The Nd:YAG Laser in Dentistry - Part 2 of 2

This issue of Wavelengths continues to study Nd:YAG, the wavelength with the largest market share and a long history of use in dentistry.

By way of review, Nd:YAG is a solid active medium, a crystal of Yttrium Aluminum Garnet doped with Neodymium, and is fiber optically delivered, used most often in contact with the target tissue. The emission wavelength is 1064 nm, in the near infrared invisible nonionizing spectrum. It is highly absorbed by pigmented tissue and is about ten thousand times more absorbed by water than an argon laser.

The vast majority of the instruments manufactured utilize a true free-running pulse mode of emission. Unlike the continuous wave emission mode of the argon and diode lasers, Nd:YAG lasers have pulse durations of approximately 100-500 microseconds, depending on the model. An important parameter that the surgeon can adjust is the energy per pulse, measured in millijoules. Because of the very short pulse duration of the laser-emitted laser light, this free-running pulsed instrument can generate a peak power of 1000 Watts per pulse. At a repetition rate of 50 pulses per second, the laser energy is inactive for over 99% of the duration of the laser procedure, allowing for a maximum thermal relaxation, or tissue cooling time. As an aside, Dr. Douglas Gilio in his case presentation utilizes an Nd:YAG laser device that operates in continuous wave mode, without the peak power phenomenon.

Common clinical applications are cutting and coagulating of dental soft tissues with good hemostatic ability. The free-running pulse mode also allows the clinician to treat very thin or fragile tissue with a reduction in heat buildup in the surrounding area. Nd:YAG laser energy is slightly absorbed by dental hard tissue, but there is little interaction with sound tooth structure, allowing tissue surgery adjacent to the tooth to be safe and precise.

The following clinical cases will demonstrate both hard tissue and soft tissue surgical indications, as well as removal of the diseased epithelial lining of periodontal pockets, known as curettage. This particular clinical procedure is used in the first phase of periodontal therapy along with the scaling of calculus and other debris from the tooth surface. Quite often, many beginning-to-moderate cases of disease will be successfully treated without further surgical intervention when the patient enters continuing care.

In hard tissue applications, the pulsed Nd:YAG laser can be used to selectively remove pigmented enamel caries, to desensitize hypersensitive dentin, to induce analgesia before initiating restorative procedures, and to modify the surface of dentin prior to application of a bonding agent.

There are a handful of articles describing what appear to be catastrophic effects of direct exposure of Nd:YAG on tooth root surfaces. The reader should be cautioned that there is no manufacturer-recommended clinical procedure for direct fiber contact of laser power in excess of 1 Watt on the tooth surface. The aforementioned manuscripts have operating parameters much in excess of that, with expected consequences of thermal damage.

The final caution concerning any laser procedure is that the surgeon must always carefully observe the target tissue to monitor the interaction. Suggested powers may need modification to reach the treatment objective safely and effectively.

The following clinical case studies demonstrate the value of this laser instrument in clinical surgical practice:

- Dr. Ambrose Chan performs laser-induced analgesia and desensitization of hypersensitive dentin.
- Dr. Enrique Treviño describes analgesia for a combined air abrasion and laser restorative procedure.
- Dr. Donald Coluzzi shows treatment of enamel caries.
- Ms. Laura Maestas presents three cases in which the laser is used adjunctively to treat case Type III and IV periodontal disease.
- Dr. Douglas Gilio used the laser to remove hyperplastic tissue as adjunctive orthodontic treatment.
- Dr. Gary Griffin treats a 21-year-old male with Dilantin hyperplasia. In addition, Dr. Steven Parker details a laboratory study using a scanning electron microscope to analyze the results of hard tissue exposure to both the Nd:YAG and Er:YAG lasers.

Additional highlights include:

- Ambrose L. Chan, DDS
  Caringbah, NSW, Australia
- Enrique Treviño, DMD
  El Paso, Texas
- Donald J. Coluzzi, DDS
  Redwood City, California
- Laura B. Maestas, RDH
  Socorro, New Mexico
- Douglas A. Gilio, DDS
  Visalia, California
- Gary Griffin, DMD
  Louisville, Kentucky
- Stephen Parker, BDS
  Harrogate, North Yorks
  United Kingdom

Readers are reminded of another recent issue of Wavelengths which featured a hard tissue case involving the Nd:YAG laser:

A 29-year-old female presented with negative medical history and no periodontal surgery in the last 6 months. Intraoral examination revealed an extensive erosive lesion and gingival recession on the neck (facial surface) of tooth #29. Her chief complaint was that tooth #29 was sensitive to cold/acid diet and brushing but was otherwise asymptomatic.

