_C.E. article
Laser-assisted new attachment procedure

trends
Lasers in endodontics

case report
Diode laser applications in clinical orthodontics
The Dual Wavelength waterlase iPlus™
Advancing Laser Technology to Its Ultimate

INTUITIVE & INTELLIGENT GRAPHICAL USER INTERFACE

For example, performing a Class I Cavity Prep with the iPlus™ is as easy as 1,2,3...

Step 1 Select “Restorative” from the first screen
Step 2 Choose “Class I” from the next screen that appears automatically
Step 3 Specify any other concerns such as patient sensitivity or bond strength

That’s it! Step on the foot pedal, and start working.

iLASE™ 940nm DIODE LASER DOCKING STATION

- Adds dual wavelength versatility and convenience
- First totally wireless dental laser
- 5 Watts peak power with ComfortPulse™
- Battery operated with finger switch activation
- Exclusive bendable tips in many diameters & lengths

BREAKS THE SPEED BARRIER

- RR™ powered laser delivers 100 pulses/sec. for superior soft-tissue cutting
- Patented laser technology delivers 10 watts of power
- Enables multi-quadrant same-day procedures

ENABLES BIOLOGICALLY FRIENDLY DENTISTRY

- No micro-fractures or thermal damage
- More precise, minimally invasive

©2012

waterlase iPlus | www.BIOLASE.com | Toll-free 888-424-6527

BIOLASE | 25 YEARS

DENTISTRY TODAY 2011 TOP 50 Technology Products
Need an answer?

Look to lasers ...

Summer is upon us, and while many will be taking some well deserved vacation time, it’s also an excellent time to reassess where you are with your practice. Do you need to make changes to improve your bottom line, such as purchase new equipment or hire a new staff member?

If you are looking to expand your armamentarium, then adding a laser to your practice should be your first consideration. If you already have a laser, have you thought about adding another one? The versatility of dental lasers coupled with their ease of use are just two of the most basic reasons to own one. From uses in general practice, implantology, endodontology and orthodontics, lasers have a place in every clinician’s hand. Having been first introduced into dentistry in 1976, lasers have a come a long way, and we hope this publication helps to keep you up to date with the latest research and trends. We’ve gathered experts from within the borders of the United States but also from around the globe to round out this publication and make the most of your reading time.

There is a nice variety of subjects in our C.E. articles within this edition, starting with the LANAP procedure and moving through to frenectomy and, finally, enamel alterations. After you read the articles, visit www.DTStudyClub.com to take the short quiz and earn one unit of ADA CERP-certified C.E. credit. Because this is a quarterly magazine, you’ll have the opportunity to earn at least three more C.E. credits this year. Annual subscribers to the magazine ($50) need only register at the Dental Tribune Study Club website to access these C.E. materials free of charge. Non-subscribers may take the C.E. quiz after registering on the Dental Tribune Study Club website and paying a nominal fee.

In this edition, a large international team brings you the word on research in regard to the effect of low-level laser therapy during rapid maxillary expansion. Similarly, the application of lasers in endodontics and orthodontics are also represented here.

Dental Tribune America is part of the largest dental publishing network in the world, Dental Tribune International (DTI), which consists of 23 DTI license partners around the globe publishing in 19 different languages. The DTI network publishes a variety of dental publications that are distributed in more than 90 countries. Please visit us online at www.dental-tribune.com to see the complete list of publications we offer, and at www.DTStudyClub.com to see the complete list of online and offline C.E. opportunities available.

If there is a topic you’d like to see covered in this publication, please don’t hesitate to let us know by contacting us at feedback@dental-tribune.com. If you have questions, concerns, praise or a critique about some of the materials presented, we want to hear those comments too, so don’t hold back.

Our goal with this publication is to make it a valuable return on your reading time, so if we can help improve that, we certainly want to know!

Sincerely,

Torsten Oemus
Publisher
C.E. article
06 Laser-assisted new attachment procedure (LANAP) _David Kimmel, DDS
10 A good modality for the treatment of prominent frenulum _Merita Bardhoshi, DDS; Esat Bardhoshi, DDS, MSc; and Ina Thereska, DDS, MSc
12 Enamel alterations _Prof. Giuseppe Iaria, MD, DDS

research
14 The effect of low-level laser therapy during rapid maxillary expansion _Eyad Hamade, DDS, MSc; Rwaida Saimeh, DDS, MSc; Mina Mazandarani, DDS, MSc; Maziar Mir, DDS, MSc, PhD; and Norbert Gutknecht, DMD, PhD

trends
18 Lasers in endodontics _Enrico DiVito, DDS; Prof. Rolando Crippa, MD, DDS; Prof. Giuseppe Iaria, MD, DDS; Prof. Vasilos Kaisas, DDS; Prof. Stefano Benedicenti, DDS; and Prof. Giovanni Olivi, MD, DDS

case report
27 Diode laser (810 nm) applications in clinical orthodontics _Prof. Deepak Rai, MDS; and Prof. Gurkeerat Singh, MDS

industry
36 Dental lasers: Improving clinical results and patient treatment acceptance _Anthony R. Cardoza, DDS
38 World’s first Android-based control screen in the dental laser industry

about the publisher
40 Submissions
42 Imprint

on the cover
Cover image provided by Biolase
Technology 4 Medicine

LIGHTWALKER
Dual Wavelength, Er:YAG & Nd:YAG

The 2 leading LASERS, 1 superior package. Invest Less. Do More.

Best of Class
Pride Institute

“red dot” Design Award 2012
Superior Design & Technology

red dot

DENTISTRY TODAY
Dentistry Today’s Top 100 Products

PIPS™ - Photon Induced Photoacoustic Streaming™
A Dramatic Breakthrough in Endodontics
Available Exclusively with the Lightwalker

“I have been using PIPS for over a year on most of my cases. Herb Schilder stated that endodontic cases had the potential of 100% success minus X. The X factor being the complexity of the root canal system and the operator’s ability to manage the cleansing and shaping of that system. I believe that PIPS enhances my ability to reduce this X factor to as close to 0 as is possible today. The Dual Wavelength LightWalker has also proven to be very valuable to my implant cases. Having both the Er:YAG and the Nd:YAG in one system is an important advancement which allows you to get more for your investment. I recommend this product without reservations.”

Bryan M. Beebe D.D.S.
Endodontist, Sarasota, FL

For More Information, visit www.T4Med.com or call 949-276-6650
Laser-assisted new attachment procedure (LANAP)

Author: David Kimmel, DDS

A historical perspective of the development of the laser-assisted new attachment procedure (LANAP) is presented in this article. The simplicity of the protocol is discussed, as well as its nuances. The concept of LANAP was born back in 1989 with Drs. Robert Gregg II and Del McCarthy. As with most general dentists battling with the day-to-day realities of periodontal disease, they were looking for an answer on how to better care for their patients. The reality at the time was that periodontal disease was difficult to treat and maintain. It was primarily based on older concepts of wound debridement and amputation. Once treated, relapse was common.

We know periodontal disease is a multifactorial disease process and patient behavioural routines can play a significant role. It is a wonder that the conventional treatments worked as well as they did. Even when they did work, there often were significant secondary repercussions clinically as well as psychologically.

Clinically, many of these traditionally treated cases were difficult to restore whenever dental prosthetic treatment was needed and patients were often left with the compromised aesthetic result of a long tooth appearance.

Post-surgically, there was significant root surface exposure and with patients’ increased life span and the...
incidence of dry mouth, root caries can become a very difficult entity to control.

More problematic, is that psychologically many of these patients felt that the discomfort from the procedure and/or the residual tooth sensitivity after treatment was so great that they would not complete remaining areas that needed treatment or declined retreatment when they relapsed.

Further complicating matters, the patients would recant their experiences to friends and family, making case acceptance for periodontal treatment often a challenge.

During this same time, Drs. Gregg and McCarthy were involved in the early use of Nd:YAG lasers in dentistry. Confronted with patients not wishing to lose teeth and declining traditional surgery or extraction, they developed the LANAP protocol, which eventually led to its United States FDA clearance in 2004.

In concept, the LANAP protocol is rather simplistic. The ultimate goal is to set up the periodontal environment to promote self-regeneration of the lost attachment and osseous structure that result from periodontal disease. Regeneration is a rather complex event and, as seen with guided tissue regeneration or scaling and root planning alone, can be very unpredictable. LANAP is predictable.

Clinically, those clinicians who have been using the LANAP protocol for some time know this, and its predictability was reinforced when new attachment was found on all the LANAP-treated teeth in the initial histology studies done by Dr Ray Yukna. LANAP is also a very safe protocol.

The use of the Nd:YAG laser has often been of concern by some owing to possible damage to root surfaces and the tissue attachment but, with a basic understanding of laser physics, laser–tissue interaction parameters were developed that enabled the use of an Nd:YAG in a very safe and effective manner. LANAP is also standardized. That is, before a doctor can obtain his laser he goes through three days of training: one day of laser physics and laser–tissue interaction and then two days of hands-on training with patients.

This is then followed up by two more separate days of treating patients to refine techniques and add other treatment modalities utilising the Nd:YAG. Because of the simplicity, predictability and standardisation of LANAP, it has become a very safe and effective way to treat periodontal disease. The simplicity of the LANAP protocol can be seen in Table I.

