_C.E. article
Introduction to the LANAP protocol for the treatment of periodontitis

_research
New horizons for Er:YAG lasers

_technique
Crown troughing with the 810 nm diode laser
"More" Human Histology supports LANAP.

Cementum-mediated periodontal ligament new attachment to the root surface in the absence of long-junctional epithelium.¹

Nevias Histology 2012 Sept/Oct LPRD - LANAP x 9 months

Human histologic, peer-reviewed, published manuscript #2.

Key: FC = new cementum; NB = new bone; OC = old cementum; D = dentin; JEP = junctional epithelium; ND = new periodontal ligament.

Yukna Histology 2007 Nov/Dec LPRD - LANAP x 3 months

Human histologic, peer-reviewed, published manuscript #1.

Key: N = notch in calculus; B = new bone; C = new cementum; OC = old cementum; JEP = junctional epithelium.

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5 TLR IV, Effectiveness of LANAP as measured by tooth loss. J Oral Dent 2012;20:143-146

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With the development of so many new procedures and techniques, it’s sometimes difficult to stay on the cutting edge. That’s why the magazine you are holding right now is so valuable.

For this issue of laser, we’ve assembled a valuable collection of articles from some of the most respected names in dentistry. The issue leads off with an introduction to the laser-assisted new attachment procedure for the treatment of periodontitis by none other than Dr. Robert H. Gregg II, who is a pioneer in the field of laser dentistry and one of the inventors of the LANAP procedure itself.

Dr. Glenn A. van As offers an article on crown troughing technique using the 810 nm diode laser. Dr. Darius Moghtader describes the Elap-p I procedure for the treatment of periodontitis. Dr. Evgeniy Mironov offers the results of extensive research on the use of Er:YAG lasers, and Dental Tribune America Group Editor Robin Goodman offers a first-person account of what it was like to be treated for the removal of an uncomfortable fibroma. (Her story has a happy ending.)

In addition, you’ll find articles on the treatment of gingival hyperpigmentation for esthetic purposes using the diode laser, and an article on how laser phototherapy can be used to treat Bell’s palsy patients.

Remember that every issue of laser magazine also contains a C.E. component. By reading the article by Dr Gregg mentioned above, plus the article on infection control by Dr. Frank Yung, then taking a short online quiz about these articles at www.DTStudyClub.com, you will gain one ADA CERP-certified C.E. credit. Keep in mind that since laser is a quarterly magazine, you can actually chisel four C.E. credits per year out of your already busy life without the lost revenue and time away from your practice.

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Sincerely,

Torsten Oemus
Publisher
C.E. article
06 Introduction to the LANAP protocol for the treatment of periodontitis
   _Robert H. Gregg II, DDS
10 Infection control
   _Frank Yung, DDS

research
12 New horizons for Er:YAG lasers: QSP mode advantages in the Lightwalker AT
   _Evgeniy Mironov, DDS; Assist. Prof. Zhasmina Mironova, DDS; Assoc. Prof. Radosvet Vassileva, DDS and Assoc. Prof. Krassimira Genova

| trends |
| 20 ‘Bye-bye fibroma!’
   _Robin Goodman, Group Editor, Dental Tribune America |
24 Periodontitis therapy with 3,000 percent more power
   _Darius Moghtader, DDS |
28 Laser phototherapy in Bell’s palsy
   _Prof. Aparecida Maria Cordeiro Marques, MSci, PhD; Luiz Guilherme Pinheiro Soares, DDS; Cristina Maria do Nascimento, M.Sci; Alberto de Aguiar Pires Valença Neto, DDS; Roberta Cordeiro Marques, Physiotherapist (Specialist) and Prof. Antonio Luiz Barbosa Pinheiro, MSci, PhD |

| case report |
| 30 Treatment of gingival hyperpigmentation for esthetic purposes using the diode laser
   _Prabhuji Munivenkatappa lakshmaiah Venkatesh, MDS; Madhu Praetha, MDS and Archana Vilasan, MDS |

| technique |
| 34 Crown troughing with the 810 nm diode laser
   _Glenn A. van As, BSc, DMD |

| industry |
| 38 DC International launches redesigned and advanced soft diode laser: DCLase 980nm 7 watts |

| about the publisher |
| 41 submissions |
| 42 imprint |

on the cover
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Introduction to the LANAP protocol for the treatment of periodontitis

Author: Robert H. Gregg II, DDS

The breakthrough LANAP® protocol offers many advantages over conventional flap periodontal surgery or scaling and root planing for the treatment of periodontitis. This no-cut, no-sew technique is bringing revolutionary outcomes into the treatment rooms of general dentists and periodontists alike, allowing the profession to battle against a disease that threatens the health of more than 80 percent of Americans. This overview explains what the LANAP procedure is, how it works and what clinical trials are showing about the exciting results this strict protocol can achieve for patients with gingivitis, "garden variety" periodontitis — and even the most extremely severe forms of gum disease.

Most Americans — about 80 percent — suffer with gum disease on some level, according to the U.S. surgeon general. Michael Newman, DDS, PhD, says that only 3 percent of the 100 million-plus Americans with moderate to severe periodontal disease are treated each year, which means an increasing number of worsening cases appear in general dental practices across the country every day. The growing threat requires a greater number of general dentists to take the lead in properly performing a periodontal probing exam. Still, for many offices, the challenge lies in persuading the patient to seek treatment via referral to a periodontist.

A growing number of general practitioners have reached a frustration threshold, seeing one patient after another who either continues with poor gum health or seeks treatment from a periodontist and achieves results that ultimately leave much to be desired. Some of these dentists have discovered a treatment protocol that allows them to take action and provide patients improved care — without even referring them out of the practice. The treatment is achieving unsurpassed results not otherwise attainable with conventional techniques.

Widely known to be closely linked with heart disease and strokes, periodontitis has now been fingered as the cause in a full-term baby’s death. It is believed that the mother’s gum disease introduced fatal bacteria to her womb. In an age of burgeoning technology, the news stories linking gum disease to more disastrous results are inevitable. As the dangerous consequences of gum disease become increasingly clear, more dental clinicians must take the reins in educating patients and ensuring their successful treatment.

Dental practitioners have used free-running (FR) pulsed Nd:YAG lasers for longer than 20 years, but only recently has the laser been combined with a specific, successful protocol and research-proven operating parameters to achieve FDA clearance and a track record of success in university-based clinical studies for its efficacy at "cementum-mediated new PDL attachment to the tooth root surface in the absence of long junctional epithelium." The protocol has shown consistent probe depth reduction, histological and clinical new attachment, and radiographic bone growth for periodontally involved teeth with no elevation of the periosteum and minimal patient discomfort.

Its greatest potential may lie in patients’ willingness to accept treatment and comply. With 97 percent refusing current protocols, a no-cut, no-sew solution has meant a flock of new patients willing to seek treatment for their gum disease from those dentists who choose to offer the LANAP protocol.

What is the LANAP protocol?

The procedure combines the PerioLase MVP-7 Free-Running (FR) pulsed Nd:YAG laser with a strict, specific, research-proven protocol that has achieved FDA clearance for the treatment of all forms of gum
The LANAP treatment protocol

Designed and refined for 10 years, the LANAP technique’s specific clinical steps must be performed properly and in precise order to achieve consistent positive outcomes. The key steps, in order, make up the patented portion of the technique and are the crux of why the LANAP protocol is so successful. The procedure may be performed in all four quadrants in a single appointment, but for patient comfort and case control, laser treatment is typically limited to no more than two non-adjacent quadrants per visit, with several days between visits.

First, the patient is profoundly anesthetized with local anesthetic so that the patient’s pocket depths can be probed down to the level of intra-osseous defects (bone sounding). The thin optic fiber is then used parallel to the root surface, to effect the pocket wall. Next, an EMS ultrasonic scaler removes calcified plaque and calculus adherent to the root surface. The first pass with the laser, called laser troughing, is accomplished with the short duration pulse. The FR pulsed Nd:YAG laser is used to achieve optimal reduction of microbiotic pathogens (antisepsis) within the periodontal sulcus and surrounding tissues. Perio pathogens and pathologic proteins are selectively destroyed by the laser’s light energy, providing an antiseptic surgical environment that allows healing following the laser hemostasis step.8–15

The technique uses selective photothermolysis to remove the diseased, infected and inflamed pocket epithelium while preserving healthy connective tissue, literally separating the tissue layers at the level of the rete pegs and ridges.8–11 The practitioner is able to achieve both tissue ablation and antiseptic hemostasis with extreme precision by varying the laser’s energy density, pulse duration and rate of repetition. The laser assists in the destruction of perio pathogens while preserving the healthy tissue, allowing for less post-operative discomfort and a much shorter post-surgical recovery perception for the patient.

