is caused, among other reasons, by a bacterial biofilm that adhere to exposed root surfaces, carious lesions can be prevented or even inactivated through the adoption of preventive actions such as the reduction of carbohydrate intake, biofilm control, oral hygiene instruction and the use of fluoride compounds[16]. Researchers have shown that oral hygiene with fluoride compounds and the incorporation of fluoride

5

2. EXPANDING THE Er,Cr:YSGG LASER'S CLINICAL BENEFITS

The use of Er,Cr:YSGG lasers to prevent caries in enamel has shown positive results. Researchers sought to determine whether the Er,Cr:YSGG laser could also be used to increase the acid resistance of root dentin, which is a central factor in the reduction of subgingival caries and decay.

3. DISTINGUISHED RESEARCHERS

Led by Dr. Vinícius Geraldo-Martins, the authors of this paper have also been individual contributors to more than 40 other published reports regarding the clinical efficacy of Er,Cr:YSGG and Er:YAG laser wavelengths, including a paper released in 2013 on the acid resistance of enamel treated with the Er,Cr:YSGG laser.

4. SOLID STUDY DESIGN

The study design used 100 root dentin blocks from the buccal and lingual surfaces of extracted human molars. The specimens were randomly assigned to 10 test groups according to the surface treatment. The mechanism for measuring variability in hardness is the longitudinal Knoop hardness test.

5. INCREASED ACID RESISTANCE

Based on the results of the study, it was possible to verify that the use of the Er,Cr:YSGG laser with water spray and 2% neutral sodium flouride promotes an increase in the acid resistance of root dentin.

HOW DO WE KNOW LASER CAVITY TREATMENT IS PAINLESS?

PEDIATRIC LASER DENTISTRY CAN BE more efficient, provide better outcomes, and provide a better treatment experience for patients. But how do we know it is painless?

By Linda Murzyn-Dantzer, DMD, MWCLI

PEDIATRIC DENTISTRY IS different than general dentistry. Children are different. They have an inability to localize and differentiate pain. They often can't communicate what they are feeling. Attention spans are short and time is of the essence. The longer they are in the chair, the more challenging performing dentistry can be.

Using a laser for pediatric dentistry can be more efficient, provide better dentistry and provide better outcomes for pediatric patients. One of the most gratifying experiences in practice is when I can provide treatment to my patient or relieve a painful problem and change the association of dentistry from being a fearful experience to a fun one because I used the laser.

Laser dentistry is a way to provide "no shot" dentistry for kids. This is a big selling point for patients and their parents, because, as we know, the fear of the shot and the pain of dentistry are some of the factors that prevent people from seeking and completing treatment.

With laser dentistry, not only are there less shots, but there is also no friction, vibration, or heat from a drill to cause discomfort. There is no doubt that laser dentistry allows me to perform minimially invasive conservative treatment with better outcomes and greater satisfaction for our patients.

SOFT-TISSUE LASER TREATMENT FOR PEDIATRIC PATIENTS

In our hospital-based practice the laser is utilized for a wide variety of soft tissue and surgical applications. Soft tissue applications include frenectomies, treatment of aphthous ulcers and removal of fibromas, mucoceles and other lesions. For orthodontics, gingivectomies and gingivoplasties are performed quite easily. We also perform exposure of developing teeth to aid in eruption or the placement of orthodontic appliances. Additionally, we find lasers quite helpful in preparing a tooth for extraction and achieving hemostasis at the completion of the procedure.

A study conducted by the Children's Hospital at the University of Colorado studied the relationship of pain to heart rate in pediatric patients undergoing cavity preps. The most striking result from this study is the high percentage of patients reporting a Wong-Baker pain score of zero.

We utilize lasers for periodontal therapy. Infected sulcular epithelium and granulation tissue from the gingival walls of the pocket can be removed with a laser and we can provide debridement and calculus removal. Some of our lasers provide a low level "biomodulation effect, which helps to speed healing or reduce postoperative discomfort.

Continued on page 10

LASER CAVITY TREATMENT

continued from page 9

The laser is my favorite choice for performing pulpotomies. It is thought to contribute to disinfection or bacterial reduction while achieving the necessary hemostasis and does not have the reaction potential of a chemical medicament such as formocresol. We have abandoned the use of formocresol in light of the success, ease and safety of the newer methods.

HARD-TISSUE LASER TREATMENT FOR PEDIATRIC PATIENTS

With the exception of amalgam removal and some crown preps, we prefer the laser as a gentler treatment modality for hard tissue. With kids, our hard tissue application is most commonly the prevention or treatment of dental caries. I am often asked, "How do we know the laser is comfortable for pediatric patients?" Many people think that laser dentistry is some kind of voodoo or expensive toy and they just don't believe laser analgesia works. Sometimes they have criticized that we are basing our claim of comfort on the fact that we are only considering treatment that was superficial and did not require anesthesia anyway, such as a sealant. That misconception motivated us to do a study at Children's Hospital of Colorado to measure heart rate to assess if there was pain during cavity preparations. We wanted to quantify this relationship better than in previous studies and try to make a correlation between the depth of the prep and the pain levels that were experienced.

PURPOSE: The purpose of the study was to quantitatively measure the patient's pain and anxiety during operative procedures using the Er,Cr:YSGG laser for low-level laser therapy (LLLT) and caries removal during Class I cavity preparation. In our study, we wanted to assure that the cavities we were prepping were actually in dentin, not just superficially in enamel.

METHODOLOGY: Children, ages of 5 to 12 years old were included in the study. All treatment was completed by the same pediatric dental resident. Caries was measured using the KaVo DIAGNOdent® pen 2190. Anesthesia and caries removal were achieved using the Er,Cr:YSGG laser at a power setting of 4.5 watts, 70% air, 40% water. Teeth were restored with 37% etch and a light-cured composite. Heart rate was measured throughout the entire procedure. A spike in heart rate that was two standard deviations above the mean was considered an event, signifying that the patient felt pain or was anxious about what they were feeling. Patients were also asked to rate their experience using the Wong-Baker FACES Pain Rating Scale.

RESULTS: Collected data comes from a total of 61 teeth. The median age of the patients was 8.35 years (range 5.02, 12.79). Of the 61 teeth 25 or 41.0% were primary teeth. The median KaVo DIAGNOdent® pen 2190 reading for the teeth treated was 34 (range 17, 99). Results from the Wong-Baker ratings had an average of 0.48 of a possible 10 for the 61 teeth. The responses ranged from 0 to 3 with 73.8% reporting 0 of a possible 10. With regard to the heart rate analysis, there were a minimal number of events during the actual time of treatment. We observed males having a lower number of events,

At the Children's Hospital pediatric dental practice, an Er,Cr:YSGG laser is utilized for a wide variety of soft tissue and surgical applications, including frenectomies, treatment of apthous ulcers and removal fibromas, mucoceles and other lesions.

SHOWN: Patient before and after frenectomy laser surgery.