1. Clinical Examination
   - Absence of periodontal and periapical pathologies.
   - Absence of cracks, caries and hyperocclusion was noted.
   - A pain score (1-10) of 9 was recorded.

2. Tooth Vitality
   - Vitality of the adjacent teeth was confirmed with cold (air spray) testing. Tooth #29 was subjected to a one-second air blast (air syringe). Pretreatment view (Figure 1).
   - Vitality of tooth #29 was confirmed with electric pulp tester. Laser-induced pulpal analgesia being performed (Figure 2).

3. Hard Tissue Test
   - TMD test was negative. Tooth #29 was negative to percussion and fract-finder testing (on cusps). Absence of cracks, caries and hyperocclusion was noted.

4. Radiographic Exam
   - Absence of marginal gingivitis.
   - Normal healthy oral tissues with adequate anti-cariogenic potential.
   - Chemical anti-sensitivity home treatment.
   - Laser-assisted desensitization is responsive, simple, effective, diagnostic and has possible anti-cariogenic potential.

5. Soft Tissue Test
   - Use laser energy to close the exposed dentinal tubules through laser-induced surface modification (melting) and reduce dentinal fluid flow.

6. Other Tests
   - Class I malocclusion with cross-bite between teeth #6 and #29 and edge-to-edge on bicuspids and molar segments.
   - Resolve the condition of dentine hypersensitivity using a laser to render patient comfort during brushing and having cold/acid diet. Manage bruxism and overbrushing. Correct the dental cross-bite orthodontically.

7. Alternative Treatment
   - Use laser energy to close the exposed dentinal tubules through laser-induced surface modification (melting) and reduce dentinal fluid flow.

8. Treatment
   - Use laser energy to close the exposed dentinal tubules through laser-induced surface modification (melting) and reduce dentinal fluid flow.

9. Contraindications
   - Thermal injury due to overexposure. Not a permanent solution if the cause is not managed or rectified.

10. Informed Consent
   - Verbal consent was obtained prior to treatment.

References

Dr. Ambrose Chan is in private dental practice in New South Wales, Australia and has been clinically using the laser and involved in laser research since 1990. In addition, he works as an associate researcher at Macquarie University’s Centre for Lasers and Application into Aspects of the Use of Lasers in Dentistry, concentrating on the applications of Er:YAG, Nd:YAG, argon, carbon dioxide, and diode lasers.
A Combination Case Report: Nd:YAG Laser-Induced Analgesia, Caries Removal, Dentin Surface Modification; Air Abrasion Cavity Preparation; and Argon Laser Composite Polymerization

Enrique Treviño, DMD, El Paso, Texas

For the last decade, we laser dentists have been searching for a conservative, painless, drill-less way to clean and remove decay. Today we have various alternatives, but by combining two technologies we can be conservative and efficient in reaching our goal.

A technique of caries removal and tooth restoration is described.

A 32-year-old female patient presented for an initial oral examination. The patient had not been in a dental office for over 3 years. Medical history was noncontributory and there was no chief complaint. The diagnostic tests of radiographs, explorer and caries detector dye confirmed the presence of caries on enamel and also the probability of dentin caries. Vitality test was positive on both teeth. The diagnosis was incipient occlusal caries on teeth #20 and 21.

The treatment consisted of analgesia induced with a pulsed Nd:YAG laser (Duopulse 2000, Excel) at 10 Hz, 1.75 Watts, using a 320-micron fiber. The laser was used for 2 minutes on each tooth in order to achieve analgesia and to reduce sensitivity. Local anesthesia was not necessary. A rubber dam was then placed with a disposable retainer. Cavity preparation began with an air abrasion device (Mach 5.0, Kreativ) in a power pulse mode at 80 pps with a .46 mm supersonic nozzle used about 1 mm away from the surface. The abrasive was Gammagure 27.5-micron aluminum oxide at a flow rate 2.5 grams/minute. A caries detection dye confirmed the presence of dentin caries (Figure 1). Caries was then removed with the Nd:YAG laser (15 Hz, 1.50 Watts, again using the 320-micron fiber) and tested with caries detector until contaminated dentin was removed (Figure 2). Teeth were treated with the laser to increase the microhardness of dentin (20 Hz and 2.25 Watts) and promote better adhesion. A dental adhesive material was then used (Tenure Quick, Denmat), then restored with a hybrid flowable composite resin (Fluorestore, Denmat). The resin was placed and cured for 5 seconds on each surface (lingual, buccal and occlusal) with an argon laser (Arago, Permiier Laser Systems) at 300 mW until the cavity was filled. The restoration was then sealed with a (Fortify, Bisco) sealant material (Figure 3).