At this point, a second pass is completed to finish debriding the pocket and achieve hemostasis with a thermal fibrin clot. Gingival tissue is compressed against the root surface as necessary to close the pocket and aid with formation and stabilization of the fibrin clot. No sutures or surgical glue is needed. Mobile teeth above class II mobility are splinted. Occlusal adjustments are performed to remove interferences, minimize trauma, and provide balance to long axis forces and are considered an essential component of the LANAP protocol.

Finally, post-operative instructions specific to the LANAP protocol, diet guidelines and oral hygiene instructions are explained and their importance is stressed, and continued periodontal maintenance is scheduled. Patients are monitored at one week, 30 days and then every three months for periodontal maintenance. No subsequent probing is performed for at least six months to a year, to allow sufficient healing time for the cementum-fiber PDL interface.

Harnessing the LANAP protocol’s results

The availability of a procedure that eliminates cutting and sewing without gum recession is changing the standard of care for periodontitis treatment. Not only is there a treatment protocol that is universally accepted by patients, but it also represents an option that includes both specialists and general practitioners in the solution. A general practitioner who may be reluctant to perform invasive surgery may welcome the opportunity to treat such an overwhelming health issue without referring patients elsewhere. Alternatively, the LANAP protocol practiced by periodontic specialists, becomes a more attractive referral for general practitioners and their patients.

Those who choose to embrace the LANAP protocol do so with a support system in place. Clinicians are required to undergo extensive training and adhere to the protocols that have proven successful before performing the LANAP technique. Millennium Dental Technologies, the manufacturer of the PerioLase MVP-7, requires clinicians satisfactorily complete a three-day lecture course and live, hands-on patient
treatment and patient response before the company will ship the laser and all the essential elements of the protocol. Additional study follows the initial training.

_The science behind the LANAP protocol_

Early LANAP protocol research showed consistent mean pocket depth reduction (nearly 50 percent) and improved bone density (38 percent) in an eight-year retrospective study of the protocol’s earliest clinical results. The Emago imaging system demonstrated that 100 percent of these cases showed bone density increases. The procedure has also proven effective at reducing pocket depth without gingival recession over a six-month period.16,17

In the fourth-largest human histological study in the perio regeneration literature (with a control group), the LANAP protocol using the PerioLase MPV-7 was compared to a blinded examiner (clinical) conventional scaling and root planing without laser assistance. Twelve teeth were removed en bloc and examined by a blinded histologist. When the blinded code was broken, all teeth treated with the LANAP protocol demonstrated 100 percent cementum-mediated new periodontal ligament attachment to the previously periodontally affected tooth roots in all six of the LANAP-treated teeth and in the absence of long junctional epithelium.8,11 These results are unique in the perio literature.

Given its unique, predictably regenerative results, it should come as no surprise that the LANAP protocol has inspired its share of imitators. As yet, those copycat protocols have no science to support their continued use. The patented LANAP protocol is the only peer-reviewed and FDA-cleared approach that is proven successful at treating mild, moderate and especially severe periodontitis.

_**LANAP protocol vs. cut-and-sew procedures**_

The successful treatment of periodontal disease requires thorough debridement of the root surface. Pockets of 5 mm or greater depth make it difficult to remove subgingival plaque and calculus. Surgical intervention allows access and visualization for scaling and root planing in these deep pockets.18 While scalpel surgery can accomplish such access and visualization, it can also result in attachment loss, gingival cratering and gingival recession.19–22 Additionally, the associated pain and discomfort can be deterrents.23

In any case, many general practitioners would never consider performing conventional flap surgery because of its invasive nature.

LANAP treatment, while an exceptional alternative, is not without its drawbacks. The predominant issues involve cost and time. The initial financial outlay for the laser equipment can be cost-prohibitive for some practices. Similarly, dental clinicians must be willing and able to take time away from the office to undergo procedural training and learn LANAP treatment with live patients. Following the training, and as with anything new, there can be a learning curve as clinicians grow comfortable and begin to excel at treating patients with LANAP procedures.

For now, cut-and-sew techniques remain the standard of care and additional study will be required to persuade many professionals that any laser system provides clinical value surpassing scaling and root planing techniques and conventional surgical treatment.24 Cautious experts warn that the improper use of the Nd:YAG laser can have detrimental effects on the root surface ranging from heat cracking to charring, cementum meltdown and crater formation.25 These negative outcomes are not typical with adherence to current LANAP protocols and thus far appear to result from improper laser settings. Studies continue, and most researchers agree that laser or laser-assisted pocket therapy is expected to become a new technical modality in periodontics.26

The LANAP treatment protocol achieves the same access to the problem that root planing and scaling or conventional flap surgery does, but it achieves its...
success differently. The practitioner uses a quartz fiber in place of a scalpel to achieve both tissue ablation and antibiotic properties. No cutting means a significantly more comfortable recovery. Patients typically remain on a soft diet for several days to a week following LANAP treatment and are instructed to avoid brushing at the surgical site for that period.

Conclusion

Whereas treatment outcomes with conventional modalities may be variable, in stark contrast the LANAP protocol allows clinicians to achieve predictable positive results — including three-dimensional regeneration of bone. Also, comfort levels associated with this minimally invasive treatment are substantially increasing patient acceptance rates.

Ongoing additional studies are expected to continue to underscore the LANAP protocol advantages and pave the way for its acceptance as a standard of care in treating patients with moderate to severe gum disease.

*LANAP is a registered trademark of Millennium Dental Technologies.

References

More than 20 years ago, a dental patient named Kimberly Bergalis was diagnosed with AIDS. The source of her HIV infection was her dentist. Even though the exact path of transmission is still not known, this first proven transmission of HIV from dentist to patient—and the subsequent intense coverage by the media—set off tremendous confusion and panic among dental patients. It was her unfortunate death in 1991 that changed the dental profession almost overnight, prompting all sorts of new regulations and guidelines, including the sterilization of dental instruments.

The document Guidelines for Infection Control in Dental Health-care Settings was published by the U.S. Centers for Disease Control and Prevention (CDC) on Dec. 19, 2003, providing some of the current and available scientific rationale for infection-control practices, for which recommendations were made. These suggestions were followed closely by various governing dental health organizations, including the U.S. Occupational Safety and Health Administration (OSHA) and Health Canada.

In dentistry, we see patients from different walks of life every day and they bring all kinds of pathogens to our dental offices. It is our responsibility to arrest the path of these pathogens and attempt to prevent them from infecting others and spreading beyond our practices. Following the CDC recommended infection-control guidelines and procedures can help stop and prevent transmission of infectious organisms through blood, oral and respiratory secretions and contaminated equipment during the course of dental treatment. One factor to consider in assessing the risk of contamination is the type of bodily substances to which dental health-care personnel (DHCP) are exposed. It is generally understood that human blood has a high infectious potential. In addition to bacteria and fungi, human saliva has been found to be capable of harboring many kinds of infectious viruses. Without the benefits of a quick and reliable reference, DHCP have to assume that everyone is a potential carrier. This is the fundamental reason that dental practices should have a universal infection prevention protocol.

Among many other related issues, the CDC guidelines explain the manner in which to wear surgical gloves properly and implement a glove protocol. These recommendations will help properly prevent contamination from our patients’ oral tissues and fluids. Regarding surgical masks, laser ablation of human tissue or dental restorations can cause thermal destruction and can create smoke byproducts containing dead and live cellular material (including blood fragments), viruses and possible toxic gases and vapors. One concern is that aerosolized infectious material in the laser plume, such as the herpes simplex virus and human papillomavirus, may come into contact with the nasal mucosa of the laser operator and nearby DHCP. Although no evidence exists that HIV or the hepatitis B virus (HBV) has been transmitted via aerosolization and inhalation, there are scientific studies that confirm the risk of this possible route of contamination. The risk to DHCP from exposure to laser plumes and smoke is real, and, along
with other measures such as strong high-volume suction, the use of a high-filtration mask is strongly recommended (Fig. 1).