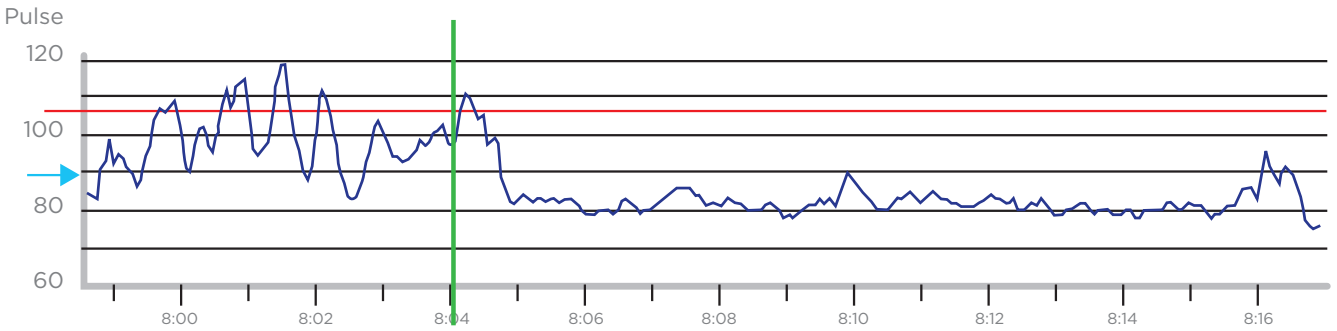

Fig 1. Example of HR analysis: Green line indicates when treatment was started. Red line indicates 2 SD above the mean. Blue arrow indicates the mean HR.

and for all patients there was a decrease in the number of events with increases in age. Work done on primary teeth was observed to have a greater number of events than work done on adult teeth, a result matching the observations with respect to age.

CONCLUSIONS: The most striking result from this work is the high percentage of patients reporting a Wong-Baker pain score of zero. Overall, it appears as if treatment with the laser resulted in essentially painless dental procedures. Due to the high percentage of zero pain responses, there is a limited amount of statistical inference that can be made. The lack of statistically significant associations between the odds of reporting pain does not mean there is no association, only that we were unable to detect a difference. Overall, for the whole study, the observed results suggest laser dentistry is nearly painless for the studied patients and that the heart rate spike metric for pain may not be apt.

The study supports the use of an Er,Cr:YSGG laser for cavity preparation with minimal discomfort or pain within the pediatric population. Due to limitations in the study, completing a similar study with a higher number of patients might allow for more precise statistical analysis of the correlation between a patient's level of pain and anxiety with the use of an Er,Cr:YSGG laser.

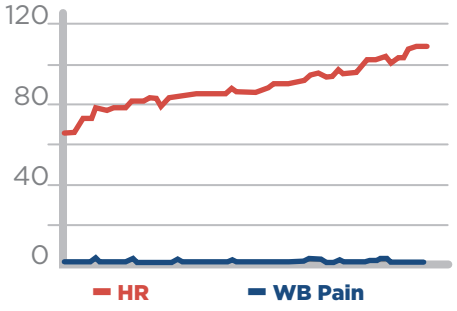

Fig 2. Graph showing relationship of reported Wong-Baker FACES Pain Scale to HR.

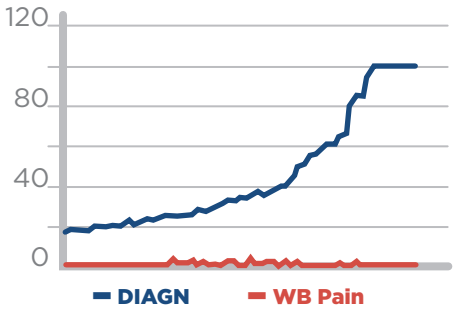

Fig 3. Graph showing relationship of reported Wong-Baker FACES Pain Scale as depth of caries increases.

ABOUT THE AUTHOR

Dr. Linda Murzyn-Dantzer started her career in dentistry as a dental assistant. After graduation from high school, she attended Forsyth School for Dental Hygienists in Boston, Massachusetts, and received a certificate in dental hygiene and an associate degree from Northeastern University. She went on to receive her DMD from the Harvard School of Dental Medicine. Dr. Murzyn-Dantzer completed her pediatric dental residency at the University of Michigan and is a Diplomate of the American Board of Pediatric Dentistry. She is currently an assistant professor at the University of Colorado and a full-time faculty member at Children's Hospital Colorado in the Denver area. Dr. Murzyn-Dantzer has attained Mastership Certification in the WCLI. ■

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UNDERSTANDING LASER ANALGESIA **OF TOOTH PREPARATIONS WITH ERBIUM LASERS**

A foundational knowledge of laser analgesia for hard- and soft-tissue applications will improve your laser dentistry and assure maximum comfort for your patients. By John Hendy, DDS, MS, FADSA

Many dental professionals are attracted to laser dentistry because of the capacity of lasers to deliver "painless dentistry." There are many opinions about what constitutes painless dentistry, but the ultimate verdict about whether or not dentistry is painless belongs to the patient.

It wasn't that long ago that the analgesic effects of laser energy were poorly understood. But today with years of experience, research, global learning and collaboration, our knowledge has grown immensely. This is particularly true with respect to the utilization of the Er,Cr:YSGG laser to best optimize rapid tooth cavity preparation while performing painless dentistry.

This article will provide erbium laser users with a basic understanding of dental analgesia for tooth preparations. Learning these techniques will improve your skills as a laser dentist and help you deliver greater comfort to your patients.

Erbium lasers have been used for many years with great success for rapid tooth preparation using low to high power (3 to 8 watts) while still maintaining great comfort control. Laser practitioners have a wide variety of protocols to follow for desensitizing or developing laser analgesia. Some are more direct and involve the immediate preparation of the tooth. Others are more indirect, requiring a separate procedure for analgesia before tooth cavity preparation is initiated.

After more than 13 years of experience, I prefer direct analgesia tooth preparation where I apply 3 to 4 watts of power, defocused and move the laser quickly across

Continued on page 14

HARD TISSUE ANALGESIA

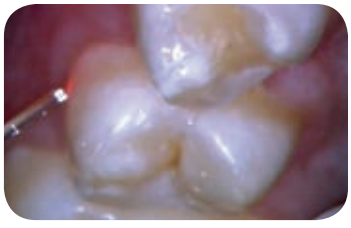
Laser practitioners have a wide variety of protocols to follow for desensitizing or developing laser analgesia. Steps 1 through 4 below demonstrate direct analgesia for tooth preparation. If the direct technique does not produce the desired level of comfort, use defocused laser energy on the buccal surface as shown in steps 5 and 6.

STEP 1 • To initiate laser analgesia, use 3 to 6 watts defocused energy across the occlusal of the tooth, moving quickly for 60 to 90 seconds.

STEP 2 • Bathe the central groove on of the occlusal surface with laser energy.

STEP 3 • Slow the movement and focus the fiber tip, moving it closer to the lesion.

STEPS 4 • With the focused laser energy on the target, move the laser handpiece more slowly with the preparation design in mind.



STEPS 5 & 6 • If the direct or technique does not produce the desired level of comfort, stop and reset the laser to a lower power and bathe the buccal surfaces with laser energy for 90 seconds as described.

LASER CAVITY TREATMENT *continued from page 13*

the occlusal surface of the tooth. I spend 60 to 90 seconds doing this before slowing movement and focusing the laser energy. With the finely focused laser beam on the target, I move the laser handpiece closer to the tooth with the preparation design in mind.

If the direct technique doesn't produce the desired level of comfort, I stop and reset the laser at a lower power — generally 0.25 to 0.5 watt — and then start again on the buccal surface with an exposure of 90 seconds. This is defocused laser energy application 5 to 6 mm from the tooth, with slow, constant movement and with no interruption.

Depending on the type of preparation, I increase the power to the 3 to 6 watt range and work in a defocused mode on the tooth. Next focus in at the proper tooth ablation distance, and slowing my hand movement for more rapid tooth preparation.