Alternative treatments might have included use of other cavity preparation technologies; however, micro-abrasion has been shown to be a very effective alternative for patients who dislike the air turbine.

There were no contraindications for treatment which was performed following a review of the patient’s options and a verbal informed consent. Treatment was performed with no complications and recorded in the patient’s chart with clinical photographs. The patient tolerated the procedure very well. Routine postoperative instructions were given to the patient who was then released. The patient was seen 2 weeks, 4 weeks and 3 months postoperatively and no discomfort was reported. Vitality test performed 3 months post-op revealed that the teeth were still vital. There were no side effects from the treatment.

Treatment consisted of the accurate diagnosis and proper management of the clinical operation of the devices and knowledge of the materials used.

Treatment was indicated and the procedure was very successful. The long-term prognosis and results for these teeth and patient are good.

Conclusions

By using both technologies, I was able to be very conservative and improve the prognosis of the restorations.

References

1. Bida D. Personal communication.

Dr. Enrique Treviño graduated from the School of Dentistry, University of Juarez, Mexico in 1981. He attended a postgraduate program in current concepts of American Dentistry-Implantology at New York University in 1987. He is a Diplomate of the International Congress of Oral Implantologists. Dr. Treviño has achieved Advanced Proficiency status from the Academy of Laser Dentistry, is a certified dental laser educator, and maintains a private dental practice. He is a professor of the Mexican Dental Association. Dr. Treviño has lectured for Kreativ and received products as a form of compensation. He also lectures for Calcitek and receives an honorarium, and for Duo-Dent and receives no compensation. He has no financial interest in any laser manufacturer.
A 35-year-old male with negative medical history presented with occlusal caries on the upper right bicuspids. The first bicuspid had a larger lesion than the second; both teeth had no previous restorations. The patient had no painful thermal symptoms, and radiographs showed enamel caries, penetrating to the dentin-enamel junction, and there were normal hard and soft tissue structures with no apparent pathology. The teeth tested vital with normal occlusion. (Figure 1)

A free-running pulsed Nd:YAG dental laser (PulseMaster 600 LE, American Dental Technologies) with an emission wavelength of 1064 nm was used. Energy of 100 mJ per pulse and a repetition rate of 10 Hz produced 1.0 W of power, and a 320-micron fiber was used in contact with the tooth. Air spray and high-volume evacuation was utilized. Total treatment time was 5 minutes for both lesions. No anesthesia was used for the tooth preparation, and the patient was comfortable throughout the procedure. Caries were removed (Figure 2) and the teeth were restored (Figure 3).

This case illustrates the clinical application of pigmented caries removal using the Nd:YAG laser. The resulting conservative preparation is minimal in size, since the wavelength has little interaction with healthy tooth structure. 

Dr. Donald Coluzzi graduated from the University of Southern California School of Dentistry in 1970. He maintains a general practice in Redwood City, California. He is a past president of the Academy of Laser Dentistry, a fellow of the American College of Dentists, has Advanced Proficiency in Nd:YAG and Er:YAG wavelengths, and is a certified dental laser educator.
Ms. Laura Maestas received her dental hygiene degree from the University of New Mexico in 1992 and has had 8 years of experience with dental lasers. She received her Nd:YAG Hygiene Mastership in 2000. Ms. Maestas has no financial interest in any laser manufacturer.

A 35-year-old male presented with heavy calculus and moderate-to-severe inflammation (Figure 4). Four bitewing radiographs and a panograph were taken. Medical history was negative. The patient quit smoking 2 years previously.

A free-running pulsed Nd:YAG laser (dLase300, American Dental Technologies) was used.
Wavelength: 1064 nm
Delivery System: 320-micron fiber in the contact mode
Settings: 2.5 W at 20 Hz for approximately 30 to 60 seconds per tooth.