Sterilization is a multistep procedure that must be performed carefully and correctly by the DHCP to help ensure that all instruments are uniformly sterilized and safe for patient use. Cleaning, which is the first basic step in all decontamination and sterilization processes, involves the physical removal of debris and reduces the number of micro-organisms on an instrument or device. If visible debris or organic matter is not removed, it can interfere with the disinfection or sterilization process. Proper monitoring of sterilization procedures should include a combination of process indicators and biological indicators, and should be assessed at least once a week (Fig. 2).

Patient-care items are generally divided into three groups, depending on their intended use and the potential risk of disease transmission. Critical items are those that penetrate soft tissue, touch bone or contact the bloodstream. They pose the highest risk of transmitting infection and should be heat sterilized between patient uses. Examples of critical items are surgical instruments, periodontal scalers, surgical dental burs, optical fibers (Fig. 3) and contact tips (Fig. 4). Therefore, it is extremely important to examine, cleave, polish and sterilize optical fibers and contact tips after each use. Alternatively, sterile, single-use, disposable devices can be used. Semi-critical items are those that come into contact with only mucous membranes and do not penetrate soft tissues. As such, they have a lower risk of transmission. Examples of semi-critical instruments are dental mouth mirrors, amalgam condensers and impression trays.

Most of the equipment in this category is heat tolerant, and should therefore be heat sterilized between patient uses. For heat-sensitive instruments, high-level disinfection is appropriate. Non-critical items are instruments and devices that come into contact only with intact (unbroken) skin, which serves as an effective barrier to micro-organisms. These items carry such a low risk of transmitting infections that they usually only require cleaning and low-level disinfection. Examples of instruments in this category include X-ray head/cones, blood-pressure cuffs, low-level laser emission devices and laser safety glasses. For low-level laser therapy, the use of a transparent barrier similar to disposable sleeves for curing lights is acceptable. For safety glasses, the use of a low-level disinfectant is suitable as long as it has a label claim approved by OSHA for removing HIV and HBV. The disposal of used instruments and excised biological tissues should be managed separately. A cleaved optical fiber, broken contact tips, or disposable fibers should be disposed of properly in a sharps container. Harvested biological waste should be placed in a container labeled with a biohazard symbol. In order to protect the individuals handling and transporting biopsy specimens, each specimen must be placed in a sturdy, leak-proof container with a secure lid to prevent leakage during transport. By following these guidelines, the spread of pathogens amongst dental patients, DHCP and their families can be prevented, and the passing of Kimberly Bergalis will not have been in vain._

Disclosure: Dr. Yung has no commercial or financial interest regarding this article.

Editorial note: A list of references is available from the publisher. This article was first published in the Journal of Laser Dentistry, 18/2 (2010): 68–70.

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frankyung@rogers.com
www.drfrankyung.com
New horizons for Er:YAG lasers: QSP mode advantages in the Lightwalker AT

Abstract

Lasers as a tool for everyday practice in dental medicine are becoming more popular since the 1992 invention of the Er:YAG wavelength for hard dental tissue preparation. Strong acceptance from patients, plus painless and easy operation are just some of the many advantages that usually influence the decision to add a laser in the clinic.1,2 Today, requirements demanded by and expectations of the dental community to add a laser to the practice are much higher, and just being quieter than the high-speed drill and providing painless dentistry is not enough.

Dentists expect much more — to be able to do almost everything with one machine, to do procedures in less time and to be cost-effective. A very important step forward in dental lasers and specifically Er:YAG applications is the QSP (quantum square pulse) modality in the range of VSP (variable square pulse) available in Fotona’s Lightwalker AT hard- and soft-tissue laser (Technology4Medicine, San Clemente, Calif.). Based on simple physics, this mode allows dentists to work with finesse and control, even on higher energy and power settings, making all procedures faster compared with traditional Erbium laser pulsing modes, and even more painless. This in-vitro study researches the most suitable parameters for hard tissue preparation with the new QSP mode and compares it with the classic tools such as the high-speed drill, and the proven gold standard for Er:YAG laser enamel preparation, the MSP mode. Clinical cases from everyday practice are presented to illustrate a wide range of flexible and fast procedures that can be performed with the Er:YAG QSP pulse mode.

Introduction

For 20 years erbium lasers have been on the dental market, and their main usage has been the preparation of the hard tissues, including enamel, dentine, caries lesions and bone. The widely used Er:YAG laser is well known for its strong absorption in water and hydroxyapatite, which gives it the ability for fast cutting and preparation speeds in these tissues with negligible thermal effects.3 During past years, manufacturers have worked on improving their laser systems, researching more suitable parameters for optimizing the work on hard tissues. Even though the Er:YAG laser wavelength is well absorbed in dental tissues due to the high percentage of hydroxyapatite...
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  Featuring: Urs Belser; David Garber; Joseph Kan; Henry Salama; Maurice Salama; & William Scarfe

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and water in the tooth structure, there have been some residual side effects affecting cutting ability. One is absorption of the laser energy in the debris cloud, which is formed after the ablation from the very first shot, thus reducing the useful energy for cold ablation of dental tissues. Scattering of the beam in the debris cloud can also lead to redirection of the beam from its original path and preparation margins are not well defined.3–5

Research led to the development of a pulse duration shorter than the time necessary to form a debris cloud (50–150 ms),3 making the time between pulses longer than the debris cloud, ensuring there will be no absorption of the pulse energy. This is done by dividing one long pulse (for example 600 ms) into five super short pulses (50 ms) increasing the herz-rate up to 120 Hz. This is possible because of physical properties of the Er:YAG atoms and Fotona’s advanced and proprietary control of the laser pump source.

Another useful effect of dividing a pulse is that the QSP mode achieves five shorter pulses with the same energy but with significantly higher peak powers. This makes it possible to work with low energy but with high peak powers, higher precision and more speed compared with other hard-tissue pulsing modes for other lasers. Higher energy density and higher peak power ensures cold, effective ablation, resulting in less thermal damage and less pain.

**Materials and methods**

Our team designed this study to find the best parameters for enamel preparation with the QSP mode and compare them with the proven and effective MSP mode and high-speed drills. Microleakage tests and time-splitting were used to determine the preparation speed advantages.

The experiments were conducted on bovine teeth, freshly extracted and kept in saline solution before preparation. The teeth were extracted from cows raised on the same farm under the same conditions and diet. The donor animals varied in age, so we found three groups of teeth to work on — freshly erupted incisors, old incisors and premolars.

For the microleakage test we prepared cavities sized 3-by-3 mm on the lingual surface of the incisors and premolars until reaching the enamel-dentine junction. One hundred fifty teeth were divided into five groups — 15 in each group were tested for microleakage with methyleneblue and 15 for bacterial contamination with Lactobacillus.

The first test group was treated with the QSP mode with 500 mJ/12Hz, an average power of 6 watts to approximate the MSP average power for enamel preparation, which was the speed-determining parameter.

The second test group was treated with the QSP mode with 300 mJ/15Hz, an average power of 4.5 watts. This is the same pulse energy for MSP enamel preparation from the factory presets.

The third test group was treated with the QSP mode with 300 mJ/15Hz, an average power of 4.5 watts and subsequent surface modification procedure, QSP 120 mJ/10Hz, the same as the MSP factory presets.

The first control group was treated with the MSP mode with 300 mJ/30Hz, average power of 9 watts and subsequent surface modification procedure — MSP 120 mJ/10Hz, the factory presets for enamel preparation and surface modification.

The second control group was treated with a high-speed drill, the Kavo GENTLEsilence 8000 LUX.

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**Table 1**. Results from the dye immersion test are given in percentages and number of teeth with coloration. The last column shows the most successful samples number in each group.