The LANAP protocol

Step A

Patients undergo a full dental examination and treatment plan—as with all dentistry. If they have an appropriate diagnosis of Type III or greater periodontal disease, all treatment options are presented to the patient. The initial step of the LANAP protocol, after anaesthesia has been administered, is bone sounding around each tooth. The objective is to de-
Step B
This is the first time the laser is used. The objective of this step is to remove only diseased epithelium, to affect selectively bacteria associated with periodontal disease, to affect the calculus present, and to affect thermolabile toxins. The bacteria that are associated with periodontal diseases are pigmented and are found in the sulcus, within the root surface and within the epithelial cells.

One of the reasons for the predictability of this step is in the selection of a free-running pulsed Nd:YAG laser with a wavelength of 1,064 nm and pulsed in a range of seven different microseconds. The shorter 1,064 nm wavelength was selected for its affinity for melanin or dark pigmentation, unlike the longer wavelengths that are highly absorbed in water and would have a shallow depth of penetration.

This ability to increase the depth of penetration of the laser energy with minimal collateral damage is the reason that the diseased epithelium can be selectively removed without damage to the underlying tissue, leaving intact rete pegs.

The diode lasers are also known for this selective absorption in pigmented tissues, but the free-running, pulsed Nd:YAG lasers differ in their ability to operate at very high peak powers in very short time-frames, which allows the Nd:YAG to have the greater depth of penetration and the lack of collateral damage (Fig. 1).

Step C
This step in the LANAP protocol is straightforward; it is just a matter of using the piezo-scalers to remove the calculus present on the root surfaces. The removal of calculus is believed to be easier after the interaction of the laser energy with the calculus. The first interaction of the laser results in the initial formation of a mini-flap, thereby further assisting in the removal of calculus because of increased visibility and access to the calculus.

Step D
The next step again utilises the laser. This time the parameters are varied to enhance the ability to form a fibrin clot to close the mini-flap and to disinfect the site again. The formation of the stable fibrin clot is significant, as it is stable for approximately 14 days. The role of the fibrin clot is to keep the sulcus sealed against bacterial infiltration and to prevent the growth of epithelium down into the sulcus.

Other laser wavelengths not only lack the ability to form this stable fibrin clot, but also require repeated treatments to prevent epithelium growth down into the sulcus. The ability to select the laser–tissue interaction specifically is unique to the PerioLase MVP-7 (Millennium Dental Technologies).

Through the use of specific fiber sizes, energy, repetition rates, pulse durations and standardization of the energy at the fiber tip, this protocol can be followed in a predictable and reproducible manner. The high standard of training that each LANAP doctor receives also contributes to the predictability of this protocol and to its safety.

Patients often present with different tissue types along with different degrees of disease. One of the purposes of the hands-on training is learning to recognize these differences and how to change the laser parameters accordingly so that the desired laser–tissue interactions are achieved (Fig. 2).

Step E
The fifth step in LANAP is the compression of the fibrin clot to enhance the healing process. Because laser wounds heal by secondary intention, closer approximation enhances the healing time.

Step F
Following the compression and stabilisation of the clot, the last step of LANAP is refining the occlusion. Occlusion has been considered a greater co-factor in the progression of periodontal disease than smoking. In order to minimize this role, extensive adjustments are made to the dentition.

The patients are then followed for nine to 12 months with routine supra-gingival cleanings and occlusal refinements. No sub-gingival restorative or periodontal probing is done during this time. Only during the final post-operative visit is a periodontal probing done.

The results that are seen from LANAP treatment are very similar to the following cases, where new bone fill can be seen in vertical osseous defects. The bone fill ranges from simple proximal defects to the more complex furcation defects. The hallmark of
LANAP is pocket reduction, new tissue attachment and a lack of tissue recession.

**LANAP case No. 1**

The patient in this case was a 40-year-old female patient with a history of lupus, rheumatoid arthritis and Sjögren’s syndrome. She was also a smoker. There was generalised deep pocketing as seen in her periodontal charting (Fig. 3).

The extent of the osseous defect is shown on the lingual view of the right quadrant preoperative CBT scan (Fig. 4). The initial post-LANAP evaluation was done at 15 months. Post-operative probing is shown in Figure 5.

The CBT from the lingual view of the right quadrant at 15 months post-operatively is shown in Figure 6. The change in the osseous defects is apparent. Minimal to no recession is shown in the preoperative clinical photograph in Figure 7 and the post-operative in Figure 8.

**LANAP case No. 2**

The patient in this case was a 59-year-old male patient, with Type 1 diabetes and a smoker. His periodontal pocketing was 7 mm on the mesial second premolar. The preoperative X-ray is shown in Figure 9 and the 36-month post-LANAP X-ray in Figure 10. The 7 mm pocket had been stable and maintained at 3 mm for the last 36 months.

The LANAP protocol will be 22 years old this year. It is coming of age. It has stood the test of time. There are over 1,000 trained clinicians applying LANAP. They have all been standardized. The uniqueness of the protocol is that whether the doctor is new to LANAP or a veteran “LANAP’er,” his results are similar.

During its early stages, early adopters accepted LANAP with anecdotal evidence alone, which was reinforced by the individual successes seen clinically. It was further validated by Dr. Ray Yukan’s histological studies in 2003. As the LANAP multicentre clinical studies move to completion, it would be reasonable to expect to see LANAP become the conventional manner or the standard for the treatment of periodontal disease. It is a very simple but eloquent protocol, one in which the patient has no to minimal discomfort and treatment acceptance is high._

The 980 nm diode laser: A good modality for the treatment of prominent frenulum

Authors: Merita Bardhoshi, DDS; Esat Bardhoshi, DDS, MSc; and Ina Thereska, DDS, MSc

_Labial frenectomy_ is a common surgical procedure in the field of oral surgery. Labial frenectomy is a procedure generally used for orthodontic and prostodontic reasons. A diode laser is portable, compact, efficient and has good bactericidal and coagulation properties.

A diode laser has a wavelength between 810 and 980 nm. They can be used in the continuous as well as pulsed mode with a contact or non-contact handpiece. The aim of this study was to present the efficacy of using a diode laser 940 nm for treatment of prominent labial and lingual frenulum and to demonstrate the healing characteristics after laser surgery.

_Materials and methods_

Ten patients with prominent labial and lingual frenulum are included in this report (Figs. 1, 2). All patients were treated with a 940 nm diode laser at the Dental University School in Tirana, Albania.

The technique of frenectomy was used under local anesthesia (lidocaine 2 percent, 1 cc). Informed consent was obtained from all patients.

Laser settings were: fiber optic 300 micrometer, cw, 4 W. The laser fiber was applied vertically and laterally to the frenulum, initially causing disruption of the mucosa continuity. This easily allowed performing a deeper cut of the frenulum in a horizontal dimension.

The design of the frenectomy was rhomboid and the whole procedures were performed in about four to five minutes. No sutures were required in any cases. In addition, ice was applied to avoid the increase of tissue temperature and control necrosis in the tissue.

All clinical participants were examined one week, three weeks and three months after surgery. Postoperative complications, such as pain, bleeding, swelling, scar formation and wound healing characteristics were evaluated.
Results

No bleeding was observed either during treatment or during the healing period (Figs. 3–5). One week after surgery a superficial layer of fibrin was observed in all clinical cases. No postoperative pain and swelling were recorded. Three weeks after surgery oral mucosa was completely healthy.

No scar tissue formation was observed in any case. In long-term follow-up, the oral mucosa in all clinical cases looked normal in color and consistence (Figs. 6, 7).

Discussion

Frenectomy is a common procedure in the field of oral surgery. The advantages of laser surgery include higher precision, less pain, bleeding, swelling and scarring. The procedure is quick, safe, easy to perform in an outpatient setting and no sutures are required.

All patients were satisfied with the treatment and the results obtained.

Conclusion

The diode laser has beneficial aspects, such as its small and compact size, and its portability allows it to move easily from operatory to operatory.

The technique of frenectomy is easy, fast and safe to be performed with a 940 nm diode laser. It could be done in outpatient clinic with local anesthesia, with good degree of acceptance by the patients and perfect results.

Contact info

Merita Bardhoshi, DDS, is an oral surgeon at the Dental University School in Tirane, Albania.
You may contact her at meritabardhoshi@yahoo.com

Editorial note: This article first appeared in the international magazine of laser dentistry, Vol. 3, No. 1, 2011.
A healthy 56-year-old male patient presented with enamel alteration of tooth #7. The oral examination showed a healthy periodontium and temporomandibular joint, and the teeth were in a Class I occlusion (Figs. 1-4). The radiographic examination showed no other radicular lesions.

The soft-tissue status indicated good periodontal health. For the hard-tissue test, percussion was normal, and there was no mobility or tenderness to touch or air spray. The tooth tested vital with the electric pulp tester and cold testing.

The objective was to restore tooth #7 using an Er:YAG laser in the following sequence:

- Prepare the cavities of the tooth.
- Decontaminate bacteria in the treated surfaces.
- Prepare the margins using a bur to obtain an adequate surface with a maximum area of adhesion.
- Restore the cavities with a hybrid composite resin.

The Er:YAG laser wavelength is readily absorbed by hard tissue; therefore, it is possible to conserve healthy tooth structure more easily than using a conventional high-speed handpiece. In addition, the relative lack of tactile stimulation offered by laser treatment compared with a conventional high-speed handpiece often allows the procedure to be performed without the need for an anaesthetic.