After just 7 days post-treatment, the tissue had already started to become pink and healthy-looking. Pocket depths were dramatically reduced by 2-3 mm. The patient’s home care was reviewed and adjusted to aid in removing the plaque more effectively from the mandibular lingual area. There was very little bleeding upon probing and the tissue was much less tender. The tissue had already started to exhibit some stippling at this early assessment appointment. Continued healthy appearance was evident six weeks after initial treatment (Figure 5).

When using the Nd:YAG laser for the clinical procedure of sulcular debridement or soft tissue curettage, the clinician should take note of the following points:

1. Use conventional instrumentation first to remove calculus and other root surface deposits.
2. Extend the laser fiber from the cannula by measuring with the perio probe to match the pocket depth MINUS one millimeter.
3. Aim the fiber at the diseased epithelium (Figure 1), keeping the fiber fairly parallel to the root surface, and ALWAYS maintain contact with the soft tissue. Do not direct the laser energy toward the tooth/root surface.
4. Move the fiber smoothly and at a moderate speed, covering the inflamed epithelium and connective tissue. Move the fiber both horizontally and vertically.
5. Watch carefully as the granulation tissue is removed — it usually will cling to the fiber tip (Figure 2). Remove the granulation tissue with a dry or water-moistened cotton sponge.
6. Usually lasing is complete when signs of a new wound site (fresh bleeding) have appeared. In general, lase pockets 6 mm or less in depth for approximately 30 seconds; 45 seconds for deeper pockets.
Adjunctive Orthodontic Treatment: Hyperplastic Tissue Removal Using the Nd:YAG Laser with Contact Tip

Douglas A. Gilio, DDS
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Hyperplastic tissue develops during routine orthodontic treatment. This may occur as a result of poor oral hygiene alone or in conjunction with medications required by the patient for a medical condition. The patient treated in this case presented with poor home care and was a mouth breather. These two existing conditions can create severe pathology during orthodontic care.

The orthodontist referred an otherwise healthy 14-year-old female for evaluation and treatment. My approach for reduction of hyperplastic tissue (Figure 1) was to use the Nd:YAG laser with contact tip. The traditional treatment would have involved blades and sutures. This traditional technique is difficult due to bleeding and postoperative discomfort. The fiberoptic delivery system of the Nd:YAG laser enables the operator to cut, remove and coagulate hyperplastic tissue without the need for orthodontic band removal. This technology benefits patient and care provider, eliminating additional expense and chair time.

For this case, an Nd:YAG laser (Pegasus, Premier Laser Systems, 1064 nm wavelength) with contact tip was used at power settings of 3.0 - 6.0 Watts, continuous mode. Local anesthetic (2% lidocaine and epinephrine 1:100,000) was administered. The hyperplastic tissue was cut, sculpted, vaporized and removed from around the orthodontic bands (Figures 2-4). The final result was a good clinical appearance and provided the patient with improved home care access (Figures 5-6). The orthodontist was able to continue treatment with minimal disruption of needed tooth movement for completion of the case. It may be concluded that this type of laser procedure provides significant improvement over traditional methods when treating keratinized gingiva with the advantage of minimal morbidity and pleasing cosmetic results.

Dr. Douglas A. Gilio received his certificate in periodontics from the University of Southern California in 1981. He maintains a private practice in periodontics and implants in Visalia, California and is a clinical instructor in the general residency program at Veterans Hospital in Fresno, California.

Wavelengths
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Nd:YAG Laser Reduction of Dilantin Hyperplasia

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Pretreatment

A. Diagnostic Tests

1. Clinical Examination
A 21-year-old white male presented to the office seeking laser services, having read about dental laser surgery for treating his own condition, Dilantin hyperplasia. Clinical exam revealed moderate-to-severe gingival hyperplasia on the facial of all the anterior teeth, with the mandibular arch being the more severe, and that arch had the more fibrotic tissue. There was no attachment to the tooth enamel, and these areas could be easily reflected with a peri probe. The patient was anesthetized, the tissue reflected, and probe readings were taken; the maxilla had generalized 4-5 mm pockets and the mandible had 4 mm pockets.