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<thead>
<tr>
<th>Change in a filling color</th>
<th>++</th>
<th>+</th>
<th>-</th>
<th>+</th>
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<tr>
<td>Penetration in tissue of MB</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12 Hz/500 mJ</td>
<td>2/15 13.33%</td>
<td>2/15 13.33%</td>
<td>1/15 6.67%</td>
<td>2/15 13.33%</td>
<td>8/15 53.33%</td>
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<td>MSP - 6 W avg.</td>
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<td>15 Hz/300 mJ</td>
<td>2/15 13.33%</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>QSP - 4.5 W avg.</td>
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<td>15 Hz/300 mJ+10 Hz/120 mJ</td>
<td>1/15 6.67%</td>
<td>-</td>
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<td>QSP - 4.5+1 W</td>
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<tr>
<td>30 Hz/300 mJ+10 Hz/120 mJ</td>
<td>1/15 6.67%</td>
<td>3/15 20%</td>
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<td>MSP - 9 W avg.</td>
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<td>High speed drill</td>
<td>5/15 33.33%</td>
<td>-</td>
<td>4/15 26.67%</td>
<td>2/15 13.33%</td>
<td>4/15 26.67%</td>
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B, 19 watts output power, equipped with a Meisinger green-coded diamond bur. The burs were replaced with new burs for every 10 teeth.

Each group consisted of six premolars, six to seven freshly erupted incisors and 17 to 18 old incisors, divided in subgroups for coloration and Lactobacillus contamination tests with an equal number of three kinds of teeth in each (Fig. 1).

All teeth were prepared in one day, kept in saline and filled with GrandioSo (Voco, Germany) nano-hybrid light-cured composite and Futurabond M (Voco, Germany) one-bottle, self-etching, seventh-generation bonding agent. All roots were cut for retrograde pulp removal procedure. Pulp chambers of 75 teeth for methyleneblue coloration test were filled with additive-condensation silicone impression material, but those used designated for bacterial penetration testing were left hollow.

Teeth were thermocycled (5o-55oC) with 5,000 cycles. After isolation with vanish, except 1 mm around the cavities, they were immersed in Methyleneblue for 48 hours. After longitudinal section at the middle of the filling on each tooth, microleakage was registered with light transition microscopy analysis. Leakage and coloration of more than 1 mm are given two pluses (++), while less than 1 mm receive one plus (+), considering coloration of the filling material and toward dentine.

_Results and conclusions_

Results from the dye immersion test are given in Table 1 in percentages and number of teeth with coloration. The last column shows the most successful samples number in each group – without any microleakage in both filling materials and dental tissues. The best results showed QSP preparations done with 300mJ/15Hz and surface modification with QSP 120mJ/10Hz – 14 of 15 samples are without any leakage. The group with same parameters but without subsequent surface modification also demonstrated good results of 80 percent success rate.

Analysis of microleakage test results:
1) Surface modification done with 10Hz/120mJ in QSP mode ensures perfect sealing of the cavity and had to be performed with faster movements compared with the same procedure in MSP mode.
2) QSP preparation without subsequent lowering of the energy and repetition rate for etching also is ensuring adequate bond strength if the energy used was lower than 300mJ.
3) High-speed drill specimens showed results with much higher incidence of microleakage, only 26.67 percent without any leakage.

Clinical aspects:
1) QSP mode preparations were much faster and also much quieter.
2) Using 12Hz/500mJ was too powerful and hard to control. To achieve deeper preparation it is recommended to switch to 15 Hz/160 to 300 mJ.
3) The surface modification regime was faster, so to perform efficient etching the handpiece needs to be moved faster.

_Time-split test_

For the time-split test, four groups of 30 teeth (10 from each kind) are prepared with four modes, without using the surface modification procedure.

1) 500mJ/12 Hz QSP
2) 300mJ/15 Hz QSP
3) 300mJ/30 Hz MSP
4) High-speed drill

For this test we used a digital stopwatch operated by an assistant, starting on the first laser shot and stopping on command from the operator. The size of the cavities was 4-by-4 mm until reaching the
Er:YAG lasers were used to prepare the enamel-dentine junction on the lingual surface, thus ensuring that equal amount of enamel was removed and the only difference was due to enamel hardness. Average times in each mode are given in Table 2. Taking as a standard the fastest prepared teeth — i.e., old incisors — the time difference between different kinds of teeth in same mode is shown in Table 3. Also the time difference between different modes in the same kind of teeth can be calculated by using as a standard the fastest mode — 500mJ/12 Hz QSP — as shown in Table 4.

**Time-split test conclusions**

1) In harder enamel specimens (premolars), the time for preparation does not vary significantly in QSP and MSP, while the high-speed drill was much slower (compared with old incisors).

2) There was a proportional slowing of the preparation speed according to the enamel hardness. This was an in-vitro test, and the results cannot be correlated to any kind of human dental-tissue preparation speed.

3) QSP 500 mJ/12 Hz is the fastest and, if we take it as a standard, calculation of the difference according to operation mode and types of teeth is possible.

4) The high-speed drill was slowest in all kinds of tissue.

5) Between MSP and QSP mode, there is significant difference only in the hardest teeth (premolars). The two modes are equally suitable for cavity preparation of enamel of average hardness.

<table>
<thead>
<tr>
<th>Mode used / Tooth type</th>
<th>Old incisor</th>
<th>Freshly erupted incisor</th>
<th>Premolar</th>
</tr>
</thead>
<tbody>
<tr>
<td>500mJ/12 Hz QSP</td>
<td>10,13 sec. avg.</td>
<td>14,08 sec. avg.</td>
<td>16,48 sec. avg.</td>
</tr>
<tr>
<td>300mJ/15 Hz QSP</td>
<td>11,09 sec. avg.</td>
<td>14,63 sec. avg.</td>
<td>19,96 sec. avg.</td>
</tr>
<tr>
<td>300mJ/30Hz MSP</td>
<td>11,92 sec. avg.</td>
<td>15,31 sec. avg.</td>
<td>21,33 sec. avg.</td>
</tr>
<tr>
<td>High speed Drill</td>
<td>12,84 sec. avg.</td>
<td>19,89 sec. avg.</td>
<td>24,90 sec. avg.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode/ difference between groups</th>
<th>Freshly erupted incisors to Old incisors</th>
<th>Premolars to Old incisors</th>
</tr>
</thead>
<tbody>
<tr>
<td>500mJ/12Hz QSP</td>
<td>38,99% slower</td>
<td>62,68% slower</td>
</tr>
<tr>
<td>300mJ/15Hz QSP</td>
<td>31,92% slower</td>
<td>79,98% slower</td>
</tr>
<tr>
<td>300mJ/30Hz MSP</td>
<td>28,43% slower</td>
<td>78,94% slower</td>
</tr>
<tr>
<td>High speed Drill</td>
<td>54,90% slower</td>
<td>93,92% slower</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>300mJ QSP To 500 mJ QSP</th>
<th>300mJ MSP to 500mJ QSP</th>
<th>High speed Drill to 500 mJ QSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Old Incisors</td>
<td>9,47% slower</td>
<td>17,67% slower</td>
</tr>
<tr>
<td>Freshly erupted Incisors</td>
<td>3,90% slower</td>
<td>8,73% slower</td>
</tr>
<tr>
<td>Premolars</td>
<td>21,11% slower</td>
<td>29,42% slower</td>
</tr>
</tbody>
</table>

Table 2. Average times in each mode.

Table 3. The time difference between different kinds of teeth in the same mode.

Table 4. The time difference between different modes in the same kind of teeth.
_A clinical case_

A clinical case is described to show the advantages of the QSP mode in everyday practice. The patient is a 23-year-old male with anxious reactions to dental procedures and is sensitive to cold in the lower right quadrant. After initial checkup we found a carious lesion on the cervical area on tooth #45 (European numbering system), appearing to be deep and acute with exposed dentine.

After injection, explanation of the laser function and possibilities, we started the cavity preparation with QSP mode and 500mJ/12 Hz, the highest possible average power with QSP and, as proved in the in-vitro test, the fastest regime. Working time was counted with a stopwatch, and after five seconds most of the decayed enamel and dentine were removed.

The gum is unharmed even after marginal preparation with such a high energy – this is a clinical evidence that in this mode the scattering and absorption effects in the debris cloud are negligible and allows fast and accurate preparation (Figs 5–7). In the deeper zone, we reduced the energy to 300mJ, but raised the repetition rate to 15Hz, thus being fast enough but still quiet.

After five seconds the whole cavity is cleared of carious dentine. After placing the haemostatic cord (#8, Pascal Co., USA), Calcimol LC (Voco, Germany) is used as a liner, covered with Grandioso Heavy Flow and finally filled with GrandioSo (Voco), using the Futurabond M (Voco) bonding system (seventh generation self-etching).