Thanks in no small part to Dr. Roberta Chow, PhD, a global leader and researcher in the field of laser therapy for pain management, we now better understand the effects of light energy upon nerves. Low Level Light Therapy (LLLT) has been used for a couple of decades with remarkable results. Studies show that these low energy levels affect nerve tissues by stabilizing the nerve cell membranes. Light energy causes changes within the cell, which results in the nerve conducting fewer impulses per second and requiring a greater stimulus to initiate an action potential. With the nerve less sensitive and conducting with fewer impulses, the patient perceives less pain (similar to the effects of a local anesthetic on the nerve membrane). When practically applied via the Er,Cr:YSGG laser, this adds up to more comfort — almost immediately.

The analgesic effect cannot be visualized. With erbium lasers, there is only surface action seen up to 100 nm, depending on the energy delivered, which is observed as ablation on the tooth or soft tissue. Since absorption curves explain that only some of the light energy is absorbed by the chromophores — here, mainly water and hydroxyapatite — there is some light energy penetrating that delivers low-level laser changes to the deeper nerves, thereby rendering them less responsive and less sensitive because they fire more slowly and less frequently.

There are also theories that the photoacoustic effects of erbium lasers, when delivered with 20 hertz or 20 pulses per second, will affect the pain sensing A-delta and C nerve fibers. These are the nociceptors for production of pain perception, and they produce other action potentials with the application of pulsing laser energy. This may occur from affecting the sodium and potassium pumps on the axon and interfering with the repolarization of the nerve after an action potential is produced. It is hypothesized that this interference requires more stimulus to get the nerve to fire, which then takes longer to be ready to fire again. So fewer pain signals from these fast pain myelinated A-delta and C nerve fibers are able to reach the brain to report a painful stimulus.

Thanks in no small part to Dr. Roberta Chow, PhD, ... we now better understand the effects of light energy upon nerves.

After a rest period of 20 to 60 seconds, the nerve resumes activity with normal or slightly diminished sensitivity. The longer the laser energy is delivered and the greater the energy during analgesia and tooth preparation, the longer the residual analgesia effect lasts, providing more time to use a high-speed or low-speed rotary handpiece to complete the cavity preparation with no discomfort to the patient.

Interestingly, these analgesic techniques can also be used for soft-tissue applications. If the Er,Cr:YSGG is placed over a major nerve supplying a soft-tissue area with 3 watts defocused for 90 seconds of constant small movements, excellent analgesia can be produced.

An example of soft-tissue analgesia I performed in a study of six adults (three men, three women) was to prepare the bed sites to harvest donor tissue from the palate without using any injectable anesthetics. This was accomplished using the defocused 3 watts of power bathed over an area of the donor site while topical anesthetic was allowed to have a very superficial effect. The topical provided psychological benefit to the patients who felt numbness on the surface of their tissue.

After the nerves were desensitized with laser energy, a split thickness flap up to 8 mm deep was cut with laser energy reduced to 1.25 watts. Topical anesthetics do not penetrate deeply enough to provide comfort while cutting into tissue as deep as 8 mm or harvesting palatal donor tissue.

Continued on page 16

PALATAL GRAFT ANALGESIA STUDY

The principals of laser analgesia apply to both hard tissue and soft tissue. To assess soft tissue analgesia, Dr. Hendy performed a study of six adults requiring palatal grafts. Donor tissue was harvested and bed sites were prepared without using any injectable anesthetics.

IMAGE 1 • Applying laser energy to the soft tissue to create analgesia.

IMAGE 2 • After the analgesic effect, incisions for bed sites are made.

IMAGE 3 • Laser analgesia was accomplished on the posterior palatine foramen and then the donor tissue was removed with a laser.

IMAGE 4 • Donor tissue is oriented.

IMAGE 5 • After placement of the graft tissue at the recipient site.

IMAGE 6 • Application of PeriAcryl® to secure graft.

Opposite: Analgesic technique photos courtesy of William H. Chen, DMD, MAGD; Chen Laser Institute.
Above Right: Palatal graft study photos courtesy of author.

LASER ANALGESIA *continued from page 15*

As a laser tip was advanced into the surgical site, the energy was continually being applied and focused on the incision. The photoacoustic and laser energy effects penetrated to nerves deeper within the tissue and continued to produce an analgesic effect ahead of the actual incision. As the laser continued to advance to deeper tissue, this energy penetrated into the soft tissue ahead.

This technique was used on both the bed site and also for the donor tissue from the palate of all six participants. Since no injectable anesthetics were used, PeriAcryl® by GluStitch was used instead of sutures to secure the graft for healing and as a periodontal dressing over the donor site. The graft was successful for all six patients who reported that they would do exactly the same if they ever needed a graft again without injections. So it appears that nerve tissue responds to the photoacoustic effect whether in soft tissue or hard tooth structure.

A similar technique can be applied with deciduous tooth preparations where even greater analgesia occurs in a shorter period of time with less energy. This may be from the primary tooth's anatomy with thinner layers of both enamel and dentin. It may also be that the young and more delicate tissues of the pediatric patient are more susceptible to the energy input from the laser and respond with greater changes within the nerve itself. This allows the practitioner to quickly produce analgesia for a variety of cavity preparations from the very small to the more extensive.

During the 20 to 30 seconds of residual analgesia gained from laser energy during a small preparation, the use of a rotary handpiece can be used very comfortably to finish a laser-prepared cavity. Do not hesitate to use a high-speed handpiece with a small bur or slow-speed handpiece with a small round bur to help with rapid excavation of decay. A small spoon excavator may also be used without discomfort. Always finish cleaning and shaping the cavity preparation with the Er,Cr:YSGG laser to remove the smear layer and produce a clean surface which bonds well and is devoid of bacteria.

Applying these techniques is an especially rewarding aspect of providing of minimally invasive dentistry.

Laser analgesia offers amazing possibilities, and applying these techniques is an especially rewarding aspect of providing minimally invasive dentistry. One only needs to understand how and why it works for the patient's overall comfort. Any committed practitioner can learn more about laser analgesia and its techniques at advanced laser training courses.

Improving your analgesia techniques will improve your results and help you deliver remarkable comfort and care to your patients. ■

ABOUT THE AUTHOR

John Hendy, DDS, is an internationally recognized laser dentist, educator and researcher. He received his DDS from University of the Pacific and holds a master's degree in laser dentistry from the University of Vienna. He is a Diplomate of the National Board of Dental Anesthesiology, a Fellow of the American Dental Society of Anesthesiology and a member of the International Association of Orthodontics. He has conducted and authored extensive research in the field of laser dentistry, with a special emphasis on periodontic study. Dr. Hendy is a long-time member of WCLI and holds a Mastership Certification. In his research on laser-assisted periodontics, Dr. Hendy postulated that a modified laser tip could improve clinical outcomes. This led him to the creation of radial firing laser tips for which he holds multiple patents. Dr. Hendy performs dentistry at his practice in Grants Pass, Oregon, with the BIOLASE WaterLase iPlus™ laser.

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FIVE CLINICAL TIPS: IMPROVING PREDICTABILITY OF LASER RESTORATIONS

MANY CLINICIANS CHOOSE TO ADD an Er,Cr:YSGG laser with the hope of being able to provide patients predictable composite restorations with less need for local anesthetic. At times, frustration can occur as new laser dentists struggle with these procedures. This short article will provide some insight into simple adjustments that can help improve your success with restorative laser procedures.

By Glenn A. van As, DMD

1 PATIENT SELECTION

The most important clinical tip to learn is which patients are ideal candidates for anesthesia-free laser preparations — not all of your patients fall into this category. For example, patients that wince when you put the cotton roll in their mouth are not going to magically be able to sit through every laser procedure.