2. Tooth Vitality
All teeth tested vital with the electronic pulp tester.

3. Hard Tissue Tests
For a large resin restoration in the incisal of tooth #9, all teeth appeared clinically sound.

4. Radiographic Exams
Periapical and vertical bitewings were taken, and all structures appeared within normal limits.

5. Soft Tissue Tests
Perio probings were performed as noted above. The patient is a mouth breather and the general appearance of the gingiva was red and dry. Oral hygiene was acceptable.

B. Diagnosis and Treatment Plan

1. Diagnosis
Moderate-to-severe hyperplasia and dry mouth.

2. Treatment
Recontour, sculpt and plasty the facial areas of the anterior teeth using the pulsed Nd:YAG laser.

3. Possible Treatment Alternatives
Conventional surgical instrumentation or electrosurgery device.

4. Indications
Moderate-to-severe hyperplastic tissue is easily removed with the laser.

5. Contraindications
Inadequate zone of attached tissue remaining, cautious use of the laser near bone and tooth structure, esthetic result could be objectionable, and patient’s hygiene and medical condition.

6. Informed Consent
Written informed consent about the procedure was signed by the patient, a witness, and the doctor.

Treatment

A. Objective
The patient desired a more natural and more esthetic appearance that could be easier to maintain. The objective was to remove the extra tissue and provide better architecture for improved hygiene.

B. Laser Operating Parameters
A pulsed Nd:YAG laser (PulseMaster 600 LE, American Dental Technologies) was used for the surgery.

1. Power Setting: 100 mJ per pulse, 3.0 W
2. Repetition Rate: 30 Hz
3. Fiber Diameter: 320 micron bare fiber, in contact with the tissue
4. Exposure: 30-second treatment intervals for a total time of 8 minutes
5. Wavelength: 1064 nm

C. Treatment Sequence
The patient was anesthetized with 0.75 cc of 2% lidocaine with 1:100,000 epinephrine. Appropriate protective eyewear was worn, and the laser safety signs were posted. The laser was energized and the tissue areas were ablated. Final recontouring of the cervical areas was accomplished with several bristle-like strokes. High-volume evacuation was employed through the surgery.

D. Management of Complications
There were no complications.

E. Surgical Prognosis
The surgical prognosis is good; however, because the patient must continue to take the Dilantin medication, it is expected that there will be relapse in the treatment area. Since the patient is a mouth breather, healing may be slightly delayed and the tissue color may have a shiny red color.

F. Treatment Record
All notes about anesthesia, laser parameters, before and after photos, and consent forms were placed in the patient’s chart.

G. Patient Management
The patient managed the procedure well, but was concerned about the dark tissue color immediately postoperatively. He was reassured.

H. Postoperative Instructions
The patient was given brushing instructions for gentle brushing, and advised to use over-the-counter medications as needed.

Follow-Up Care

A. Side Effects and Complications
There were no side effects from the surgery and the patient continued to progress in healing. It was expected that the Dilantin will produce further tissue regrowth and the mouth breathing may cause the tissue to have a shiny red color.

B. Assessment of Treatment
At the 10-day postoperative examination, the dark char layer of tissue was gone. The gingival margins were quite ragged and exhibited marginal redness.

C. Long-Term Results
At the 4-month postoperative visit, the gingival tissues had mostly healed, and the probing depths were normal with slight bleeding interproximally on teeth #24 and #25. (Figure 3.) As mentioned, the medication and mouth breathing contributed to this.

D. Healing Assessment
The 6-month post-op view shows the treated areas to be slightly red with no bleeding on probing. The patient’s oral hygiene is improved, and the tissue is easier to maintain. (Figure 4.) The patient reports more confidence in his smile.

Figure 1: Preoperative view.

Figure 2: Immediately postoperative.

Figure 3: Four-month postoperative view.

Figure 4: Six-month postoperative view.

Dr. Gary Griffin is a 1985 graduate of the University of Louisville, Louisville, Kentucky. He is a clinical instructor and lecturer for Aesthetic Advantage at the University of Kentucky, New York University, and in West Palm Beach, Florida. He received Advanced Proficiency in the Nd:YAG wavelength from the Academy of Laser Dentistry in 2000 and participated in the Educators Course in October 2000. Dr. Griffin is currently in private practice in Louisville, Kentucky and focuses on appearance-related laser and reconstructive dentistry.
Nd:YAG Lasers and Hard Tissue

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It is now over 10 years since the first dedicated dental laser, the dLase 300 (American Dental Technologies), was first launched. The operative wavelength of this laser was Nd:YAG, at 1064 nm. Owing to the relatively poor absorption of Nd:YAG laser light by water and hydroxyapatite (Figures 1 and 2), the most effective hard tissue uses of this laser are limited primarily to pigmented caries removal, desensitisation of hypersensitive dentine, laser analgesia, dentine surface modification, and (in endodontics) intracanal bacterial reduction.