So fast preparation is possible in acute caries, there is proportional relation of the time needed for preparation and the water content of the target tissue, but this mode is very suitable in pediatric dentistry, where in most cases the working time is limited by the patient’s tolerance (Figs. 8–10).

_Discussion_

Real clinical benefits from new mode of quantum square pulse are easy to recognize. The margins of preparations for filling, or for surface modification are clearer and sharper than with any other working mode. This is important when working close to the pulp or near the gingiva. It is a safe operation mode in class II cavity preparation where the neighbor teeth should be kept untouched.

The parameters used in these cases are subject to change according to personal sensitivity and the type of target tissue, but biophysical constants guarantee the cold ablation regime such as power density, time of exposure and proper water supply should be closely observed. This requires a good working knowledge of the properties of light and
lasers and the ability to calculate parameters and make necessary changes by monitoring laser-tissue interaction.

Speed of preparation is especially important in pediatric dentistry and with anxious patients, and the QSP mode is the method of choice and does not sacrifice precision. The ability to quickly change pulse durations and repetition rates gives us the opportunity to work efficiently in different types of tissues with maximum safety.

_End of research_ Er:YAG lasers

_Fig. 8_ Fast preparation is possible in acute caries.

_Fig. 9_

_Fig. 10_

_Conclusion_

This study demonstrates that an Er:YAG laser can offer significant advantages to standard treatment protocols. Also, the QSP mode offers even more important advantages, adding additional treatment options. The laser is safe and effective, appealing to patients who are afraid of dentistry.

_References_


_About the author_

Evgeniy Mironov, DDS, is working on his master’s of science degree in lasers in dentistry from the Aachen Dental Laser Center (AALZ), RWTH International Academy, in Germany. AALZ works in cooperation with the Clinic for Dental Conservation, Periodontology and Preventive Dentistry, at the University of Excellence RWTH Aachen. AALZ is known for its research in laser-assisted dentistry, and it cooperates nationally and internationally with major research facilities. Mironov may be contacted at dr_em@abv.bg.
In June 2011, I was having lunch at home when I suddenly bit the inside of my cheek on the right side. The yelp of pain I emitted startled my dog enough he got up from where he was lying to check if I had dropped any food to the floor in my distress (he was unlucky). A bump arose where I had bit my cheek, and during the course of the next nine months, the bump not only seemed to be constantly in my way, but also became a distraction. No matter how careful I was, the tall conical bump found its way between my teeth a few more times during mealtimes. In addition, I'd probe it with my tongue and even chew on it in moments of contemplation. I kept waiting for it to disappear, but I knew it wouldn't on its own.

A bump arose where I had bit my cheek, and during the course of the next nine months, the bump not only seemed to be constantly in my way, but also became a distraction. No matter how careful I was, the tall conical bump found its way between my teeth a few more times during mealtimes. In addition, I'd probe it with my tongue and even chew on it in moments of contemplation. I kept waiting for it to disappear, but I knew it wouldn't on its own.

During a routine checkup, my dentist kindly offered to get rid of the bump for me. When I asked her how, and the words "cut it off" were part of her response, I had to stop myself from curling my lips over my teeth and clamping my jaws shut in response. "Cut? Bloody open wound? Thanks, but no thanks," I replied.

I'm no stranger to dental procedures and not afraid of a needle, but the thought of her excising this annoying bump with a scalpel was definitely not a welcoming thought. I knew there had to be a less painful way, and to me that meant using a laser. I've worked in dental publishing for nearly 10 years, so Biolase lasers are familiar to me, but I've never seen one in action for a real procedure. Thus, I offered myself as a willing patient, with pen in hand, if Biolase would help me find a local dentist to do the procedure.

Enter Dr. Sharad Pandhi,1 a Tucson, Ariz., dentist with more than 25 years of experience who has been recognized locally for the two days each week he spends providing treatment to patients in nursing homes and other care facilities as well as home-bound patients. Pandhi is trained to treat special-needs patients with physical or developmental disabilities. In April 2010, he was interviewed on local TV station KVOA News 4 about a laser root canal treatment he performed on a patient with sensitive teeth and considerable fear of the dentist.2 I, however, was unaware of all this before I met Pandhi on a Saturday morning in March at a laser dentistry lecture by Bruce Cassis, DDS, sponsored by Biolase (Fig. 1).

Cassis gives one the impression that he could explain even quantum physics in his gentle Southern accent such that anyone would understand. This and his calm demeanor are traits I am certain his patients benefit greatly from. Pandhi projects a great sense of peace and immediately engenders one's trust, which makes him equally well appointed as a dentist. He and I scheduled a preliminary appointment for him to assess the bump and plan its removal a few days later.

On the fibroma removal day, I was scheduled as a guest lecturer in the law department at the University of Arizona in the afternoon. Sitting in Pandhi's chair, I asked if I would be able to speak normally in six hours and he assured me I would. As Pandhi and his staff prepared me for the procedure, I found that I kept

---

**Fig. 1** From left, Dr. Sharad Pandhi, Gilda Parada, RDH, and Dr. Bruce Cassis during a break in Cassis’ lecture on laser dentistry in Tucson, Ariz., on March 17. (Photo/Robin Goodman, Dental Tribune)
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reminding myself that this was not going to hurt and was likely going to be less of an uncomfortable experience than the replacement of some fillings recently by my regular dentist. I recalled the conversation I had with Pandhi when he answered my question, “So why doesn’t it hurt when you use lasers for these types of procedures?”

He explained how the stimulus for a nerve to feel pain is 150 microseconds in length and that his laser uses short pulses from 5 to 50 microseconds in length, depending upon the setting he chooses. These short pulses have an analgesic effect. The Waterlase YSGG laser is an air and water handpiece that actually excites the water molecules within the spray and in the target tissue. Thus, the result is micro-ablation of tooth structure, bone or, as in my case, soft tissue.

After administering a shot of local anesthetic, Pandhi and his team proceeded to photographically document the laser procedure from start to finish (Figs. 2–4). Much credit goes to him and his team for achieving my request of getting an image of Pandhi using the Waterlase on the fibroma. Despite his kind warning that he was ready to apply the laser, a small kernel of doubt remained that I had to tamp down in private.

“This is not going to hurt, do not worry. Lasers are cool in every sense of the word,” I told myself. My only sensation was that of my mouth being kept open and the gentle tug on the inside of my cheek where Pandhi held the fibroma out for removal. There was no pain. There was, however, a frisson of pleasure as Pandhi showed me the contents of the sample tube he would send to the lab for diagnosis: “Bye-bye fibroma!”

I dutifully kept pressure on the site for 30 minutes after the procedure with the gauze Pandhi provided me, and truth be told, that is about the only time I noticed the removal site until my follow-up appointment one week later (Fig. 5). Of course, I scrutinized it in a mirror the moment I got home, and marveled at its bloodless and painless condition. The loss of the fibroma was so simple and aggravation free — no collateral numbness, pain free — that I simply forgot to pick up the chlorhexidine rinse Pandhi had prescribed, so I didn’t rinse twice a day with this as instructed.

Six hours later, I was lecturing a group of senior law students about how to write and edit documents and organize their files. I had no awareness of the tiny depression in my check left by the removal of the fibroma beyond the fact that it was no longer there to nudge with my tongue as a colleague introduced me to the class.

I’ve always thought lasers were cool (pun intended), but now I know from personal experience. In my opinion, any clinician offering laser dentistry should be shouting this in his or her waiting room 24/7, so to speak.

_References_

1. www.smileperfectionaz.com
2. www.youtube.com/watch?v=Z2wHXY0d2oY
3. The laboratory report noted the following: “Comment: There is subepithelial expansion by dense fibrous tissue, rich in fibroblasts. Gross: Received in formalin, a fragment of pink-tan mucosal soft tissue measuring 0.6 x 0.5 x 0.2 cm. Clinical: Fibroma.”
For more information, please visit www.biolase.com. Also, check out the offerings of the World Clinical Laser Institute (WCLI), which recently held a Super Symposium in San Diego. This laser organization is more than 2,000 members strong and provides education and fellowship at major symposiums in the eastern and western United States every year, as well as numerous local and regional symposiums and seminars in the United States and other countries. More information about WCLI is available at www.learnlasers.com.

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**Fig. 4** _Immediate post-op.