Geriatric patients do better than teenagers, primarily due to their smaller pulp size. Typically in my practice, the laser is used for most preparations on children, for many Class III, IV, V and VI adult preps and for small Class I and II preps. When you see areas of recession in the patient's mouth and air/water spray from your Triplex syringe causes sensitivity, the odds are higher that a laser procedure — particularly one that involves dentin — will result in pain.

Geriatric patients do better than teenagers, primarily due to the size of their pulp.

2 MAGNIFICATION

Visual acuity is vital for successful laser dentistry. "You cannot treat what you cannot see" is one of my favorite quotes, and this particularly applies to lasers where the primary mode of evaluation is visual rather than tactile. Because the tip is not in contact and water floods the field of view, it is sometimes difficult to see. For restorative success, magnification is mandatory. Use at least medium-powered loupes. I suggest a minimum of 4X magnification for clinicians using hard-tissue lasers. I use a dental operating microscope at magnifications of 3.2 to 13X power routinely and it helps me to ablate tooth structure better with less damage to the tips and at lower settings — all of which help to minimize patient discomfort.

Visual acuity is vital for successful laser dentistry. I use a a dental operating microscope at magnifications of 3.2 to 13x power.

ABOUT THE AUTHOR

Dr. Glenn A. van As, DMD, is a graduate of University of British Columbia. He holds a Mastership in lasers from the Academy of Laser Dentistry (ALD), a Mastership in implant placement from the Global Institute of Dental Education and is an active member of the International Congress of Oral Implantology. Dr. van As is a founder and past president of the Academy of Microscope Enhanced Dentistry and has been selected by *Dentistry Today* magazine as one of the top "Leaders in CE." In 2006, he was selected by the ALD as the recipient of the Leon Goldman Award for Clinical Excellence in the field of laser dentistry.

3 WATER

Water is necessary for effective hard-tissue ablation, including cooling the tooth, minimizing sensitivity, washing away ablation byproducts from the preparation and for continued rehydration of the tooth surface to allow for progressive ablation. The iPlus Class I setting of 30% water and 50% air provides around 9 mL per minute of water flow; however, I prefer 13 to 18 mL of water per minute. Increasing the water to between 80% and 90%, particularly for patients who are sensitive, may be helpful in anesthetic-reduced preparations.

High-volume suction tips can also create sensitivity if they are positioned close to the laser tip. With high-volume evacuation, the water will be suctioned up prior to cooling the tooth. Using a saliva ejector or an isolation device such as the Isolite system may be helpful. This can help to significantly reduce the sensitivity caused by inadequate water to the ablation field.

Ideal water flow is 13 to 18mL/minute. Position high-volume suction to avoid interfering water spray to the tissue.

4 REDUCING HERTZ

Hertz is simply a measurement of the frequency of pulses per second. Often clinicians will work with the laser on a tooth and notice that a more rapid hertz rate creates faster ablation. The side effect is increased sensitivity for anesthetic-free preparations. This is particularly true for younger patients with larger pulps.

Lowering the frequency of pulses to 5 to 10 per second (as opposed to 20 to 30) will allow the tissue more time to cool between pulses. The number of pulses per second is inversely related to sensitivity in many laser preparations, so as a clinician you have to ask yourself if you have the patience and time to complete the procedure with the laser only, or are you better off using the laser with anesthetic? Remember, it is not a complete failure should the patient still feel the sensitivity despite lowering the hertz rate. In general, if I have to lower the repetition rate to below 10 hertz or the power below 1.5 watts, then it is unlikely the laser will be working on all but the tiniest of carious lesions.

Reducing the pulses per second can increase prep time slightly but can result in a more comfortable experience for the patient.

5 LASER TIPS

There is an assortment of tips available for the WaterLase iPlus™, including tips for soft tissue, bone, enamel and dentin. In general, the wider the tip, the higher the energy needed in order to cut.

Concurrently, more narrow tips have a higher power density and cut faster at the same output power setting. Smaller tips are easier to use with greater magnification, but they are also more fragile.

I find that the Turbo handpiece is not as precise for many situations as a tip in the Gold handpiece. Below is a list of the tips I primarily use for my dentistry. I recommend always having a standard tip ready to go so that the laser is already equipped and simply needs to be turned on. Even if you are using a bur and drill for your cavity preparation (say an amalgam needs removal), you may want to disinfect the dentinal surface of your restoration, especially if it is deep. My standard tip is an MZ5 or MZ6 with a 9 mm length, and it is always ready in the handpiece. ■

SELECT THE CORRECT LASER TIP FOR BEST RESULTS

Tip	Length	Procedure
MT4	6 mm	Incision for Implants and Soft-tissue Surgery
MZ5 or MZ6	6, 9, 14 mm	Standard Restorative Tip Standard Surgical and Soft-tissue Tip
MC3	0.3 by 1.2 mm chisel	Soft-tissue Plasty, Laser Bandage
RFT3	17, 21 mm	Endodontics
RFPT5	14 mm	Socket Degranulation, Periodontal Therapy (only use once in perio)
MX9	Turbo	Restorative, Veneer Removal

FIVE PROCEDURES YOU CAN COMPLETE *IF YOUR LASER IS READY TO GO*

By Glenn A. van As, DMD

MANY TIMES IN THE MIDDLE OF A BUSY DAY, a clinician will think he or she should use the laser to assist in a procedure. Laser usage should be contemplated for two reasons: It might make your life easier or it might make the procedure more productive. Unfortunately, all too often the sudden thought of using the laser is immediately followed by the thought that it would take too long to set it up. If the laser is in another room and not ready to go in standby mode with a tip in the handpiece, the time necessary to set it up will cause many clinicians to choose another alternative.

My suggestion is to always have the laser equipped with an MZ5 tip with a small sterilization bag covering it and the laser in sleep or standby mode in the room in which you are working. Your dental assistant should be able to set this up just like the rest of the tray so that the laser is within easy reach when needed.

So what are some procedures that might be easy to treat using laser if they suddenly arise during the clinical procedure?

DENTIN DISINFECTION

At times when doing crown preparations by traditional means (i.e., burs), removal of old restorations will yield stained, carious or infected dentin. The use of the Er,Cr:YSGG laser with an MZ5 tip at low to moderate power settings (2 watts, 30 hz, 80% water, 60% air, H mode) can clean the deep stain. This simple step for disinfecting the dentin can yield improvements in treatment outcomes by reducing bacterial loads[1] and removing the smear layer[2] to enhance bonding of the core buildup. Although, there is no fee associated with this procedure, our office will often charge the patient a laser usage fee that includes the laser disinfection and laser troughing for the crown preparation.

GINGIVECTOMY FOR CLASS V CAVITY PREPARATIONS

Often during Class V preparations, the soft tissue at the gingival margin can obscure caries and interfere with bonding. Traditionally, gingival retraction for these procedures has been accomplished using rubber-dam clamps, scalpels or retraction cord. The laser can be used for the cavity preparation as well as to recontour the gingiva to provide a dry field for bonding. In addition to greatly simplifying the process of placing the resin restorations, the use of the laser to recontour soft tissue is billable. An MZ5 tip (settings: 2 watts, 40 hertz, 40% water, 20% air, H or S mode) can be used for the soft tissue. The literature supports the use of the Er,Cr:YSGG laser for both the soft tissue[3] and the hard tissue[4] portions of the preparation for Class V restorations.