Practical Considerations

In spite of the research into a given treatment modality, all innovative dental procedures must satisfy the demands of commercial dental practice, namely, positive treatment benefits, positive treatment time benefits, positive marketing benefits, and absorbable cost ratios. Certainly, the advent of laser dentistry has posed serious evaluations of these considerations amongst those practitioners entering this field and the promise of tooth-cutting capabilities would have evoked expectations for practitioner and patient alike. With hindsight, the passage of time, and with respect to those pioneering workers in the field, it is clear that the original high anticipations of this wavelength for multiple hard tissue applications cannot be fulfilled.

Theoretical Considerations

The predominant laser-tissue interaction of all laser wavelengths is photothermal, i.e., absorption of incident energy is converted to heat, effecting a tissue change. When an Nd:YAG is used in the treatment of pigmented soft tissue, this interaction can be both predictable and clinically beneficial, subject to correct energy considerations. With dental hard tissues, this interaction is fraught with danger; the poor absorption coefficients of enamel and dentine, the predominant laser-tissue effects on these tissues, namely transmission and scatter and the presence of a central photoabsorbent pulpal tissue, all contribute to a potentially dangerous situation. In the absence of sufficient tissue cooling, exposure of tooth tissue to Nd:YAG laser light beyond a certain power setting may be accompanied by tissue cracking, amorphous mineral production and pulpal damage. A water spray to minimize these problems would interfere with the wavelength’s absorbance by the tooth structure.

On the other hand, several studies by Japanese researchers have suggested the use of Nd:YAG laser light to actively produce such effects in enamel and to offer treatment benefits. It has been shown that amorphous hydroxyapatite is more resistant to acid attack; it can be hypothesised that a change in the surface enamel configuration in molar occlusal fissures, following laser irradiation, may be an effective treatment for increased resistance to caries. Equally, studies of Nd:YAG laser light at low incident energy levels on exposed cervical dentine have suggested a treatment modality for the relief of true dentine hypersensitivity.

Parenthetically, two other wavelengths, Er,Cr:YSGG and Er:YAG, have a number of indications for use for hard tissue ablation. Two wavelengths of carbon dioxide lasers, 9.3 and 9.6 microns, are also being investigated for similar applications.

Tissue Analysis

The investigation of exposure of enamel and bone to Nd:YAG, as illustrated by the following scanning electron microscopic (SEM) images, shows the tissue interaction. It must be noted here that current indications for use for a free-running pulsed Nd:YAG laser suggest laser parameters of approximately 1 Watt (100 mJ and 10 Hz) of average power for treatment of enamel caries and much less than half of that for dentine hypersensitivity (30 mJ and 10 Hz in a defocused mode). It also bears mentioning that, at present, no laser is clinically indicated for use on osseous tissue. In this study, an Nd:YAG laser (Twinlight, Fotona) was operated at the following parameters:

Nd:YAG total average power: 2.0 W. Energy per pulse: 100 mJ. Hz: 20. Duration of exposure: 10 secs.

It can be readily seen that, in accordance with accepted studies, there is a dramatic change in both macro- and microscopic structure of the tissues (human enamel and porcine jawbone). Thermal cracking, consistent with excessive heat production, occurs, together with a change in the mineral crystalline framework to produce amorphous spheres of re-constituted hydroxyapatite with large non-mineral spacing (Figures 3-6).

Compare these characteristics to enamel and bone exposed to Er:YAG laser light (Twinlight, Fotona) with operating parameters as follows:

Er:YAG total average power: 1.6 W. Energy per pulse: 320 mJ. Hz: 5. Duration of exposure: 10 secs.