**Fig. 5** _One week post-op.

---

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Sometimes by asking questions that nobody has ever asked before you break new ground. In my case, this was: how can I help periodontitis patients even more effectively? And the simple answer is: with the "3,000 percent more power" therapy.

What's that? Is that dangerous? How is that supposed to work? Why do we need this? What's that supposed to mean?

No one had asked me these questions when I presented the concept (developed in our office in 2007) as a pilot project at IDS. Nevertheless, I shall answer these previously unasked questions here.

The idea

I came upon the idea of a different way to treat periodontitis while researching literature on the topic of lasers. The 2003 Yukna Report' described the LANAP method. This laser-assisted new attachment procedure promised regeneration instead of repair, combined with a spectacular design. Dr. Yukna of New Orleans had three female patients, each of whom agreed to undergo the study on two single-rooted teeth with plaque. One tooth in each patient was treated using the LANAP method and the other with the Nd:YAG laser in accordance with a standard protocol.

And here's the kicker (this would happen only in the United States): after monthly recalls, both teeth were removed from the bone block in all three patients!

The histological results showed regenerated bone and new periodontal ligament in two of the three LANAP teeth. The control group had only one long functional epithelium. Neither the root surface nor the pulp showed histological changes.
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So far so good — anyone who knows me knows that, as a general dentist, I am a fan of the diode laser. The only Nd:YAG laser that can handle the LANAP procedure and is patented for the job is the Millennium Laser from the undisputed master inventor and laser pioneer, Dr. Robert H. Gregg.

_The method_

I analyzed which factors were different from a standard laser protocol and tried to adapt the diode-laser procedure accordingly. Thanks to the support of elexxion, I was able to develop a protocol for the claros at 30W and 20,000Hz.

What clinical indication of successful treatment can we expect based on the Yukna Report?

Such an indication is bleeding from the treated socket. As a laser user, I am sure you know that treated sockets can become very dry after normal laser treatment. Many manufacturers even use this as a selling point, and the patient is satisfied as well — after all, there is no more bleeding. The problem is, no blood means no regeneration, no healing, no new bone. Every dentist is familiar with the problems caused by dry sockets. Schulte addressed this concept in the filling of cysts with autologous blood.

_The questions_

_How do we achieve this?_
We achieve this with extremely short impulses at very high wattage levels.

_Is this safe for the patient?_
In order to answer this question, we asked Dr. I. Krejci of the University of Geneva to conduct a pilot study in 2007. The results of the study can be summarized as follows.

At the recommended tested settings, a temperature reduction of up to 20 percent occurred compared with treatment with a 1.11W continuous wave. There were no significant electron microscopical changes to the root. At these settings, no carbonization of the root surfaces took place. Of course, further studies are necessary and desirable to corroborate these results.

_Why do we need this?_
The goal is greater regeneration instead of repair.

_How does this work?_
This works using elap-p, a procedure developed in the dentist’s office for the dentist’s office.
**What is elap-p?**

Simply put, elap-p means the following: 3,000 percent more power with up to 20 percent less heat generation with no carbonization or coagulation.

Every dentist has experienced first-hand the scenario below.

**Case study**

*Initial scenario*

The patient comes into the office on Friday evening with sharp shooting pains and was not able to sleep the night before. Pain medication works only for a short period. Redness and bleeding clearly indicate an acute periodontal cause.

*Opening the socket*

After local anesthesia, a traditional cleaning, including plaque removal, is first performed, either with an Er:YAG laser or, as shown here, through an ultrasonic periodontal probe. Of course, manual instruments can also be used if preferred. This allows the laser fiber easy access to the site of the inflammation.

*Elap-p, the first time around*

Laser decontamination is performed using the 810nm, 30W, 5,000Hz diode laser at a pulse duration of 10µs. The average measured output from the 400µm fibre tip is 1.2 W. The surface of each tooth is treated using the periodontal handpiece in a grid pattern for five seconds, about 20 seconds per tooth. With a knock-on effect (repeated laser decontamination) on bacteria and intentional forced bleeding with no carbonization or coagulation, the effect of the 30W pulse on the tissue shows an excellent healing prognosis and minimal damage to the gingival tissue, as the blood contains everything for tissue regeneration or repair.

*Plaque and toxin removal*

The Er:YAG laser, ultrasonic periodontal probe or manual instruments are once again used to remove bacterial debris, toxins (antigens) and plaque.

*Elap-p, the second time around*

Laser decontamination is repeated using the 810 nm, 30 W, 5,000 Hz diode laser at a pulse duration of 10 µs with an average output from the 400 µm fibre tip of 1.2 W. The surface of each tooth is treated using the periodontal handpiece in a grid pattern for five seconds, about 20 seconds per tooth. With a knock-on effect (repeated laser decontamination) on bacteria and intentional forced bleeding with no carbonization or coagulation, the effect of the 30W pulse on the tissue shows an excellent healing prognosis and minimal damage to the gingival tissue, as the blood contains everything for tissue regeneration or repair.

*Wound closure*

The socket is closed through bidigital pressing of the gingiva.

*Soft-laser treatment*

Soft-laser treatment is then performed at 75MW, 8,000Hz and 9µs for two minutes to alleviate pain and accelerate wound healing.

*Follow-up after 48 hours*

The patient comes in on Monday at 8:30 a.m. and reports immediate pain relief directly after treatment. She was able to enjoy the weekend without pain medication or antibiotics and was able to eat anything she wanted later in the evening following treatment.

*Comparison between treated side and untreated side*

For mobility grades higher than 1, simple acid-etch composite splinting is required. Premature contact leading to non-physiological stress must generally be removed. Naturally, after successful acute treatment, systematic periodontal treatment is to be performed.

Wishing you successful tooth maintenance!

**Editorial note:** This article first appeared in laser, the international magazine of laser dentistry, Vol. 3, No. 2, 2011. The reference is available from the publisher.
Bell’s palsy is a sudden idiopathic peripheral palsy of the facial nerve. This condition is caused by some kind of damage to the VII cranial nerve that causes either complete or partial paralysis of the facial mimics. It may be associated or not to gustative disturbance, hyper salivation and eye and ear disturbances. Its diagnosis is by the exclusion of any other causes that may cause the palsy of the facial nerve, because its etiology remains unclear. It has been demonstrated that herpes virus may cause this type of palsy due to reactivation of the virus or by immunomediated post-viral nerve demielinization. Most cases of Bell’s palsy resolve without treatment. Besides the unbalance of the facial esthetic and some sensorial symptoms, the acute phase of this disease is not associated to severe disturbances. The condition has an annual incidence estimate of 20–30:100,000 people and has a good prognosis, with spontaneous resolution in 95 percent of the cases within six to eight weeks.

One common symptom reported by sufferers is pain around the ear prior to the clinical appearance of the facial palsy. This pain is caused by sensorial disturbance of the facial nerve. The muscular spasm and sensitivity around the ear is an alert, an early sign, and it is due to hyper excitability of the facial nerve that causes the spasm of the facial muscles of the mimic and that may be provoked by centripetal impulses generated by the contact of the axons of the nerve with the Nervi nervorum. Clinical examination evidences the loss of facial expression on the affected side. The patient is not able, for example, to close the eye because the eyelid does not respond to the order to close because of the palsy of the facial nerve. The eyeball rotates itself up. This is known as Bell’s sign. Aging increases the severity of the condition due to a reduced capacity of neural regeneration. This may be attributed to a hyperactivity of glial cells and increased activity of cerebral cytokines that impair the repair of nerve cells. There is also some evidence that Bell’s palsy may be associated to bacterial infection. The success of the treatment of Bell’s palsy by using laser phototherapy isolated or in association with other therapeutic approach has been reported in the literature. The ability to increase the amplitude of the action potential and increased regeneration...
of nerves are probably related to the efficacy of the protocol used on cases of Bell’s palsy. A previous report by Shamir et al. (2001) on a rodent model used applications of l=780nm light applied daily and transcutaneously (30 minutes, 21 consecutive days), to corresponding segments of the spinal cord and to the injured sciatic nerve. Their results showed positive somato-sensorial response on 69.2 percent of the animals that were irradiated with the laser. Controls showed only 18.2 percent of positive responses. Immunohistochemical analysis evidenced both increased number of total axons and improved quality of nerve repair on irradiated animals.