ORAL LESIONS

Many patients will develop oral lesions such as aphthous ulcers or herpetic lesions shortly before a restorative procedure and the discomfort associated with these lesions can threaten the restorative appointment itself. Patients are fearful of the lesion cracking, causing pain or spreading during the dental appointment and often will request to reschedule the treatment. The Er,Cr:YSGG laser can help comfort the patient and provide faster healing while increasing the remission period before a subsequent outbreak occurs. Using the MZ5 tip in the laser (settings: 0.25 watts, 10 hertz, 0% water, 40% air, H mode) can alleviate the discomfort and help with the restorative procedure by creating a laser bandage over the ulcer itself. [5,6]

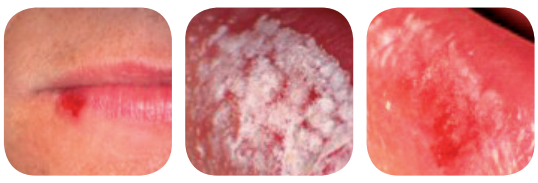
HEMOSTASIS & CROWN LENGTHENING

During crown preparations sometimes existing restorations, caries or fracture lines that occur interproximally cause the margins to be deeper than anticipated. Soft-tissue revision for tissue management and osseous hard-tissue recontouring may be necessary[7]. If the laser is ready to be used, a gingivectomy or closed flap osseous crown lengthening[8] can quickly and easily expose the otherwise deep margins. If soft-tissue revision is necessary, an MZ5 tip (settings: 3.25 watts, 75 hz, 40% water, 20% air, S mode) can be used if coagulation is necessary as the longer pulse duration of the S mode provides better hemostasis. The settings must be changed for bone revision to reduce pulse length and heat and to allow for greater water flow to the osseous sites. Typical settings for an MZ5 tip might be 4 watts, 40 hz, 90% water, 50% air, H Mode. Gingivectomy and osseous recontouring are services that should be charged to the patient.

KEEP THAT LASER READY With your laser ready to go for every patient, you can provide better dental care and create a more productive practice.

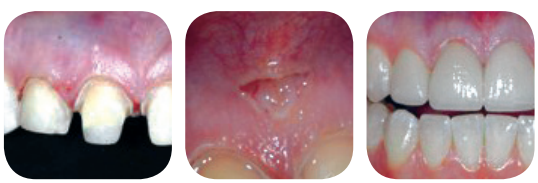
DENTIN DISINFECTION Stained dentin during crown prep; after laser disinfection; after core buildup and laser troughing is completed.

GINGIVECTOMY FOR CLASS V Soft-tissue gingivectomy and hard-tissue preparation for the Class V restoration.



ORAL LESIONS "Laser bandage" treatment of herpetic lesion on the lower lip.

HEMOSTASIS AND CROWN LENGTHENING Deep interproximal preparation where soft-tissue revision was required on the distal and osseous; recontouring was necessary on the mesial. Two-week healing shows great appearance of the soft tissue at the time of crown insertion.



FRENECTOMY After preparation of the four maxillary incisors, the strong frenum pull was noted, and the Er,Cr:YSGG laser was used to revise the attachment. Postoperative result shows great healing at 4-weeks post-frenectomy with excellent esthetic results. Laser recontouring and laser troughing were also performed.

FRENECTOMY

The laser can be quite useful for smile makeover cases. Lasers are routinely used for gingival recontouring, closed flap crown lengthening, ovate pontic development and crown troughing — all procedures that can be completed to enhance esthetic results.[9] In order to provide a broader, fuller smile and to provide for greater vestibular depth to aid in cleaning the facial surfaces of the porcelain restorations, aberrant frenums can be revised at the same time as the crown or veneer preparations.[10] Typical settings would be 3.5 watts, 50 hertz, 50% water, 30% air, H mode. If hemostasis is an issue, S mode can be used with the MZ5 tip. The procedure is a simple and quick one that not only enhances the clinical result but can also be billed.

IN SUMMARY

These five simple procedures are possible to implement into a busy practice if the laser is ready to go with a tip in place and the laser set in standby. The ability to quickly initiate laser treatments such as these depends on proper preparation: having the laser, tip engaged, ready to go within arms' reach. The implementation of these procedures make life easier and more productive in every laser dentist's practice. ■

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HARD-TISSUE CASE STEP BY STEP

Jose Marcano, DMD

PERFORMING CAVITY PREPARATIONS with the Er,Cr:YSGG laser offers many benefits for the patient, not the least of which is the possibility of completing the preparation without the need for injectable anesthetic.

The ability to perform cavity preparations without anesthetic using an Er,Cr:YSGG laser on a reliable basis requires practice and repetition, but once the dentist has developed clinical confidence in preparing cavities without anesthetic, these types of procedures can be a powerful growth engine for the entire practice — both professionally and clinically.

In this case, my team and I demonstrate the use of the Er,Cr:YSGG laser to complete a Class II cavity preparation on tooth #5 with no local anesthetic.

Continued on page 24

STEP 1
PRE-TREATMENT

A key to success in completing cavity preparations is patient selection. In this case, a 24-year-old female presented with Class II decay on tooth #5.

STEP 2
LASER ANALGESIA

Using the Er,Cr:YSGG laser with a Turbo handpiece and MX9 Turbo tip, hold the tip 3 to 4 mm from the treatment site and bathe the occlusal surface with defocused energy at 3 watts for 60 to 90 seconds. Then, slow down the movement of the laser tip and begin to focus the energy. Move the tip of the laser slowly toward the tooth with the preparation design in mind.

STEP 3
HARD TISSUE ABLATION

With the MX9 Turbo tip in place, set the Er,Cr:YSGG laser to the Class II ComfortPrep procedure setting (6 watts, 15 hertz, 50% water, 80% air, H mode). Maintain the ideal distance from the target tissue, in this case 3 to 4 mm from the tooth surface. Slowly move the handpiece circumferentially around the desired prep to ablate the enamel. The slower you move the handpiece tip, the quicker you will remove tooth structure.

STEP 4
ASSESSMENT

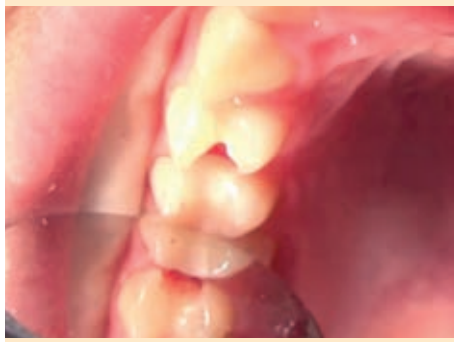
Assess your progress. As shown, a prep is beginning to take shape, and the decay is visible at the dentino-enamel junction.

HARD-TISSUE CASE STEP BY STEP

Continued from page 24

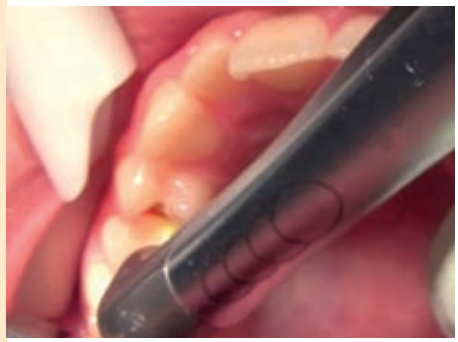
ABOUT THE AUTHOR
Jose Marcano, DMD, is the proprietor of Orlando Cosmetic Dentistry in Orlando, Florida. Dr. Marcano first deployed the Er,Cr:YSGG laser in his practice in 2005 and has lectured, authored and contributed to numerous research projects on the wavelength and its applications in dentistry.

STEP 5
COMPLETE THE PREP
Maintain the Er,Cr:YSGG laser on Class II ComfortPrep settings. Finish shaping the prep dimensionally, maintaining a distance of 3 to 5 mm from the prep.