**Precautions**

Adequate water spray must be maintained as the procedure is performed. Good visibility and low power are necessary for careful preparation in order to avoid both thermal damage and excessive removal of tooth structure.

**Treatment alternatives**

The treatment alternatives would have been conventional dental drills to roughen the dental surfaces. Such burs could have caused a greater loss of hard tissue, microfractures of the tooth enamel and tenderness.

**Laser operating parameters**

An Er:YAG laser (DELight, HOYA ConBio) with a wavelength of 2,940 nm was used with its fibre delivery system and a 600µ quartz tip. It operates in a free-running pulse mode with a pulse duration of 300ms. The laser was used at 5 W (200 mJ, 25 Hz) with an 80° quartz tip and water mist in non-contact mode for enamel ablation and at 3.2 W (160 mJ, 20 Hz) with an 80° quartz tip and water mist in non-contact mode for dentine ablation. Prior to commencing the procedure, the patient was familiarised with the procedural steps.

---

**Fig. 1** A 56-year-old male patient presented with a tooth that showed enamel alterations. (Photos/Provided by Prof. Giuseppe Iaria)

**Figs. 2** The use of the dam is suggested.

**Fig. 3** The use of the DELight Er:YAG laser.

**Fig. 4** The craters left by the laser are visible.

**Fig. 5** The use of the bur to remove the unsubstained enamel.
Subsequently, all laser safety precautions were performed. These included, but were not limited to, the administering of laser safety glasses to the patient and operators, displaying laser hazard signage, and inspecting the mechanical components of the laser.

Once safety systems were in place, the laser was test-fired to ensure proper beam function and water spray delivery. As the target tissue was addressed, high-volume suction was used continuously.

The laser pulse rate was set to 25 Hz and the laser energy was set to 200 mJ, which produced a power of 5 W. Enamel ablation was achieved using an 80° quartz tip with water mist in non-contact mode.

After this had been done, the laser pulse rate was set to 20 Hz and the laser energy was set to 160 mJ, which produced a power of 3.2 W. Dentine ablation was achieved using an 80° quartz tip with water mist in non-contact mode.

Thereafter, Clearfil SE Bond (Kuraray America) was applied to enamel and dentine surfaces and a nano-composite Adonis (Sweden and Martina S.p.A.) was used as the restorative material. Finishing of the restoration was performed with coarse diamond burs, 12-blade finishing burs and finishing discs (Figs. 5–15).

**Postoperative instructions**

The patient was told that he could resume normal activities owing to the lack of numbness because of no anesthetic having been administered.

**Follow-up care**

The objectives originally set were achieved. The entire procedure was performed with success without the use of dental anesthetic. In addition, satisfactory esthetic results were obtained (Fig. 16).

The long-term results are in keeping with the objectives of the original treatment plan. The tooth maintained healthy vitality tests.

---

**about the author**

Prof. Giuseppe Iaria, DDS,
University of Genoa, Italy
President, International Academy of High Tech;
President, Academy of Laser Dentistry Italian Study Club
Educator, Academy of Laser Dentistry

19, Via S. Eustachio–25128 Brescia, Italy
Tel.: +39 030 391239
iariagiuseppe@virgilio.it

---

**Editorial note:** This article first appeared in the international magazine of laser dentistry, Vol. 3, No. 2, 2011.
The effect of low-level laser therapy during rapid maxillary expansion

Authors: Eyad Hamade, DDS, MSc; Rwaida Saimeh, DDS, MSc; Mina Mazandarani, DDS, MSc; Maziar Mir, DDS, MSc, PhD; and Norbert Gutknecht, DMD, PhD

Orthodontic tooth movement is the result of alveolar bone remodeling due to a response to mechanical stimulus at the interface with the periodontal ligament.

Although Wolff’s law is generally considered to be a philosophical statement but states the effect that, over time, the mechanical load applied to living bone influences the structure of bone tissue. Bone remodeling can be categorized into two different types:1,2

- External bone remodeling, in which the outer geometry of bone tissue adapts due to change in applied forces, while the material properties remain constant;

- Internal bone remodeling in which internal structure of bone tissue remodels due to changes in applied forces, in fact, this type of bone remodeling is related to remodeling of spongy bone in which elasticity parameters of bone tissue change.

Sutures are considered as the growth sites of intramembranous bones3-6 in the craniofacial complex. Accordingly, it is fair to assume that if sutures were not present, craniofacial bones might grow only in thickness.

The tissues surrounding sutures, such as the dura mater,1 have a significant effect on sutural patency and growth. Earlier studies have repeatedly confirmed that compressive forces applied across sutures reduce bone deposition and induce bone resorption, while tensional forces increase bone deposition.

This response characteristic makes sutures important target areas for orthodontic: orthopedic appliances designed to control vertical and transverse growth of the maxilla, such as palatal expander and cervical, high-pull and protraction headgears.

The dramatic development of technology in the last decades offers a small but a powerful tool to be used in clinical trials, which is the Laser Beam. LLLT is a type of laser that penetrates deeply into the tissue and affects the cells.

This is due to its specific wavelength and low energy level. Treatment with laser therapy is not based on heat development but on photochemical and photobiological effects in cells and tissue.

Discomforting pain is a burdensome side effect accompanying orthodontic treatment and/or orthopedic procedure due to force application for movement. Several studies showed an effective pain reduction after different dental treatments using LLLT. Also it has been shown that LLLT is an effective method to prompt bone repair and modeling after surgical procedures.
SHATTERING PARADIGMS
The World's First Truly Upgradable Dental Laser

TECHNOLOGY
meets
SCIENCE
and
Style

BREAKTHROUGH IN SCIENCE AND ENGINEERING!!
The PerioLase® MVP-7™ for the LANAP® protocol integrates the first Android-based control screen in the world of medical devices, providing true laser device upgradeability and backwards compatibility with all existing PerioLase MVP-7 devices. MDT was the first and remains the only laser manufacturer to offer fully custom painted lasers, as well as standard red, white, and blue, with breakthrough science under the cover.

LANAP WORKS!

The Android™ PerioLase MVP-7 expands the support for the LANAP protocol, the ONLY evidence-based laser periodontitis treatment with guaranteed clinical results and proven ROI.

Live Patient Demonstration of the LANAP protocol at the CEREC 27.5 Aug. 16-18

Pre-Op
3 Years Post-LANAP® Protocol

Courtesy of Robert H. Gregg II, DDS, Centura, CA - General Dental
Same tooth radiographs. Redacted charts available for inspection.

MILLENNIUM
Dental Technologies, Inc.
(888) 49-LASER  WWW.LANAP.COM
_Aim of the study

Our aim is to take advantage of the technological development, in order to increase the bone formation quality, accelerate the formation rate and therefore decreasing the relapse rate.

Also, we hope to take our patients through a relatively short and happy orthodontic treatment journey, without discomforting pain.

_Materials and methods

_Patient selection

Twenty patients of both genders participated in the research and were distributed as following.

All the patients and their legal guardians were informed of our intent to apply LLLT during orthodontic treatment and they approved to go through it (consent).

_Orthodontic treatment

After thorough clinical examination, the following diagnostic tools were obtained for each patient:

1) _X-rays_
   A) Panoramic view.
   B) Lateral Cephalometric View.
   C) Antero-posterior view.
   D) Upper maxillary CT scan with 3 mm sections thickness.

2) Appropriate photographs.

3) Model cast.

In addition, the followings were taken at the end of the expansion period:

1) _X-rays_
   A) Upper maxillary CT scan with 3 mm sections thickness.
   B) Antero-posterior view

The treatment plan for these patient included rapid maxillary expansion because of the presence of posterior crossbite or there was not enough space for a complete alignment. The appliance chosen was a Hyrax expander, McNamara type.

The Hyrax expander was opened twice daily until we reached an overcorrection position (Figs. 1, 2).

After one week of achieving the required expansion, Hyrax was removed temporarily to allow taking the CT scan image without artifact effect of the metal (Figs. 3, 4).

_Laser therapy protocol

_A) Selected locations for laser application:
   1) Mid-palatal suture (9 J/cm²).
2) Intermaxillary suture (4 J/cm²).
3) Zygomaticomaxillary suture (2 J/cm²) per side.
B) The laser handpiece was held in contact with the tissues and sweeping movements were performed.

_Pain questionnaire_

At every visit (after 1 mm), every patient was asked about the pain experienced during this period and was recorded and ranked according to schedule found in Table 1.

In order to study the statistical pain differences, the questionnaire was divided into three phases each phase for a duration of one week.

_Results_

- Bone density study; Graphs 2 and 3 show the Hounsfield units presenting higher levels of bone density in the irradiated group.
- Pain study; in laser group, there was no severe or intolerable pain reported (Graph 4).

_Discussion_

Orthodontic tooth movement involves both modeling and remodeling activity that is modulated by systemic factors such as nutrition, metabolic bone diseases, age and drug usage history. According to several studies LLLT is an effective tool used to prompt bone repair and modeling post surgery. This is referred to the biostimulation effect of the LLLT.

This effect had been well studied in the medical field and proven to have an enhancing effect on fibroblast growth.

Tooth movement and/or orthopedic movement is dependent on a painful and inflammatory adaptation of the alveolar process.