The abundant difference in tissue effects is accounted for by the different absorption coefficients of the constituent tissues. Water and hydroxyapatite, both constituents of bone and enamel, are highly absorbed by Er:YAG and Er,Cr:YSGG laser energy. Upon exposure, the water content of the tissues is rapidly vapourised and the increase in vapour volume causes an explosive disruption of the crystalline matrix. This process is called spallation. Such tissue ablation results in a greatly enhanced tissue surface area which, in the case of enamel, may aid any etch/bonding techniques used in restorative therapy (Figures 7-10).
Conclusions

The quest for a universal laser wavelength is very strong in dentistry, not least amongst manufacturers and distributors. However, the knowledge gleaned from research during the past 10 years only serves to establish such hopes as yet to be realised. An Nd:YAG laser does have a use for ablation of enamel caries and root desensitisation at a low power setting, but an increase in the power output is liable to cause collateral tissue damage.

Dr. Steven Parker is in private practice in Harrogate, England. He is on the board of directors of the Academy of Laser Dentistry, chair of its certification committee and co-editor of Wavelengths. He has lectured for several laser manufacturers and distributors worldwide. He undertakes personally funded research and clinical studies and is currently receiving no financial funding from any laser manufacturer.

Nd:YAG Laser Curettage as an Adjunctive Treatment of Class IV Periodontal Disease

Continued from page 18

6. Informed Consent
Verbal consent was obtained.

Treatment

A. Objective
The objective of using the Nd:YAG laser along with traditional hand scaling was to reduce the pocket depths and eliminate the bleeding, granulation tissue, and inflammation, thereby restoring the patient to a level of maintainable periodontal health.

B. Laser Operating Parameters
A free-funning pulsed laser (dLase 300, American Dental Technologies) was used. Wavelength: 1064 nm
Delivery System: 320-micron fiber used in the contact mode
Settings: 2.5 W at 20 Hz for approximately 30 to 60 seconds per tooth.

C. Treatment Sequence
• The patient was in the office for 4 one-hour appointments of root planing and curettage.
• Mepivacaine 2% with 1:20,000 levonordefrin was the anesthesia used.
• After the laser was used at the settings indicated above to remove the necrotic epithelial lining, the patient was scaled by hand.
• After the hand scaling, the Nd:YAG laser was used again at the same settings to provide bacterial decontamination.
• Chlorhexidine rinse was used to irrigate after laser therapy was complete.

D. Management of Complications
There were no complications encountered during any of the procedures or postoperatively.

E. Prognosis
Prognosis is generally good.

F. Treatment Record
Notes concerning the treatment were included in the patient’s chart.

G. Patient Management
The local anesthetic provided excellent anesthesia for laser therapy. Discomfort was managed very effectively with Ibuprofen 800 mg every 6 to 8 hours as needed.

H. Postoperative Instructions
Postoperative instructions included Ibuprofen as needed, warm salt water rinses for 48 hours, and no hard or crunchy foods, preferably soft foods only. Chlorhexidine rinses were advised twice a day along with brushing. Flossing was discouraged for the first 24 hours after treatment.

Follow-Up Care

A. Side Effects and Complications
The patient had some postoperative discomfort that was managed with Ibuprofen. There were no other side effects.

B. Assessment of Treatment
• After 30 days the tissue appeared generally much pinker and healthier, and pocket depths were generally reduced with the pocket on #2 being unprobeable. In the area of #2, there has been much recession. The pockets interproximal of #24 and #25 have been reduced to 4 mm (Figure 2).
• At the patient’s 60-day assessment, the tissue is generally pink and pocketing is 3-4 mm around #24 and #25 (Figure 3).
• After 90 days, pocketing was maintaining at the same levels. The patient was able to keep up with the prescribed home care.

C. Long-Term Results
The long-term results are felt to be fair to good with continued periodontal maintenance appointments and good home care. Tooth #30 will at some point be extracted and replaced with a bridge.

D. Healing Assessment
At the final prophy appointment (about 2 months after the initial appointment for root planing-curettage), healing was determined to be significant. The tissue was much pinker and less spongy. Pocket widths were generally better by 2-3 mm throughout. Thirty days after the final prophy, pocket depths had decreased dramatically. Tissue was pink and there was less bleeding. The area around #30 was still red with bleeding and exudate. At the time of the 3-month perimaintenance visit, home care was not as good as it must be to maintain periodontal health. Home care techniques were reviewed and modified.

Ms. Laura Maestas received her dental hygiene degree from the University of New Mexico in 1992 and has had 8 years of experience with dental lasers. She received her Nd:YAG Hygiene Mastership in 2000. Ms. Maestas has no financial interest in any laser manufacturer.