STEP 6
PREP COMPLETE
As shown, the prep is complete, but there is some minor bleeding in the gingival tissue between #4 and #5.

STEP 7
HEMOSTASIS
Control any bleeding by setting the Er,Cr:YSGG laser to S mode, which results in longer pulses of laser energy and shorter thermal relaxation time to achieve hemostasis of the target tissue.



STEP 8
READY FOR ETCHING AND BONDING
The finished prep is ready for restoration. Start to finish, the preparation was completed in less than five minutes.

Email to let us know which clinical tips you'd like to see in future issues of JLAD at: info@wcli.org

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A VISION FOR BETTER DENTISTRY: LASERS PROVIDE AN EDGE

MEET DR. CHRISTOPHER MAST. He holds a WCLI Mastership Certification and has a thriving family practice where his laser dentistry attracts patients from hundreds of miles away.

BORN AND RAISED IN MOUNT VERNON, Washington, Dr. Christopher Mast had aspirations to be a doctor and wanted to attend an Ivy League college. But when he researched where to apply, he found Carroll College located 4,000 feet high in Helena, Montana. The small liberal arts college was the perfect launching pad for his life and his career.

After graduating in 2000, Mast went on to attend the University of Minnesota where he earned his Doctor of Dental Surgery in 2003. Boldly setting off into the world with a unique vision for what he wanted his dental practice to be, Mast moved back to Helena and built the practice of his dreams. Now he's helping others to do the same.

Q: *How many years have you practiced dentistry?*

A: I have been practicing dentistry now for 12 years, and I have been a laser dentist for 10.

Q: *How was it that you became a laser dentist?*

A: As a dental student at the University of Minnesota, I saw the potential of lasers in dentistry. I did a lot of research and found that BIOLASE was the industry leader and held 80% to 90% of the dental laser patents. So I called the company and asked them to show me the technology. This was while I was in the process of building my practice, and I was spending $250,000 on construction. As a brand-new dentist, it was quite a stretch for me to invest in a state-of-the-art laser on top of the cost of establishing the new practice, but I loved that the laser offered me a way to be a better, cleaner, safer and more conservative dentist.

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

A: It's probably a tie. I love doing laser perio treatments. Seeing how you can clean out infected pockets is amazing to me. My other favorite procedure is treating tongue-tie. Having an unhappy newborn in the office along with a frantic mother is very stressful for everyone involved. But to see the baby latch onto the mother and start breast-feeding five minutes after the laser frenectomy is so moving, not to mention a total relief for the mother and the baby. It is quite rewarding to be able to provide that kind of care and positive outcome for a family without trauma and general anesthesia and at a reasonable cost.

Q: *What specific laser wavelengths do you use in daily practice?*

A: I use both the WaterLase iPlus™ 2780 nm hard/soft tissue laser and the Epic 940 nm diode. We use the laser on nearly every patient, and I even use the laser instead of packing cord. It's just better and cleaner.

With the laser, I am just doing good dentistry better. I am providing better care.

100% DIGITAL OFFICE

Dr. Christopher Mast built his practice from the ground up with fully digitized workflow and state-of-the-art dental lasers.

Q: *What do you feel are your noteworthy accomplishments as a laser dentist?*

A: Being a laser dentist allows me to be cleaner and more conservative. For example, using a drill splatters bacteria and spreads it all around. Not so with laser. There are no microfractures with laser, no heat from a drill. With the laser, I am just doing good dentistry better. I am providing better care.

Q: *Can you provide us with a few examples of how laser dentistry helps the productivity of your practice?*

A: Laser dentistry allows me to do things I wouldn't normally do — soft-tissue procedures such as a frenectomy or any kind of surgical procedure. In the past, I wouldn't do biopsies; there was just too much bleeding and bleeding is a risk. With laser, there is little to no bleeding, so I can perform these procedures now, whereas in the past I would have referred them out. Fibroma removal is another example. We do about 90% of perio for our patients in our office. The patients are happier to stay in-house. Our hygiene staff uses laser on about 85% of our patients for bacterial reduction; we can target infected and inflamed tissue. We also use laser to give patients relief from canker sores. These are just some of the ways that our lasers has enhanced our practice performance.

Q: *How long have you been a member of the World Clinical Laser Institute?*

A: I became a member as soon as I bought my first laser, and I have been an active member ever since. I achieved my Fellowship Certification in 2013 and my Mastership Certification in 2014. I am now teaching courses for WCLI and enjoy sharing my knowledge of lasers with others.

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

A: You end up at these conferences with other laser users and everyone is excited about it. It is still a small group of dental professionals. Only about 5% of dentists are using lasers so these are all like-minded dentists. It is fun to trade stories and learn from one another. Whether I am teaching or not, I always learn something.

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

A: I love spending time with my wife Aislinn, my daughter Ashton and my son Finnegan. We like to hike, bike, fish, ski and climb and spend time at our cabin in Yellowstone. ■

A STEP ABOVE AND BEYOND
DELIVERING A HIGHER LEVEL OF PEDIATRIC CARE

INSPIRED DENTIST
Dr.Luedemann-Lazar started as a dental assistant and put herself through dental school to reach her ultimate goal of becoming a pediatric dentist.

MEET THE PEDIATRIC DENTIST AND WCLI MEMBER whose reputation is growing as word spreads about several unique aspects of her dental practice, including a treatment program for special needs patients.

Dr. Amy Luedemann-Lazar's vocational call began as a phobic dental patient who — as fate would have it — got her first job as a dental assistant working for Dr. Terry Dickinson, a Houston dentist known for thinking big and serving others. Dr. Dickinson received the 2010 American Dental Association Humanitarian Award for establishing Missions of Mercy, which provides millions of dollars in dental services to the underserved.

Inspired by Dr. Dickinson to become a dentist, Luedemann-Lazar obtained her Doctor of Dental Surgery from the University of Texas Health Science Center at Houston and her master's degree in pediatric dentistry from the University of Washington. During dental school she participated in several mission trips and became passionate about helping underserved children. In fact, after her residency, she traveled to Africa, where she treated orphans and helped found a nonprofit organization called Dhwankozi-Hope, which serves a community of orphans in Zambia.

She returned to her alma mater in Seattle, where she served as acting assistant clinical professor, attending at Seattle Children's Hospital and as a member on the craniofacial team. Dr. Luedemann-Lazar would have stayed in education at the University of Washington, but a family need called her back to Texas in 2009. She and her husband moved to her hometown of Katy to raise her then-eight-year-old nephew, who is now 14.

Luedemann-Lazar's practice, Kidstown Dental, has earned a reputation for being "the best dentist in Katy area" since it opened in 2012. Dr. Luedemann-Lazar has been featured in the *New York Times*, the *Houston Chronicle* and by the Autism Care Foundation for her work with autistic patients. She is an active member of the WCLI and an aspiring WCLI lecturer. Her practice incorporates laser "no-shot" dentistry, infant frenectomies, laser (Canary System) no radiation cavity detection and the D-Termined program for special needs patients.

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

A: When I started using lasers in dentistry in 2009, I was the only one out of three in the practice who really took to using it daily. I found I could do fillings on about 85% of pediatric teeth without local anesthesia. Now I would no longer want to be a pediatric dentist if I didn't have the laser. I would encourage every new graduate to learn how to use the hard/soft tissue laser and incorporate it into the practice from day one. While there is a learning curve and initial financial investment, it has made my practice flourish in a very short period of time. And I believe it is the best, healthiest way to provide care for children.