To relieve such pain, several methods have been used. One of them is to use drugs (NSAIDs). Although these could be effective in relieving pain, they may also reduce the rate of tooth movement.

The biostimulation effect of the LLLT was also reported to be effective in reducing the pain arising from dental treatment procedures.

_Conclusion_

The (Ga-Al-As) low level laser used in this study is considered to be an effective tool during orthodontic treatment as:
- The rate of bone density raised significantly.
- The pain level reduced significantly.

Editorial note: A complete list of references is available from the publisher.
Lasers in endodontics

Authors: Enrico DiVito, DDS; Prof. Rolando Crippa, MD, DDS; Prof. Giuseppe Iaria, MD, DDS; Prof. Vasilios Kaitsas, DDS; Prof. Stefano Benedicenti, DDS; and Prof. Giovanni Olivi, MD, DDS

This article will analyze some of the most important research in the international literature today and the new guidelines for the use of the laser as a source of activation of chemical irrigants.

Laser-assisted endodontics

Preparation of the access cavity

The preparation of the access cavity can be performed directly with erbium lasers, which can ablate enamel and dentine. In this case, the use of a short tip is recommended (from 4 to 6 mm), with diameters between 600 and 800 µm, made of quartz to allow the use of higher energy and power. The importance of this technique should not be underestimated.

Owing to its affinity to tissues richest in water (pulp and carious tissue), the laser allows for a minimally invasive access (because it is selective) into the pulp chamber and, at the same time, allows for the decontamination and removal of bacterial debris and pulp tissue. Access to the canal orifices can be accomplished effectively after the number of bacteria has been minimized, thereby avoiding the transposition of bacteria, toxins and debris in the apical direction during the procedure.

Chen et al. demonstrated that bacteria are killed during cavity preparation up to a depth of 300 to 400 µm below the radiated surface. Moreover, erbium lasers are useful in the removal of pulp stones and in the search for calcified canals.

Preparation and shaping of canals

The preparation of the canals with NiTi instruments is still the gold standard in endodontics today. In fact, despite the recognized ablative effect of erbium lasers (2,780 and 2,940 nm) on hard tissue, their effectiveness in the preparation of root canals appears to be limited at the moment and does not correspond to the endodontic standards reached with NiTi technology.

However, the erbium, chromium: YSGG (Er,Cr:YSGG) and the erbium:YAG (Er:YAG) lasers...
have received FDA approval for cleaning, shaping and enlarging canals. A few studies have reported positive results for the efficacy of these systems in shaping and enlarging radicular canals.

Shoji et al. used an Er:YAG laser system with a conical tip with 80 percent lateral emission and 20 percent emission at the tip to enlarge and clean the canals using 10 to 40 mJ energy at 10 Hz, obtaining cleaner dentinal surfaces compared with traditional rotary techniques. Shoji et al. used an Er:YAG laser system with a conical tip with 80 percent lateral emission and 20 percent emission at the tip to enlarge and clean the canals using 10 to 40 mJ energy at 10 Hz, obtaining cleaner dentinal surfaces compared with traditional rotary techniques.

In a preliminary study on the effects of the Er:YAG laser equipped with a microprobe with radial emission of 200 to 400 µm, Kesler et al. found the laser to have good capability for enlarging and shaping in a faster and improved manner compared with the traditional method. The SEM observations demonstrated a uniformly cleaned dentinal surface at the apex of the coronal portion, with an absence of pulp residue and well-cleaned dentinal tubules.

Chen presented clinical studies prepared entirely with the Er,Cr:YSGG laser, the first laser to obtain the FDA patent for the entire endodontic procedure (enlarging, clearing and decontaminating), using tips of 400, 320 and 200 µm in succession and the crown-down technique at 1.5 W and 20 Hz (with air/water spray 35/25 percent). Chen presented clinical studies prepared entirely with the Er,Cr:YSGG laser, the first laser to obtain the FDA patent for the entire endodontic procedure (enlarging, clearing and decontaminating), using tips of 400, 320 and 200 µm in succession and the crown-down technique at 1.5 W and 20 Hz (with air/water spray 35/25 percent).

Stabholz et al. presented positive results of treatment performed entirely using a Er:YAG laser and endodontic lateral emission microprobes. Stabholz et al. presented positive results of treatment performed entirely using a Er:YAG laser and endodontic lateral emission microprobes.

Matsuoka et al. and Jahan et al. used the Er,Cr:YSGG laser to prepare straight and curved canals, but in these cases, the results of the experimental group were worse than those of the control group.

Using the Er,Cr:YSGG laser with 200 to 320 µm tips at 2 W and 20 Hz on straight and curved canals, they concluded that the laser radiation is able to prepare straight and curved (less than 10 degree) canals, while more severely curved canals demonstrated side effects, such as perforations, burns and canal transportation.

Inamoto et al. investigated the cutting ability and the morphological effects of radiation of the Er:YAG laser in vitro, using 30 mJ at 10 and 25 Hz with a velocity of extraction of the fibre at 1 and 2 mm/seconds, again with positive results. Minas et al. reported positive results using the Er,Cr:YSGG laser at 1.5, 1.75 and 2.0 W and 20 Hz, with water spray.

The surfaces prepared with the erbium laser are well cleaned and without smear layer, but often contain ledges, irregularities and charring with the risk of perforations or apical transportation. In effect, canal shaping performed by erbium laser is still a complicated procedure today that can be performed only in large and straight canals, without any particular advantages.

Decontamination of the endodontic system

Studies on canal decontamination refer to the action of chemical irrigants (NaClO) commonly used in endodontics, in combination with chelating substances for better cleaning of the dentinal tubules (citric acid and EDTA). One such study is that of Berutti et al., who reported the decontaminating power of NaClO up to a depth of 130 µm on the radicular wall.

Lasers were initially introduced in endodontics in an attempt to increase the decontamination of the endodontic system.

All the wavelengths have a high bactericidal power because of their thermal effect, which, at dif-
Different powers and with differing ability to penetrate the dentinal walls, generates important structural modifications in bacteria cells. The initial damage takes place in the cell wall, causing an alteration of the osmotic gradient, leading to swelling and cellular death.\(^\text{16,34}\)

**Decontamination with near infrared laser**

Laser-assisted canal decontamination performed with the near infrared laser requires the canals to be prepared in the traditional way (apical preparation with ISO 25/30), as this wavelength has no affinity and therefore no ablative effect on hard tissue. The radiation is performed at the end of the traditional endodontic preparation as a final means of decontaminating the endodontic system before obturation.

An optical fibre of 200 µm diameter is placed 1 mm from the apex and retracted with a helical movement, moving coronally (in five to 10 seconds according to the different procedures). Today, it is advisable to perform this procedure in a canal filled with endodontic irrigant (preferably, EDTA or citric acid; alternatively, NaClO) to reduce the undesirable thermal morphological effects.\(^\text{35–38}\)

Using an experimental model, Schoop et al. demonstrated the manner in which lasers spread their energy and penetrate into the dentinal wall, showing them to be physically more efficient than traditional chemical irrigating systems in decontaminating the dentinal walls.\(^\text{9}\) The neodymium:YAG (Nd:YAG; 1,064 nm) laser demonstrated a bacterial reduction of 85 percent at 1 mm, compared with the diode laser (810 nm) with 63 percent at 750 µm or less.

This marked difference in penetration is due to the low and varying affinity of these wavelengths for hard tissue. The diffusion capacity, which is not uniform, allows the light to reach and destroy bacteria by penetration via the thermal effects (Fig. 1).

Many other microbiological studies have confirmed the strong bactericidal action of the diode and Nd:YAG lasers, with up to 100 percent decontamination of the bacterial load in the principal canal.\(^\text{39–43}\)

**Decontamination with medium infrared laser**

Considering its low efficacy in canal preparation and shaping, using the erbium laser for decontamination in endodontics requires the use of traditional techniques in canal preparation, with the canals prepared at the apex with ISO 25/30 instruments. The final passage with the laser is possible thanks to the use of long, thin tips (200 and 320 µm), available with various erbium instruments, allowing for easier reach to the working length (1 mm from apex).

In this methodology, the traditional technique is to use a helical movement when retracting the tip (over
No Pre-Registration Fee

The Largest Dental Meeting/Exhibition/Congress in the United States

MARK YOUR CALENDAR

Scientific Meeting:
Friday - Wednesday,
November 23 - 28

Exhibit Dates:
Sunday - Wednesday,
November 25 - 28

ATTEND AT NO COST
Never a pre-registration fee at the Greater New York Dental Meeting

MORE THAN 600 EXHIBITORS
Jacob K. Javits Convention Center 11th Ave. between 34-39th Streets (Manhattan)

HEADQUARTERS HOTEL
New York Marriott Marquis Hotel

LIVE DENTISTRY ARENA - NO TUITION

LATEST DENTAL TECHNOLOGY & SCIENTIFIC ADVANCES

MORE THAN 350 SCIENTIFIC PROGRAMS
Seminars, Hands-on Workshops, Essays & Scientific Poster Sessions as well as Specialty and Auxiliary Programs

EDUCATIONAL PROGRAMS IN VARIOUS LANGUAGES

SOCIAL PROGRAMS FOR THE ENTIRE FAMILY

ENJOY NEW YORK CITY AT ITS BEST DURING THE MOST FESTIVE TIME OF THE YEAR!