The treatment of Bell’s palsy aims mainly to prevent corneal damage usually by physiotherapy and steroids. Physiotherapy, steroids and retro-viral agents are now widely accepted for treating Bell’s palsy. Laser phototherapy is able to stimulate the metabolism of the damaged nerve stimulating the production of proteins associated to its growth and improved recovery capacity of the facial nerve. Ailioaie, Ailioaie and Chiran (2004) studied nerve regeneration on 31 children using laser light (l=670/830nm) and found complete regeneration on 87.5 percent of the cases. Controls showed only 60 percent of recovery. This work reports the treatment of a case of Bell’s palsy with laser phototherapy, electrotherapy and physiotherapy.

Case report

A 52-year-old white male complaining of hemi facial palsy was seen at the Laser Center of the Center of Biophotonics of the School of Dentistry of the Federal University of Bahia (Fig. 1). Laser phototherapy was carried out during two months. A diode laser (l=790nm/40mW/26-29J/cm² — Kondortech®, São Carlos, São Paulo, Brazil) was used and treatment started 48 hours after the onset of the palsy. During the first week the treatment was carried out on daily basis (26J/cm²), and during the following weeks treatment was carried out three times a week (29J/cm²). The number of total sessions was 21. Laser light was delivered on extra-oral contact points on the affected hemi face and was carried out along the five branches of the facial nerve and at the infraorbitary and mental forarnens (Fig. 2). Besides laser phototherapy, the patient was also submitted to TENS and physiotherapy three times a week. The palsy weakened along the time of treatment as seen in Figures 3 and 4.

Discussion

Bell’s palsy may be a unilateral or bilateral disturbance of the conduction of the facial nerve with non-specific etiology. Treatment of this pathology is carried out using antiviral drugs, steroids, physiotherapy, and acupuncture. The use of steroids has been shown effective on the treatment of Bell’s palsy due to its strong anti-inflammatory effect that reduces the damage to the nerve resulting in a better prognosis.

During the past 10 years the use of laser phototherapy has been suggested as an associated treatment to other types of therapeutic approaches. This positive effect has been attributed to the effect of the light on nerve regeneration and consequent recovery of normal nerve physiology. Khullar et al. (1996) suggested that laser light might stimulate reinnervation of the tissues by either the penetration of the axons or on adjacent Schwann’s cells, inducing the compromised tissue to secrete proteins related to nerve growth or the releasing of mediator of nerve growth that will affect non-damaged adjacent nerves. These aspects were reflected on the treatment of the patient. Despite the positive result of the treatment, further studies are needed to elucidate the effect of the laser light on nerve as well as on the etiology of Bell’s palsy.

Conclusion

Laser phototherapy seems to positively affect the outcome of the treatment of Bell’s palsy carried out with other therapeutic approaches causing mainly quicker sensorial recovery and improved quality of life of the patients.

Abstract

Bell’s palsy is defined as a peripheral facial nerve palsy, idiopathic, and sudden onset and is considered the most common cause of this pathology. It is caused by damage to cranial nerves VII, resulting in complete or partial paralysis of the facial mimics. It may be associated with taste disturbances, salivation, tearing and hyperacusis. It is diagnosed after ruling out all possible etiologies, because its cause is not fully understood. Physical therapy, corticosteroids and antiviral therapy have become the most widely accepted treatments for Bell’s palsy. Therapy with low-level laser (LLLT) may induce the metabolism of injured nerve tissue for the production of proteins associated with its growth and to improve nerve regeneration. In most cases, the recovery occurs unevenly (without complications). The acute illness is not associated with serious disorder. This paper reports a successful treatment of Bell’s palsy treated with laser phototherapy, electrotherapy and physiotherapy.

Treatment of gingival hyperpigmentation for esthetic purposes using the diode laser

Authors: Prabhuji Munivenkatappa Lakshmaiah Venkatesh, MDS; Madhu Preetha, MDS and Archana Vilasan, MDS

Case report: depigmentation

The color of the gingiva is various among different individuals, and it is thought to be associated with cutaneous pigmentation. It depends on the vascular supply of the gingiva, epithelial thickness, degree of keratinisation of the epithelium and the presence of pigmented cells.

Oral pigmentation is the discoloration of the mucosa or gingiva. It can be either due to physiological or pathological conditions. Melanin, a brown pigment, is the most common pigment associated with the etiology of oral pigmentation. Gingiva is the most common site of pigmentation in the oral cavity. This hyperpigmentation is seen as a genetic variation in some populations independent of their age and sex. Hence it is termed as physiological or racial gingival pigmentation.

Melanosis of the gingiva is frequently present in dark-skinned ethnic groups as well as in different medical conditions. Although pigmentation of the gingival is a completely benign condition, it is an esthetic problem in many individuals.

Gingival depigmentation is a periodontal surgical procedure in which the gingival hyperpigmentation is eliminated or reduced by different techniques.

Fig. 1 Pre-op situation. (Photos/Provided by M.L.V. Prabhuji)

Fig. 2 Use of the FOX diode laser to treat gingival hyperpigmentation.

Fig. 3 Immediate post-op situation.

Fig. 4 One week post-op.

Fig. 5 Three months post-op.
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Gingival depigmentation techniques

Various depigmentation techniques have been employed with similar results. The selection of a technique should be based on clinical experience and individual preferences.

The various methods include gingivectomy, gingivectomy with free gingival autografting, electrosurgery, cryosurgery, radiosurgery, chemical agents such as 90 percent phenol and 95 percent alcohol, abrasion with diamond bur, Nd:YAG laser, semiconductor diode laser and CO2 laser.

One of the most common techniques for depigmentation is the surgical removal of undesirable pigmentation using scalpels. In this procedure, gingival epithelium is removed surgically along with a layer of underlying connective tissue. The denuded connective tissue then heals by secondary intention.

Laser ablation of gingival depigmentation has been recognized as one of the effective techniques. Different lasers have been used for gingival depigmentation, including carbon dioxide (10.600nm), diode (810nm), Neodymium: Yttrium Aluminium garnet (1.064nm) and Erbium: YAG (2.940nm) lasers.

The diode laser was introduced in dentistry a few years back. The diode laser is a solid-state semiconductor laser that typically uses a combination of Gallium (Ga), Arsenide (Ar), and other elements, such as aluminum (Al) and indium (In), to change electrical energy into light energy. It also can be delivered through a flexible quartz fiber optic handpiece and has a wavelength of 819 nm. This energy level is absorbed by pigmentation in the soft tissues and makes the diode laser an excellent hemostatic agent. It is used for soft tissue removal in a contact mode. The power output for dental use is generally around 2 to 10 watts. It can be either pulsed or continuous mode.

The present case series describes simple and effective depigmentation techniques using A.R.C. FOX (semiconductor diode laser), which has produced good results with patient satisfaction.

Case report No. 1

A 22-year-old female patient visited the Department of Periodontics, Krishnadevaraya College of Dental Sciences, Bangalore, India, with the chief complaint of “blackish gum.” The medical history was non-contributory. Intra-oral examination revealed generalized blackish pigmentation of the gingiva, however it was healthy and completely free of any inflammation. Considering the patient’s concern, a laser depigmentation procedure was planned.

Procedure

A diode laser (A.R.C. FOX) with wavelength of 810 nm was selected for the procedure. No topical or local anesthesia was given to the patient. Melanin pigmented gingiva were ablated by diode laser vaporization with a flexible, hollow-fiber delivery system with a non-contact, air cooling handpiece, under standard protective measures. The procedure was performed on all pigmented areas. Remnants of the ablated tissue were removed using sterile gauze damped with saline. This procedure was repeated until the desired depth of tissue removal was achieved. Analgesics and chlorhexidine 0.2 percent mouthwash were prescribed.

Case report No. 2

A 24-year-old female patient visited the Department of Periodontics, Krishnadevaraya College of Dental Sciences, with the chief complaint of “blackish gum.” The medical history was non-contributory. Intra-oral examination revealed generalized blackish pigmentation of the gingiva, however it was healthy and completely free of any inflammation. Considering the patient’s concern, a laser depigmentation procedure was planned.

Procedure

The depigmentation was performed identically to the first case. Analgesics and chlorhexidine 0.2 percent mouthwash were prescribed.

Results

No post-operative pain, hemorrhage, infection or scarring occurred in first and subsequent visits. Healing was uneventful. The patient’s acceptance of the procedure was good and results were excellent as perceived by the patient.