Q: *What is the best part about being a laser dentist?*

A: As a pediatric dentist I am thrilled that I can do almost any procedure without using shots. This makes children much more relaxed and happy about visiting the dentist. I use the laser for fillings, crowns, pulpotomies, frenectomies, gingivectomies and even some extractions without much root left. With the surgeries, I use a topical anesthetic, but there is no need to use local with the laser.

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

A: Infant frenectomies are so rewarding. I love being able to help a mother who brings her baby to me because it can't latch and she desperately wants to breastfeed. I do some initial assessment and when needed provide a quick, blood-free procedure. When I take the infant back to mom, it almost inevitably latches right away. There is no pain for the infant, because I finish the procedure with the laser "bandage" setting.

Q: *You opened Kidstown Dental in 2012, and since then you've rapidly earned a reputation as a leading pediatric dentist with special recognition for your treatment of autistic children. Can you tell us more about that?*

A: When I opened my practice, the first eight out of 10 calls were from parents who had children with autism. As an associate I had tried a limited version of Dr. David Tesini's D-Termined Program, but I still had some questions so I contacted him and ended up visiting his practice in Massachusetts. Since then, the program has been even more successful in my office. My assistant Jamie does the bulk of the work, so it doesn't require any more of my time clinically to see these patients. The program takes training and patience, but we are making dentistry so much easier for these kids!

Q: *What made you want to become a pediatric dentist?*

A: Working with Dr. Dickinson changed my life in so many ways. His mentorship developed my desire to help others and live a life with a higher purpose. Yet while my dental mission work was rewarding, I felt like I was putting a Band-Aid on an amputation. A host of other mentors encouraged me to work toward missions that were culturally sensitive and sustainable, and these experiences cemented my hope that I could combine my two passions: working with children and dentistry.

Q: *How long have you been a member of the World Clinical Laser Institute?*

A: I first became a member of the WCLI and completed some of my first training with pediatric dentist Dr. Fred Margolis in 2009. However, I didn't attend my first live WCLI course until last year in Vail. I wish I had gone sooner.

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

A: I always learn so much. I recently attended the WCLI Symposium in Vail, Colorado. I didn't expect to learn that much, but the meeting speakers were phenomenal. The attendees were people who I could really relate to, and we learned much from each other during breaks, lunches and social events. It was wonderful to be in an environment where providers were not afraid to share insights and information. I can't wait to go to another WCLI meeting and I'm thrilled the WCLI has started a peer-reviewed journal. I predict in 10 years time it will be one of the leading journals in dentistry.

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

A: I enjoy spending time with my husband, Marco, and our son, Kenneth. As a family we spend time together playing board games, cooking and eating healthy foods, fishing, gardening, skiing, traveling and — best of all — laughing. ■

A DIFFERENT WAY TO TREAT PEDIATRIC PATIENTS

Dr. Luedemann-Lazar has distinguished herself in pediatric practice and has earned a special reputation for the care of patients with autism spectrum disorder.

Photography: Darren Tremtacosta

DENTAL PROFESSIONALS SHARE THEIR PASSION FOR LASER DENTISTRY

LOS ANGELES, CALIF, The World Clinical Laser Institute (WCLI) hosted hundreds of dental professionals in symposia held in various corners of the globe over the past few months. These symposia featured notable presentations by the leaders in the dental laser field. A wide array of topics — from endodontics and soft-tissue treatment to laser-assisted oral surgery — was discussed. Each symposium event provided a unique blend of education, fellowship and fun while attendees learned about the latest trends in the industry.

WCLI's Asia Pacific Symposium took place in Seoul, South Korea, this past October. Numerous presentations addressed research breakthroughs for lasers in dentistry, and a number of local dentists presented case reports as part of the certification path.

In December, the WCLI hosted a symposium in Vail, Colorado. The keynote speaker was Dr. Samuel B. Low, DDS, MS, MEd, professor emeritus at the University of Florida's College of Dentistry. He talked about maximizing the versatility of the Er,Cr:YSGG laser for managing periodontal patients and provided unique insight into the oral-systemic connection.

Breakout sessions covered a wide range of topics from laser-assisted pediatric dentistry to the Er,Cr:YSGG laser in endodontic practice. Registered Dental Hygienists Heidi Christopher and Joy Raskie explored the use of lasers in hygiene, perio therapy and teeth whitening. And last but certainly not least, WCLI's Executive Director, Christopher Walinksi, DDS, spoke about surgery and pain therapy using diode laser dentistry. ■

THE VAIL SYMPOSIUM held December 12 - 14, 2014, was attended by dozens of dental professionals seeking laser dentistry training.

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 grants advanced certification to its members. Most recently the following dental professionals have qualified for Fellowship or Mastership Certification:

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Singapore

DR. STEPHEN ERIKSEN
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DR. SAADIA MOHAMMED
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JOY RASKIE, RDH
Colorado

DR. SHERVIN YAZDI
California

MASTERSHIP CERTIFICATION

DR. TEO CHIN KEONG
Singapore

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.

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

HARD-TISSUE TIPS FROM THE PROS

IT IS A POINT OF PRIDE FOR THE WCLI that we have the world's leading laser dentists as part of our educational program. We asked a few of our WCLI laser educators for some tips for hard-tissue laser use. To learn more from these laser experts, see the latest course offerings from WCLI. We strive to make our education affordable and accessible to all. Look for an upcoming program in your area by visiting: www.wcli.org.

SPEED

KEEP THE TIP AT A 45 DEGREE ANGLE TO THE SURFACE YOU ARE CUTTING, *lots of water, use slow back and forth motions, do not stay in one place.*

— Dr. Marina Polonsky

Most important to cutting efficiently on tooth structure is to keep the end of the tip 1 to 1.5 mm from the cutting surface with the Gold handpiece and 3 mm with the Turbo. Remember, the faster one moves the handpiece, the slower it cuts. SO TO CUT RAPIDLY, MOVE THE HANDPIECE SLOWER.

— Dr. Stewart Rosenberg

SLOW IS FAST; *know your focal distances!*

— Dr. Christopher Mast

READINESS

To increase success in preparation on unanaesthetized teeth: use larger diameter tips (MZ8, MZ10) and keep in mind, IF IT HURTS, REDUCE THE HERTZ.

— Dr. Tzvi Rubinger

The iPlus is a tool so treat it like another handpiece — MAKE SURE IT'S TURNED ON AND READY FOR EVERY PATIENT, EVERY DAY.

— Dr. Patrick Broome

CUTTING HARD TISSUES TAKES A LITTLE LEARNING AND A LITTLE PATIENCE. *As dentists we have to change our entire view of what we were taught when preparing a tooth; once you make this change you will you see the amazing results a laser can offer to your patients.*

— Dr. Mike Koceja

For a new laser user I would say after getting your training, read, read, read, attend conferences with other laser dentists, and don't ever put it in the corner. It's new and it will take a little getting used to it; BUT ONCE YOU DO, YOU WON'T BE ABLE TO PRACTICE WITHOUT IT!

— Dr. Amy Luedemann-Lazar

PAIN CONTROL

A PEARL TO REMEMBER IS THAT "HERTZ HURTS!" *A lower hertz rate helps control sensitivity when cutting cavity preps. I almost always use 4 watts, 10 hz, 70 % air and 90% water as my go-to enamel setting and have very few complaints of discomfort while cutting.*

— Dr. Stewart Rosenberg

CLINICALLY, ALWAYS HAVE THE LASER PRIMED VERY WELL. *If you don't and you point it at the tooth, it will feel hot and cause pain and you will possibly be fooled into thinking the patient is too sensitive. For children and anxious patients you have issues with them letting you try again!*

— Dr. Amy Luedemann-Lazar

WHAT IS THE FUTURE OF HARD-TISSUE LASERS?