FOR MORE INFORMATION:
Greater New York Dental Meeting®
570 Seventh Avenue - Suite 800
New York, NY 10018 USA
Tel: (212) 398-6922 / Fax: (212) 398-6934
E-mail: victoria@gnydm.com

Sponsored by the New York County Dental Society and the Second District Dental Society

2012
I It trends_endo 22 I

a five- to 10-second interval), repeating three to four times depending on the procedure and alternating radiation with irrigation using common chemical irrigants, keeping the canal wet, while performing the procedure (NaClO and/or EDTA) with the integrated spray closed.

The 3-D decontamination of the endodontic system with erbium lasers is not yet comparable to that of near infrared lasers. The thermal energy created by these lasers is in fact absorbed primarily on the surface (high affinity to dentinal tissue rich in water), where they have the highest bactericidal effect on E. coli (Gram-negative bacteria), and E. faecalis (Gram-positive bacteria). At 1.5 W, Moritz et al. obtained an almost total eradication (99.64 percent) of these bacteria.44

However, these systems do not have a bactericidal effect at depth in the lateral canals, as they only reach 300 µm in depth when tested in the width of the radicular wall.6 Further studies have investigated the ability of the Er, Cr:YSGG laser in the decontamination of traditionally prepared canals.

Using low power (0.5 W, 10 Hz, 50 mJ with 20 percent air/water spray), complete eradication of bacteria was not obtained. However, better results for the Er, Cr:YSGG laser were obtained with a 77 percent reduction at 1 W and of 96 percent at 1.5 W.42 A new area of research has investigated the erbium laser’s ability to remove bacterial biofilm from the apical third.46

And a recent in vitro study has further validated the ability of the Er:YAG laser to remove endodontic biofilm of numerous bacterial species (e.g., A. naeslundii, E. faecalis, L casei, P. acnes, F. nucleatum, P. gingivalis or P. nigrescens), with considerable reduction of bacterial cells and disintegration of biofilm. The exception to this is the biofilm formed by L. casei.47

Ongoing studies are evaluating the efficacy of a new laser technique that uses a newly designed both radial and tapered stripped tip for removal of not only the smear layer, but also bacterial biofilm.13 The results are very promising.

The erbium lasers with "end firing" tips — frontal emission at the end of the tip — have little lateral penetration of the dentinal wall. The radial tip was proposed in 2007 for the Er,Cr:YSGG, and Gordon et al. and Schoop et al. have studied the morphological and decontaminating effects of this laser system (Fig. 2).48–50

The first study used a tip of 200 µm with radial emission at 20 Hz with air/water spray (34 and 28 percent) and dry at 10 and 20 mJ and 20 Hz (0.2 and 0.4 W, respectively). The radiation times varied from 15 seconds to two minutes. The maximum bactericidal power was reached at maximum power (0.4 W), with a longer exposure time, without water in dry mode and with a 99.71 percent bacterial eradication.

The minimum time of radiation (15 seconds) with minimum power (0.2 W) and water obtained 94.7 percent bacterial reduction.48

The second study used a tip of 300 µm diameter with two different parameters of emission (1 and 1.5 W, 20 Hz), radiating five times for five seconds, with a cooling time of 20 seconds for each passage. The level of decontamination obtained was significantly high, with important differences between 1 and 1.5 W, with a thermal increase contained between 2.7 and 3.2 degrees C.49

The same group from Vienna studied other
parameters (0.6 and 0.9 W) that produced a very contained thermal rise of 1.3 and 1.6 degrees C, respectively, showing a high bactericidal effect on E. coli and E. faecalis.50

The need to take advantage of the thermal effect to destroy bacterial cells, however, results in changes at the dentinal and periodontal level. It is important to evaluate the best parameters and explore new techniques that reduce the undesirable thermal effects that lasers have on hard- and soft-tissue structures to a minimum.

Morphological effects on the dentinal surface

Numerous studies have investigated the morphological effects of laser radiation on the radicular walls as collateral effects of root-canal decontamination and cleaning performed with different lasers. When they are used dry, both the near and medium infrared lasers produce characteristic thermal effects (Figs. 3, 4).51

Near infrared lasers cause characteristic morphological changes to the dentinal wall: the smear layer is only partially removed and the dentinal tubules are primarily closed as a result of melting of the inorganic dentinal structures. Re-crystallization bubbles and cracks are evident (Figs. 5–8).52–55

Water present in the irrigation solutions limits the thermal interaction of the laser beam on the dentinal wall and, at the same time, works thermally activated by a near infrared laser or directly vaporized by a medium infrared laser (target chromophore) with its specific action (disinfecting or chelating). The radiation with the near infrared laser — diode (2.5 W, 15 Hz) and Nd:YAG (1.5 W, 100 mJ, 15 Hz) — performed after using an irrigating solution, produces a better dentinal pattern, similar to that obtained with only an irrigant.

Radiation with NaClO or chlorhexidine produces a morphology with closed dentinal tubules and presence of a smear layer, but with a reduced area of melting, compared with the carbonization seen with dry radiation. The best results were obtained when radiation followed irrigation with EDTA, with surfaces cleaned of the smear layer, with open dentinal tubules and less evidence of thermal damage.35–38

In the conclusion of their studies on the erbium laser, Yamazaki et al. and Kimura et al. affirmed that water is necessary to avoid the undesirable morphological aspects markedly present when radiation with the erbium lasers is performed dry.56,57 The erbium lasers used in this way result in signs of ablation and thermal damage as a result of the power used. There is evidence of ledge cracks, areas of superficial melting and vaporisation of the smear layer.

A typical pattern arises when dentine is irradiated with the erbium laser in the presence of water. The thermal damage is reduced and the dentinal tubules are open at the top of the peri-tubular more calcified and less ablated areas. The inter-tubular dentine, which is richer in water however, is more ablated. The smear layer is vaporized by radiation with erbium lasers and is mostly absent.58–64

Shoop et al. investigating the variations of temperature on the radicular surface in vitro, found that the standardized energies (100 mJ, 15 Hz, 1.5 W) produced a measured thermal increase of only 3.5 degrees C on the periodontal surface. Moritz proposed these parameters as the international standard of use
Even with erbium lasers, it is advisable to use irrigating solutions. Alternatively, NaClO and EDTA can be utilized during the terminal phase of laser-assisted endodontic therapy with a resulting dentinal pattern, with fewer thermal effects. This represents a new area of research in laser-assisted endodontics.

Various techniques have been proposed, such as laser-activated irrigation (LAI) and photon-initiated photoacoustic streaming (PIPS). Photo-thermal and photomechanical phenomena for the removal of smear layer

George et al. published the first study that examined the ability of lasers to activate the irrigating liquid inside the root canal to increase its action. In this study, the tips of two laser systems—Er:YAG and Er,Cr:YSGG (400 µm diameter, both flat and conical tips) with the external coating chemically removed—were used to increase the lateral diffusion of energy.

The study was designed to irradiate the root canals that were prepared internally with a dense smear layer grown experimentally. Comparing the results of the groups that were laser radiated with the groups that were not, the study concluded that the laser activation of irrigants (EDTAC, in particular) brought about better cleaning and removal of the smear layer from the dentinal surfaces.

In a later study, the authors reported that this procedure, using power of 1 and 0.75 W, produces an increase in temperature of only 2.5 degrees C without causing damage to the periodontal structures. Blanken and De Moor also studied the effects of laser activation of irrigants comparing it with conventional irrigation (CI) and passive ultrasound irrigation (PUI).

In this study, 2.5 percent NaClO and the Er,Cr:YSGG laser were used four times for five seconds at 75 mJ, 20 Hz, 1.5 W, with an endodontic tip (200 µm diameter, with flat tip) held steady 5 mm from the apex. The removal of the smear layer with this procedure led to significantly better results with respect to the other two methods. The photomicrographic study of the experiment suggests that the laser generates a movement of fluids at high speed through a cavitation effect. The expansion and successive implosion of irrigants (by thermal effect) generates a secondary cavitation effect on the intra-canal fluids.

It was not necessary to move the fiber up and down in the canal, but sufficient to keep it steady in the middle third, 5 mm from the apex. This concept greatly simplifies the laser technique, without the need to reach the apex and negotiate radicular curves (Fig. 13). De Moor et al. compared the LAI technique with PUI and they concluded that the laser technique, using lower irrigation times (four times for five seconds), gives results comparable to the ultrasound technique that uses longer irrigation times (three times for 20 seconds).

De Groot et al. also confirmed the efficacy of the LAI technique and the improved results obtained in comparison with the PUI. The authors underlined the concept of streaming due to the collapse of the molecules of water in the irrigating solutions used.

Hmud et al. investigated the possibility of using near infrared lasers (940 and 980 nm) with 200 µm fibre to activate the irrigants at powers of 4 W and 10 Hz, and 2.5 W and 25 Hz, respectively.

Considering the lack of affinity between these wavelengths and water, higher powers were needed which, via thermal effect and cavitation, produced movement of fluids in the root canal, leading to an increased ability to remove debris and the smear layer.