Editorial note: This article first appeared in Laser, the international magazine of laser dentistry, Vol. 3, No. 2, 2011.
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Crown troughing with the 810 nm diode laser

Author: Glenn A. van As, BSc, DMD

Introduction

In the past four to five years, there has been a dramatic increase in interest among general dentists both in North America and internationally in dental lasers. Diode lasers in particular have been demonstrated to be ultra-portable, reliable and cost-effective wavelengths, which allows them to become the “soft tissue handpiece” in every operatory. Laser technology is an attractive and increasingly popular alternative to traditional methods (cord and electrosurgery) for the management of soft tissue in fixed prosthodontic procedures. The literature has suggested laser gengivectomies are the most popular soft-tissue procedure, but after that, laser crown troughing is probably the second most commonly sought-after reason to purchase a soft-tissue diode laser.

When crown troughing with the diode laser is compared with the traditional techniques, many clinicians find the laser to be easier and quicker than “packing cord.” Often, clinicians who are looking to replace their electrosurgery units, which cannot be used safely around metals intraorally, discover that the diode laser can be used safely around adjacent restorations that are metal (amalgam and gold), as well as for dental implants.

Technique

A small learning curve exists in knowing when and how to properly use the diode laser for tissue management. The author suggests that a new user begin with posterior teeth first, where esthetic requirements are not as demanding as with indirect anterior restorations. With practice, many clinicians...
will almost completely eliminate cord from their practice, particularly in the posterior segments. In critically esthetic areas where thin tissue genotypes exist, or if the patient is changing the color of the tooth significantly from the existing stump shade, then care with diode troughing must be taken.

In the author’s experience, two vital keys to the successful integration of laser troughing are: adequate magnification for both the preparation of the tooth and the use of the laser (e.g., 4.0X loupes), and the judicious use of lower power settings on the diode laser (e.g., 0.6–1.1 watts of power in continuous wave).

The initial gross reduction of tooth structure is completed and the properly stripped, cleaved and initiated quartz fiber tip (or single-use initiated disposable tip) is extended just into the gingival sulcus subgingivally around 0.5–1.0 mm. Circumferentially the laser is moved with small, deft and light brushlike strokes around the preparation. These back-and-forth strokes create a slight distention of the tissue away laterally from the margin of the preparation. This lateral distention is not intended to lower the height of the tissue in an apical direction like a gingivectomy would, but simply to create a “moat” that separates tooth from soft tissue. This separation allows for room for the light-body or extra-light-body VPS impression material to capture details of the margin location.

The total time for the troughing circumferentially should be around 45 to 90 seconds, and careful analysis of the laser/tissue interaction should reveal minimal to no charring of the soft tissue, which can create postoperative discomfort and greater risk of gingival recession. If the laser is put in pulsed mode (comfort mode), the tissue has time to relax between pulses, mitigating any iatrogenic effects of heat buildup. Pulsed mode may also be used in situations where topical anesthetic only is desired as the sole method of anesthetic, such as in the preparation and tissue management of a previously endodontically treated tooth.

After the initial laser trough has been completed, the clinician can refine the preparation and place the final margin equigingivally on solid tooth structure or slightly subgingival on the facial for esthetics. Hydrogen peroxide in a Dental Infusor (Ultradent) or a wet cotton pellet can be scrubbed on the soft tissue to remove any white tissue tags (slight thermal damage), which may accidentally droop onto the margin. Increased lateral distention of the tissue trough may be needed at times with anterior tissue troughing. This can be accomplished by using materials such as Expasyl or Traxodent, which are injected briefly into the sulcus, and these products can not only help with crevicular fluids or slight bleeding but help to physically distend the tissue away further from the margins. Vigorous rinsing of the sulcus to remove these products after 90 to 120 seconds will yield a clean, dry and well-delineated margin, and the final impression can be taken. Provisional restorations should be evaluated to make sure that they do not extend into the sulcus, which can iatrogenically cause the tissue to recede. Careful removal of temporary cement completes the initial appointment.

The patient returns for final insertion of the crown in 10 to 14 days, and upon removal of the provisional crown, the tissue appears healthy and situated exactly where the laser troughing placed it at the first appointment. In cases of poorly fitting provisional crowns, some soft tissue “bounce back” may lead to the margin being covered by soft tissue. Typically the
diode laser can be used with topical anesthetic and settings of 0.6 to 0.8 watts (CW) (or 1.2 to 1.6 watts pulsed) to remove any soft tissue overhanging the margins and subsequently the crown can be tried in and cemented. With careful attention to detail, the results can be identical to those obtained with traditional methods (see case below) and the diode laser will become an indispensable part of the soft-tissue management and impression-taking for fixed prosthodontics.

**Posterior crown laser troughing**

This patient fractured two upper premolars that were very sensitive to chewing and required full coverage to alleviate the symptoms. The teeth were prepared for all ceramic restorations and the first premolar had the diode laser used for troughing at 0.8w CW to distend the tissue. The second premolar had tissue management completed for comparison sake with cord placed intrasulcularly. The impression shows clear margins on both preparations. The two-week healing photo shows great soft-tissue response on both teeth, and the final postoperative photos demonstrate ideal soft-tissue healing on both premolars (Figs. 1–8).

**Anterior crown (veneer) laser troughing**

This patient fractured two upper central incisors playing ice hockey. The composite restorations had stained and the patient was unhappy with the shape and symmetry of the maxillary incisors. The patient accepted the proposed treatment plan, which was to prepare veneers for the maxillary incisors and to use the diode laser for tissue management and gingival recontouring.

Smile recontouring was completed with the diode laser on the lateral incisors to remove excessive gingival tissue (altered passive eruption) with a setting of 0.8 w CW for these teeth. Afterward the four incisors were prepared for EMax veneers and the 810 nm Picasso Lite diode laser was used for troughing at 0.8w CW to distend the tissue. The Aquasil impression of Light and Heavy Body PVS shows excellent marginal detail. The two-week healing of provisionals shows a wonderful soft-tissue response to the diode troughing, and the characterized veneers were bonded into place. The final esthetic outcome shows another wonderful soft-tissue response to the gingival recontouring and diode troughing that was used for this case (Figs. 9–15).

**Conclusion**

The above cases and techniques are intended to demonstrate how laser troughing with the 810 nm diode laser can be used as an alternative to soft tissue management for indirect prosthodontic procedures in both the anterior and posterior dentition. With the increased number of clinicians now purchasing soft-tissue lasers for gingival recontouring and for tissue troughing, the need for detailed clinical treatment protocols for these simple, safe and desirable proce-
dures exists. This article demonstrates how the diode laser can act as a wonderful alternative to traditional methodologies of tissue retraction that are widely espoused in the profession.

_References_


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**Table 1** Clinical procedure for laser crown troughing.

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Initial gross reduction and margin placed equi-gingival with magnification.</td>
</tr>
<tr>
<td>2</td>
<td>Diode laser troughing: suggested settings 0.6-1.1 w CW (less in anterior)</td>
</tr>
<tr>
<td>3</td>
<td>Final margin placement subgingivally as needed for esthetics.</td>
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<tr>
<td>4</td>
<td>Hydrogen Peroxide or wet cotton pellet to remove white tissue tags</td>
</tr>
<tr>
<td>5</td>
<td>Lateral distention of tissue if needed (Expasyl, Traxodent).</td>
</tr>
<tr>
<td>6</td>
<td>Rinse and take PVS impression</td>
</tr>
<tr>
<td>7</td>
<td>Provisional fabrication - Careful to make sure no overhangs.</td>
</tr>
</tbody>
</table>

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Glenn A. van As, BSc, DMD, is the clinical director of the International Center of Laser Education at AMD Lasers (DENTSPLY), and is a founding member of the Academy of Microscope Enhanced Dentistry and a former president of the group. He has obtained standard and advanced proficiency as well as a mastership in laser dentistry from the Academy of Laser Dentistry and was distinguished with the Leon Goldman award for worldwide clinical excellence in the field of laser dentistry in 2006. An expert both in the utilization of the dental operating microscope for clinical dentistry and in the utilization of multiple wavelengths of hard- and soft-tissue lasers, he has lectured and provided workshops internationally more than 450 times on these topics. He acts as a consultant for several companies and reviews articles for PPAD and Dentaltown. He may be contacted at glennvanas@me.com.
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