WORKING IN THE FIELD OF MEDICAL LASERS FOR MORE THAN 20 YEARS, Dmitri Boutoussov has been directing the research and development at leading laser manufacturer BIOLASE for nearly 15 years. The laser scientist discusses the challenges of hard-tissue lasers and predicts the future of laser-assisted dentistry.

RUSSIAN-BORN DMITRI BOUTOUSSOV graduated from Polytechnical University in St. Petersburg, Russia, in 1987. He earned his PhD at Ioffe Physical Technical Institute in the Department of Semiconductor Devices. It was there that Boutoussov worked in a group led by Nobel Prize-winning physicist, Zhores Alferov, and it was also there that the world's first semiconductor diode lasers were invented.

We sat down with Boutoussov in his Irvine, California, office, to discuss hard-tissue lasers — from the laser scientist's perspective. We asked him: What can you tell us about the challenges of cutting hard-tissue with lasers? And what do you foresee for the future?

"The challenge with cutting teeth with laser is that the tooth — which is the hardest thing in the body — is right next to the nerve, the most sensitive part of the body. We want to cut fast and precisely and at the right depth, but we don't want to cause pain and damage the nerve. That is one of the most difficult tasks in laser medicine," explained Boutoussov. "Cutting bone isn't as challenging. The challenge with bone is bulk. For that, you need high power and that usually means a large and expensive laser."

Another challenge that Boutoussov sees with respect to the use of hard-tissue lasers in dentistry is the non-contact aspect of the laser instrument. "Unlike the drill, the laser is not tactile; there is no feedback. With the drill, you feel resistance. Some practitioners have a difficult time embracing a non-contact instrument because hand-eye coordination becomes more important than 'touch and feel.' So this is not really a technical challenge per se, but a challenge nonetheless."

Lasers today perform hard-tissue procedures quite well and have advanced significantly in the last 10 years, but Boutoussov is looking to push dental lasers to the next level. "Although we have made advances in laser technology over the past 10 years, the core technology for hard-tissue lasers hasn't really changed," he said. "Yes, they became a little less painful, a little more precise, quite a bit faster and the user interface is improved. But the core technology is still the same.

"I believe four things will occur within the next five years, which will turn the hard tissue laser from an exotic tool into a common instrument in dental offices all over the world:

1. The versatility of the hard-tissue laser will expand and the laser will become a 'Swiss army knife' in the dental practice. The tool will be chairside and used for almost every dental procedure. Hard tissue application will be one use, and may be not the most important application. Just like the smart phones changed the way we use the phone today and the calling function is just one of many.

2. Ease of use will benefit from new communication technologies. Getting specific education and training, service, or support and advice, will become available with one touch of the screen.

3. Lasers will become part of the dental curriculum at dental schools. This will significantly reduce the "laserphobia" which is quite common today and make the technology available for the majority of dental practitioners.

4. Improvements in laser technology will make lasers more compact, more reliable and hopefully less expensive. We are seeing remarkable advances in the progress of high-powered diode-based fiber lasers and this will open up many more possibilities. Then, I believe, that medical lasers will be able to capitalize on these advances and it will definitely influence medicine."

It is all so heady and fun to talk about lasers and dream what future lasers will be like. But what does this mean for the dentist in practice today and the dentist that graduates five years from now?

"Do I think that the time for the laser replacing the drill is here? No, not yet. The technology does not yet exist. But it is definitely on the way. Three to five years from now, I think the hard-tissue laser will be perceived very differently. Five to 10 years from now, I believe we will reach the tipping point." ■

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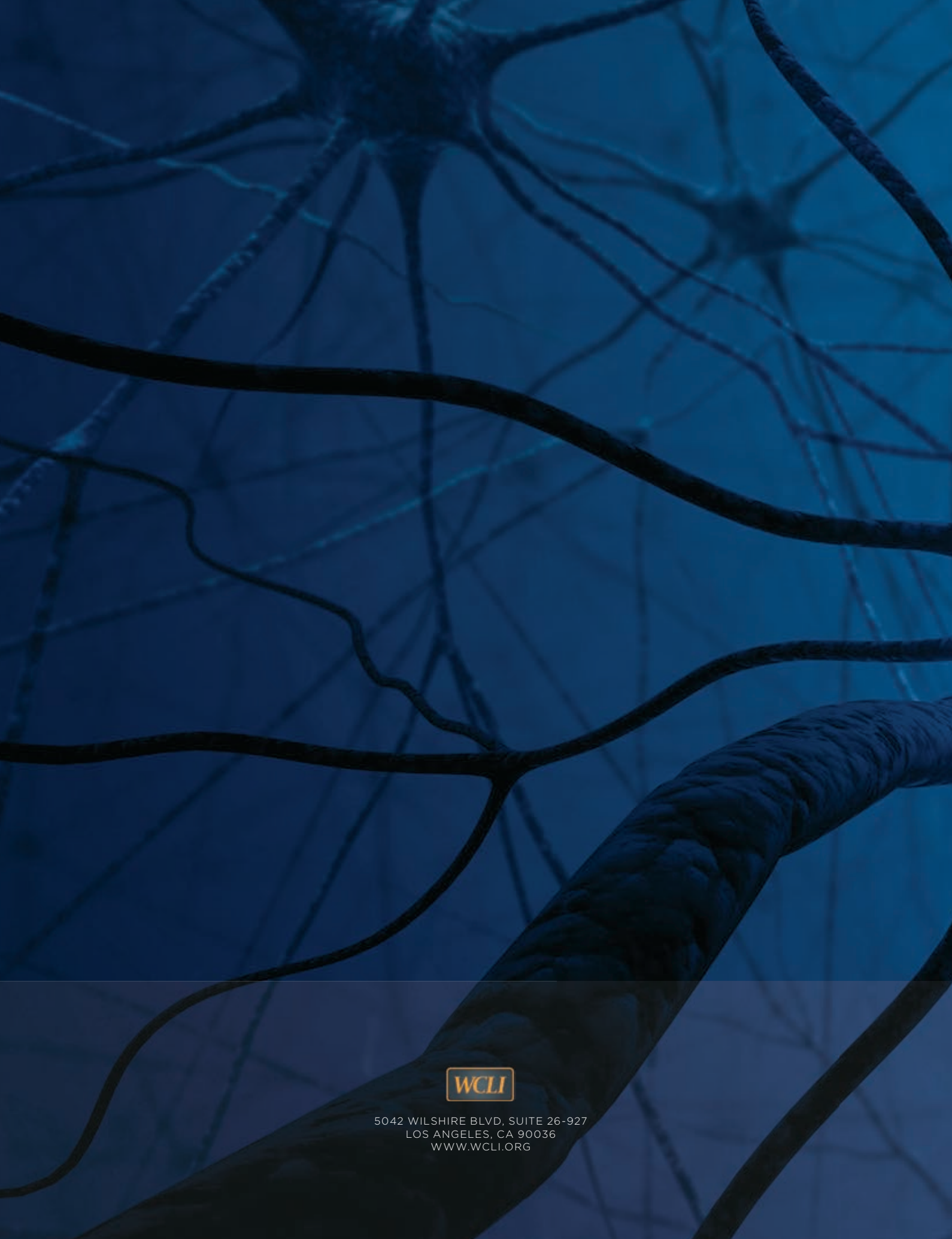

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