In a later study, the authors also verified the safety of using these higher powers, which caused a rise in temperature of 30 degrees C in the intra-canal irrigant solution but of only 4 degrees C on the external radicular surface. The study concluded that irrigation activated by near infrared lasers is highly effective in
minimizing the thermal effects on the dentine and the radicular cement.72

In a recent study, Macedo et al. referred to the main role of activation as a strong modulator of the reaction rate of NaOCl. During a rest interval of three minutes, the consumption of available chlorine increased significantly after LAI compared with PUI or CI.73

Photon initiated photoacoustic streaming (PIPS)

The PIPS technique uses the erbium laser (Powerslase AT/HT and LightWalker AT, both Fotona) and its interaction with irrigating solutions (EDTA, NaOCl or distilled water).13 The technique uses a different mechanism from the preceding LAI. It exploits exclusively the photoacoustic and photochemical phenomena, which result from the use of subablative energy of 20 mJ at 15 Hz, with impulses of only 50 microseconds.

With an average power of only 0.3 W, each impulse interacts with the water molecules with a peak power of 400 W creating expansion and successive "shock waves" leading to the formation of a powerful streaming of fluids inside the canal, without generating the undesirable thermal effects seen with other methodologies.

The study with thermocouples applied to the radicular apical third revealed only 1.2 degrees C of thermal rise after 20 seconds and 1.5 degrees C after 40 seconds of continuous radiation.

Another considerable advantage is derived from the insertion of the tip in the pulp chamber at the entrance to the root canal only without the problematic insertion of the tip into the canal or at 1 mm from the apex required by the other techniques (LAI and CI). Newly designed tips — 9 mm in length, 600 µm in diameter and with a "radial and stripped" tip — are used.

The final 3 mm are without coating to allow a greater lateral emission of energy compared to the frontal tip. This mode of energy emission makes better use of the laser energy when, at subablative levels, delivery with very high peak power for each single pulse of 50 microseconds (400 W) produces powerful "shock waves" in the irrigants, leading to a demonstrable and significant mechanical effect on the dentinal wall (Figs. 14–16). The resultant acoustic streaming allows for a three dimensional movement throughout the root canal system allowing the clinician to easier access the complex anatomy often seen in the apical one third.

The studies show the removal of the smear layer to be superior to the control groups with only EDTA or distilled water. The samples treated with laser and EDTA for 20 and 40 seconds show a complete removal of the smear layer with open dentinal tubules (score 1 according to Hulsmann) and the absence of undesirable thermal phenomena, which is characteristic in the dentinal walls treated with traditional laser techniques. With high magnification, the collagen structure is maintained intact, suggesting the ability for minimally invasive endodontic treatment (Figs. 17–19).

The Medical Dental Advanced Technologies Group, in affiliation with the University of the Pacific Arthur A. Dugoni School of Dentistry, the University of Genoa and the University of Loma Linda School of Dentistry, University of Tennessee, Boston University, Louisiana State University and the Arizona School of Dentistry and Oral Health, are currently investigating the effects of this technique of root-canal decontamination and the removal of bacterial biofilm in the radicular canal. The results, which are about to be published, are very promising (Figs. 20–25).

Discussion and conclusion

Laser technology used in endodontics in the past 20 years has undergone an important evolution. The improved technology has introduced endodontic fibers and tips of a caliber and flexibility that permit insertion up to 1 mm from the apex.

Research in recent years has been directed toward producing technologies (impulses of reduced length, "radial firing and stripped" tips) and techniques (LAI and PIPS) that are able to simplify its use in endodontics and minimize the undesirable thermal effects on the dentinal walls, using lower energies in the presence of chemical irrigants.

EDTA has proved to be the best solution for LAI technique that activates the liquid and increments its chelating capacity and cleaning of the smear layer. The use of NaOCl increases its decontamination activity.

Finally, the PIPS technique reduces the thermal effects and exerts a potent cleaning and bactericidal action thanks to its three dimensional streaming of fluids initiated by the photonic energy of the laser.

Further studies are currently under way to validate these techniques (LAI and PIPS) as innovative technologies available to endodontics.
Diode laser (810 nm) applications in clinical orthodontics

Authors_ Prof. Deepak Rai, MDS; and Prof. Gurkeerat Singh, MDS

_Dentistry has changed exponentially; osseointegration, dental bonding and kinetic energy tooth preparation are current clinical buzzwords._

The arena of dental esthetics has expanded to cover more than just simply restoring compromised teeth, but involves revamping smiles in entirety.

Soft-tissue harmonization has become paramount to overall development of dentofacial esthetics.

The unique versatility and vast potential of dental lasers allows many procedures that enhance overall treatment success.

Thus, lasers have become an indispensable clinical tool in an orthodontist’s armamentarium.1

Diode lasers allow safe fast efficient incisions with better field of visibility as there is minimal bleeding, and above that patient perceives a pressureless cut that often requires no suturing.2 This article will present clinical case reports where the diode laser has been used for the benefit of orthodontic patients.

_Case report No. 1

_Frenectomy for midline diastema correction_

Labial thick and high attached frenum is commonly regarded as contributing etiology for maintaining midline diastema.3

It is an accepted contemporary view that midline diastema first should be corrected with orthodontics and then frenectomy so that scarring that results after conventional scalpel based frenectomy doesn’t interfere with tooth movement.4

Case report No. 1

Fig. 1. Large midline diastema with thick frenum.

Fig. 2. Orthodontic closure of the diastema.

Fig. 3. High labial frenum.

Fig. 4. Diode laser frenectomy.

Fig. 5. Healed site after seven days.
Case report No. 2

*Fig. 6.* Labially erupting 43.
*Fig. 7.* Conventional scalpel surgery.
*Fig. 8.* AMD Picasso diode laser*2.3 W, rep mode.
*Fig. 9.* Diode laser bloodless incision.
*Fig. 10.* Exposed #23.
*Fig. 11.* Orthodontic attachment bonded in dry field.
*Fig. 12.* #23 orthodontically extruded.

With a diode laser the procedure can be done before complete closure or after as healing of laser wound doesn’t involve any scarring.5 The patient had large diastema (Fig. 1) and was treated with fixed appliances to first close the diastema (Fig. 2) followed by frenectomy (Figs. 3, 4). The healing was uneventful (Fig. 5).

**Case report No. 2**

*Canine exposure in labial sulcus*
Labially erupting canines are common malocclusion (Fig. 6).6,7 Conventional exposure with scalpel based method leads to extensive bleeding (Fig. 7) and the field of operation requires special hydrophilic moisture insensitive primers to bond orthodontic attachments.

The use of a 810 nm diode laser ensures easy exposure with minimal bleeding and least patient discomfort (Figs. 8–10). The clear bloodless field ensures fast predictable bonding (Fig. 11), thus enabling fast correction of malocclusion (Fig. 12).

Case report No. 3

**Canine exposure on palatal aspect**
Palatally impacted canines*8 are difficult situation requiring surgical raising of an extensive mucoperiosteal flap, with sutures at the end and an extensive postoperative discomfort and swelling.

Diode laser allows exposure without any extensive flap (Fig. 13) and generally no sutures are required after the procedure. The patient experiences minimal pain or discomfort. In addition, a bloodless field ensures instant bonding of orthodontic attachment (Fig. 14).
IMPLANT DENTISTRY:
Debating the Options for Practical Solutions

61st AAID Annual Meeting
AMERICAN ACADEMY OF IMPLANT DENTISTRY
Washington DC October 3-6, 2012

Practical Education for the Practicing Implant Dentist

www.aaid.com
**Case report No. 4**

*Fig. 15* Gingival hyperplasia during orthodontic treatment.

*Fig. 16* Diode laser assisted gingivoplasty.

*Fig. 17* Healed site.

**Case report No. 5**

*Fig. 18* Palatal gingival hyperplasia with lingual appliance.

*Fig. 19* After diode laser gingivoplasty.

---

**Case report No. 4**

*Gingivoplasty*

Orthodontic fixed appliances are generally associated with issues of good oral hygiene maintenance. In many cases we notice gingival hyperplasia (Fig. 15). Such enlargement further impedes good hygiene and is commonly associated with bleeding. Diode laser can be used effectively in such situations (Figs. 16, 17).

**Case report No. 5**

*Palatal gingival hyperplasia*

Lingual orthodontic appliances are generally associated with gingival hyperplasia, preventing us from the access to gingival hooks to engage elastic attachments (Fig. 18).

It is difficult to sculpt gingiva around lingual braces with scalpel due to poor access and poor visibility.

Even electrocautery would not be indicated due to chance of sparking on contact with metal braces.

A diode laser (2 W, repetitive mode) allowed us to sculpt the hyperplastic gingiva easily without any bleeding or discomfort allowing easy access to engage elastic attachments (Fig. 19).
Save the Date!

ICOI’S WORLD CONGRESS XXIX

ORLANDO Florida

World Center Marriott Hotel • September 20-22, 2012

Plan to attend our 29th World Congress as the ICOI turns 40!!

Sponsored by: ICOI ADIA
Case report No. 6

Diode laser assisted removal of odontome in maxillary anterior region preventing eruption of permanent incisor

Patient was a 10-year-old girl with unerupted central incisor (Fig. 20). Radiovisiographic evaluation suggested mesiodens (Fig. 21). Diode laser was used to give primary incision and simultaneous frenectomy at 2 W repetitive mode, followed by 2.3 W continuous mode, ensuring bloodless field of operation (Fig. 22). The tooth like mass was removed (Fig. 23) and orthodontic eruption appliance was bonded (Fig. 24). Histologic examination revealed it to be an odontome (Fig. 25). The tooth erupted in a few months with orthodontic active guidance (Fig. 26).
SAVE THE DATE

Yankee Dental Congress 2013 will bring together thousands of brilliant minds to learn about the most innovative approaches, practices, and resources in dentistry.

Here is a sneak peak at a few education highlights:

Gordon Christensen, DDS  
RESTORATIVE

Loretta LaRoche
PERSONAL DEVELOPMENT

Kenneth Hargreaves, DDS
ENDODONTICS

Roger Levin, DDS
PRACTICE MANAGEMENT

Laney Kay, JD
INFECTION CONTROL

Cherilyn Sheets, DDS and
Jacinthe Paquette, DDS
RESTORATIVE/ESTHETICS

877.515.9071 • yankeedental.com

Connect with us
Case report No. 7
Fig. 27. Laser assisted circumferential supracrestal fibrotomy.

Control of tooth rotation correction in orthodontics from relapse is always a challenge. Permanent lingual bonded retention is essential. It is also suggested to do circumferential supracrestal fibrotomy to allow elastic fibres to reorganize favorably without causing relapse of correction.\textsuperscript{15–17}

Conventional scalpel-assisted CSF is associated with bleeding and requires infiltration anaesthesia. The authors are trying diode laser at different settings of power and are currently evaluating success of this laser assisted circumferential supracrestal fibrotomy (LACSF) (Fig. 27).

Case report No. 8
Fig. 28. Orthodontic microimplant for anchorage.
Fig. 29. Inflammation around microimplant.
Fig. 30. Decontamination and biomodulation with laser at low power.
Fig. 31. Corrected malocclusion with healed site.

Diode laser assisted salvaging of orthodontic microimplant

Extensive work is being done on use of lasers in salvaging osseointegrated dental implants.\textsuperscript{18} We tried using diode laser for orthodontic microimplant which is used for short term. The patient received two orthodontic microimplants for retraction (Fig. 28), the one on left side was rigid but showed some inflammation of tissue around the implant (Fig. 29).

A diode laser was used at 0.5 W to decontaminate and allow healing of tissue around microimplant. The implant survived and served its orthodontic purpose (Figs. 30, 31).

Case report No. 9

Vestibuloplasty in patient with mucogingival problem before undergoing lingual orthodontics

The patient had severe deep bite, associated with extensive mucogingival damage, with poor oral hygiene\textsuperscript{19} (Figs. 32, 33).

After initial scaling and root planning (Fig. 34), a diode laser was used to perform vestibular extension (Fig. 35). Lingual appliances were bonded and spaces were consolidated with good oral hygiene maintenance (Figs. 36, 37).
A diode laser can also be used as low level therapy during orthodontic tooth movement and especially during a situation where heavy orthopedic forces are applied as in rapid maxillary expansion. This is an area where the authors are guiding a postgraduate research project in their department.

The incorporation of lasers in routine orthodontic practice is the order of the day. The practices that embrace this technology will surely flourish and will have satisfaction of providing best dental care to their patients.

Reference

*AMD LASERS, www.amdlasers.com

Editorial note: This article first appeared in the international magazine of laser dentistry, Vol. 2, No. 4, 2010.

_case report ortho_

Fig. 32, Severe deep bite, class II DIV 2, missing upper #12 and #22.

Fig. 33, Extensive mucogingival destruction.

Fig. 34, After preliminary scaling.

Fig. 35, Laser-assisted vestibuloplasty.

Fig. 36, Lingual appliance to consolidate spaces.

Fig. 37, Improved gingival attachments.

_case report ortho_

_About the authors_

Prof. Deepak Rai, MDS
Masters in Orolaser Applications (Sola, Vienna)
Department of Orthodontics
Manav Rachna Dental College
Faridabad, Haryana, India
radentalcare@gmail.com

Prof. Gurkeerat Singh, MDS
Professor and head of the Department of Orthodontics
SRCDSR, Faridabad, India

_Laser_

Case report No. 9

**Fig. 32.** Severe deep bite, class II DIV 2, missing upper #12 and #22.

**Fig. 33.** Extensive mucogingival destruction.

**Fig. 34.** After preliminary scaling.

**Fig. 35.** Laser-assisted vestibuloplasty.

**Fig. 36.** Lingual appliance to consolidate spaces.

**Fig. 37.** Improved gingival attachments.
Dental lasers: Improving clinical results and patient treatment acceptance

Author_Anthony R. Cardoza, DDS

Over the last 27 years, I have witnessed and implemented many technological advances in dentistry. Some of these advances have included computers throughout the office, digital X-rays, digital intra-oral photography, loupe and microscope magnification and CAD/CAM technology, just to name a few. One of the most significant technological advances that I have witnessed has been the evolution of the dental laser, and this technology is really firing my passion for clinical dentistry.

Lasers have been used in dentistry for several decades, but during the last five years, dental lasers have become widely accepted, and now tens of thousands of dentists in the United States and around the world have implemented lasers into their daily armamentarium. Market acceptance of dental lasers is now at a rapidly growing level, where digital imaging was five to seven years ago. The decision is no longer whether to add a laser (or two) to your practice, it is just a matter of which laser will best fulfill your clinical needs.

In my practice, we have several lasers for both hard- and soft-tissue applications that are used for a wide range of procedures. It is a well-established fact that different dental procedures require different laser wavelengths. Wavelength is important because specific body tissues [chromophores] interact in different ways depending on the particular laser source. Therefore, it is important to use the proper wavelength that is tissue specific for the procedure.

Following are just a few of the laser procedures performed in our office every day and the clinical advantages they offer both our practice and, most importantly, our patients.

The XLase™ (Technology4Medicine) 1,064 nm diode laser has become my diode laser of choice for my hygiene department. It is very effective for hygiene
procedures such as laser bacterial reduction (LBR) and laser depithelization as a treatment adjunct during scaling and root planing appointments. In addition, because of the 1,064 nm wavelength and the ability to micropulse the laser output, the XLase is an excellent laser for soft-tissue surgical procedures such as frenectomies, gingivectomies, fibroma removals and gingival retraction for crown and bridge impressions.

The most versatile laser I have is a dual wavelength Er:YAG (2,940 nm) and Nd:YAG (1,064 nm) all-tissue laser (Lightwalker, Technology4Medicine). Practically all laser-assisted dental treatments can be performed with either the most highly absorbed Er:YAG or the selectively absorbed, deeper penetrating Nd:YAG laser wavelength. I use my Er:YAG several times a day for no shot, no drill cavity preps. My patients love being able to avoid having shots and post-op numbness.

This laser gives me the ability to remove decay quickly and effectively, and often these restorations had not been scheduled but are discovered during hygiene examinations. We are able to complete these procedures in one appointment and avoid the inconvenience of rescheduling the patient. With my Er:YAG laser I am able to perform these procedures fast and most often without anesthesia.

Lasers have allowed me to significantly expand the procedures I perform and one of the most important areas is endodontics. With our Lightwalker Er:YAG laser we now routinely perform even complicated molar endo cases using an effective, fast and easy to use procedure called PIPS™ (photon-induced photoacoustic streaming). PIPS is an advanced patented method using the Lightwalker Er:YAG laser for cleaning and debriding the entire root canal system.

PIPS has also been shown to greatly reduce the bacteria found within the canal system. Also, PIPS has allowed us to reduce the treatment time for molar endo by about 30 percent while performing the procedure more effectively and reducing the need for retreatments.

PIPS uses the proprietary designed Er:YAG laser to create a photoacoustic shock wave within the cleaning and debriding solutions introduced in the canal. The containment of the shockwaves thoroughly streams these solutions three-dimensionally through the entire canal system, enhancing their effectiveness. The canals and subcanals are left clean and the dentinal tubules are free of smear layer. PIPS is equally effective for final water rinsing prior to obturation.

Another important addition to our practice has been Wavelength-optimized Periodontal Therapy™ (WPT). WPT is a minimally invasive method for treating periodontal disease utilizing both the Nd:YAG and Er:YAG wavelengths of the LightWalker. WPT creates the optimal conditions for healing of periodontal disease by removing the diseased epithelial lining of the periodontal pocket using the Nd:YAG laser, then the calculus is removed from the root surface using the Er:YAG laser.

Finally, finishing with the Nd:YAG laser, the pocket is sealed to form a stable fibrin clot. Like we see during PIPS, the Er:YAG laser creates a photoacoustic shockwave within the periodontal pocket, which is instrumental for calculus removal and bacterial reduction on the cementum surfaces. WPT has proven to be very effective and has significantly increased the level of patient acceptance of periodontal treatments.

The combination of these two proven wavelengths in one laser system has enabled our practice to perform not only single wavelength but also dual-wavelength treatments. Utilizing both wavelengths in many treatments makes optimum use of the unique laser-tissue interaction characteristics of each wavelength.

For example, Nd:YAG laser energy is superior for coagulation and deep disinfection and stimulation, while Er:YAG is uniquely efficient at abrating hard and soft tissues, and attacking bacteria and pathogens that lack pigmentation. When combined, they can dramatically improve the outcome of laser assisted treatments._
World’s first Android-based control screen in the dental laser industry

PerioLase MVP-7 for the LANAP protocol brings together advanced science and developing technology

Millennium Dental Technologies announces the first laser in the dental industry to incorporate an Android-based digital display and control system. The PerioLase® MVP-7™ for the LANAP® protocol combines its advanced laser components with the latest LCD display technology for the optimum operating experience.

The enhanced display integrates the latest developments in the tablet industry into the PerioLase MVP-7 digital dental laser, and provides a consistent platform to continually take advantage of the explosive growth and development in the electronics industry.

Millennium Dental Technologies is breaking the paradigm of the planned obsolescence built into the manufacturing of capital equipment within the dental industry. By integrating the open-platform Android operating system, the PerioLase MVP-7 will enable new display device integration and upgrades without the purchase of a new laser.

"Currently, in the industry, a device upgrade means a completely new laser at high cost. Millennium’s constant practice of ‘Kaizen’ has allowed us to break through this paradigm and provide true device upgradability," said Robert H. Gregg II, DDS, president and co-founder of Millennium Dental Technologies.

The new streamlined user interface increases usable display space to allow the clinician to focus on the clinical procedure, with intuitive operating controls and engaging graphics. The 360-degree mounting system increases clinician comfort during the procedure with a wide range viewing angle and increased flexibility of laser placement in the operatory.

"Operating system upgrades can be done in the field through encrypted hardware authentication with less downtime to the clinician," explained Patrick McCormick, chief financial officer of Millennium Dental Technology. "This enables the clinician to maintain patient treatment schedules and efficiency while giving them the power to stay abreast of the exploding high-resolution, flat-screen display technology."

Chief Technical Officer Delwin McCarthy, DDS, explained, "The transformation to the Android-based platform is fully backward compatible. All existing PerioLase MPV-7 laser devices can be merged with the advanced display and control, an important benefit to our LANAP-trained clinicians."

Millennium Dental Technologies is exploring forward compatible upgrades, including evolution to electronic medical records, the Obama initiative for integration of electronic dental records and systems, and seamless communication with case management software.
The PerioLase MVP-7, a free-running pulsed Nd:YAG laser, was developed specifically to support the LANAP protocol and through product relevancy and a dedicated management team, is the longest-lasting laser system still being sold today in the history of the dental laser device industry. The LANAP protocol is a patient-accepted, evidence-based laser, gum disease surgery, developed with the purpose of helping patients save their natural teeth and avoid the fear and pain associated with traditional gum surgery.

Headquartered in Cerritos, Calif., Millennium Dental Technologies (MDT) is the developer of the LANAP protocol for the treatment of gum disease and the manufacturer of the PerioLase MVP-7 digital dental laser. By providing a simple and comfortable experience with unique bone-building clinical results, MDT’s FDA-cleared LANAP protocol removes the fear from gum disease treatment, offering a vastly less painful and less invasive regenerative treatment alternative to conventional scalpel/suture flap surgery. The company’s PerioLase MVP-7 is a 6-watt, free-running, variable pulsed Nd:YAG dental laser featuring digital technology and seven pulse durations—the most available on the market—giving it the power and versatility to perform a wide range of soft- and hard-tissue laser procedures. Established in 1990, the company’s founding clinicians, Robert H. Gregg II, DDS, and Delwin K. McCarthy, DDS, continue to operate the company with a shared vision and purpose: To create better clinical outcomes in periodontal disease patients — and to remain true to the guiding principle — “It’s all about the patient.” For more information, please visit www.LANAP.com.
submissions: formatting requirements

Please note that all the textual elements of your submission:
- the complete article,
- all the figure captions,
- the complete literature list and
- contact info (bio, mailing address, e-mail address, etc.)

must be combined into one text document. Please do not submit multiple files for each of these items.

In addition, images (tables, charts, photographs, etc.) must not be embedded in the text document. All images must be submitted separately, and details about how to do this appear below.

If you are interested in submitting a C.E. article, contact us for additional instructions before you make your submission.

_Text length

Article lengths can vary greatly — from a mere 1,500 to 5,500 words — depending on the subject matter. Our approach is that if you need more or less words to do the topic justice then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multi-part series on various topics.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

_Text formatting

Please use single spacing and un-indented paragraphs for your text. Please do not put a blank line between paragraphs.

We also ask that you forego any special formatting beyond the use of italics and boldface, and make sure that all text is left justified.

If you would like to emphasize certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers.

Please do not “center” text on the page, add special tab stops, or use underlining as all of this must be removed before layout. If you require a special layout, please let the word processing program you are using help you to do this formatting rather than doing it by hand on your own.

If you need to make a list or add footnotes or endnotes, please let the word processing program do it for you automatically. There are menus in every program that will help you to do this.

The fact is that no matter how careful one might be, errors have a way of creeping in when you try to hand number footnotes and literature lists.

_Images requirements

Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate the images in a group (i.e., Fig. 2a, Fig. 2b, Fig. 2c).

Please put figure references in your article wherever they are appropriate, whether that is in the middle or end of a sentence but before the period.

If you are not directly mentioning the figure in the body of your article, when it appears at the end of the sentence the figure reference should be enclosed within parenthesis and appear before the final period.

In addition, please note:
- We require images in TIF or JPEG format.
- These images must be no smaller than 4 x 4 inches in size at 300 DPI.
- Images cannot be any smaller than 80 KB in size (or they will print the size of a postage stamp).

Larger images are always better, and something on the order of 1 MB is best. Thus, if you have an image that is greater than 1 MB, please do not bother “sizing it down” to meet our requirements, but send us the largest file size available.

The larger the starting image is in terms of bytes, the more leeway the designer has in terms of resizing the image to fill up more space should there be room available.

Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

You may submit images through a zipped file via e-mail, unzipped individual files via e-mail or post a CD containing your images directly to us (please contact us for the mailing address as this will depend upon where in the world you will be mailing them from).

Please do not forget to send us a head shot photo of yourself that also fits the parameters above so that it can be printed along with your article.

_Abstracts

An abstract of your article is not required. However, if you choose to provide us with one, we will print it in a separate box.

_Contact info

At the end of every article is a contact info box with contact information along with a head shot of the author.

Please note at the end of your article the exact information you would like to appear in this box and format it according to the previously mentioned standards.

A short bio (60 words or less) may precede the contact info if you provide us with the necessary information.

_Questions? Comments?

Please do not hesitate to contact us for our International C.E. Magazine Author Kit or if you have other questions/comments about the article submission process:

Group Editor Robin Goodman
r.goodman@dental-tribune.com

Managing Editor Fred Michmershuizen
f.michmershuizen@dental-tribune.com
Don’t settle for less.
When you choose an Odyssey® you get more than just a laser.

Odyssey lasers offer benefits beyond “cutting” edge laser technology, a simplified user-interface and unmatched portability. When you purchase an Odyssey Laser, you and your patients will benefit from years of research & development, clinical experience, high-quality manufacturing and personal training.

To learn more go to ivoclarvivadent.com/Odyssey
The international C.E. magazine of laser dentistry

Copyright Regulations

The international C.E. magazine of laser published by Dental Tribune America is printed quarterly. The magazine’s articles and illustrations are protected by copyright. Reprints of any kind, including digital mediums, without the prior consent of the publisher are inadmissible and liable to prosecution. This also applies to duplicate copies, translations, microfilms and storage and processing in electronic systems. Reproductions, including excerpts, may only be made with the permission of the publisher.

All submissions to the editorial department are understood to be the original work of the author, meaning that he or she is the sole copyright holder and no other individual(s) or publisher(s) holds the copyright to the material. The editorial department reserves the right to review all editorial submissions for factual errors and to make amendments if necessary.

Dental Tribune America does not accept the submission of unsolicited books and manuscripts in printed or electronic form and such items will be disposed of unread should they be received.

Dental Tribune strives to maintain the utmost accuracy in its clinical articles. If you find a factual error or content that requires clarification, please contact Group Editor Robin Goodman at r.goodman@dental-tribune.com. Opinions expressed by authors are their own and may not reflect those of Dental Tribune America and its employees. Dental Tribune cannot assume responsibility for the validity of product claims or for typographical errors. The publisher also does not assume responsibility for product names or statements made by advertisers. The responsibility for advertisements and other specially labeled items shall not be borne by the editorial department. Likewise, no responsibility shall be assumed for information published about associations, companies and commercial markets. All cases of consequential liability arising from inaccurate or faulty representation are excluded. General terms and conditions apply, and the legal venue is New York, New York.

Dental Tribune America is the official media partner of:

laser
May 24th to 28th 2013
Palais des congrès de Montréal

ON LINE REGISTRATION • www.odq.qc.ca
E-MAIL • congres@odq.qc.ca

Journées dentaires internationales du Québec

ANNUAL CONVENTION
OF THE ORDRE DES DENTISTES DU QUÉBEC
YOUR CHOICE. YOUR LASER.

FOR A LIMITED TIME, CHOOSE HOW YOU SAVE WHEN ORDERING PICASSO™ LASER TECHNOLOGY

ORDER PICASSO LASER TECHNOLOGY TODAY & PICK TWO OF THE FOLLOWING:

- Picasso iPad App * When Available
- Hands-On Training Course
- Laser Surgical Manuals (Digital) * When Available
- Full-Office Certification
- Free Shipping

MASTERS OF LASER DENTISTRY
LASERS IN SURGERY AND HYGIENE 7 CE CREDITS

A DENTSPLY International Company

866.999.2635 AMDLASERS.COM