The Nd:YAG Laser in Dentistry - Part 1 of 2

The next two issues of Wavelengths continue the series featuring individual wavelengths, spotlighting Nd:YAG, the wavelength used in the first laser designed exclusively for dentistry. It is the laser with the largest market share, and has extensive published scientific research for dental applications. This issue highlights a variety of soft tissue surgical cases; the next issue continues this discussion and will include some of this laser’s hard tissue possibilities.

Nd:YAG has 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 Nd:YAG laser instruments used in dentistry utilize a true free-running pulse mode of emission. Unlike the continuous-wave emission of the argon and diode lasers, pulsed Nd:YAG lasers have pulse durations of approximately 100-500 microseconds. An important parameter that the clinician can adjust is the energy per pulse, measured in millijoules. An interesting phenomenon of free-running pulsed lasers is that a 100-millijoule pulse lasting for 100 microseconds generates a peak power of 1000 Watts or more. At a repetition rate of 50 pulses per second, the laser energy is inactive for over 99% of the duration of the procedure, allowing for a maximum thermal relaxation, or tissue cooling time. As an aside, there are a few continuous-wave Nd:YAG instruments in use, but for our purposes, it should be understood that virtually all references to this wavelength will be to the free-running pulsed emission mode.

Common clinical applications are cutting and coagulating of dental soft tissues with good hemostatic ability. The free-running pulsed mode also allows the clinician to treat very thin or fragile tissue with a reduction in heat buildup in the surrounding area. There are numerous published clinical case studies showing effective periodontal disease control using this laser for sulcular debridement. 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. As will be seen in the next issue, pigmented surface caries can also be selectively vaporized by this wavelength without removing the surrounding healthy enamel. Some clinicians use this wavelength for desensitization and analgesia before initiating restorative procedures.

Unlike the diode, the pulsed Nd:YAG laser fiber rarely needs initiation, due to the high peak power pulse. It is normally used bare-ended. Similar to other wavelengths, the Nd:YAG’s fiber end needs to be cleaved; otherwise the laser light will rapidly lose its effectiveness. When used in a noncontact, defocused mode, the fiber should not be initiated; this allows the wavelength to penetrate several millimeters into soft tissue, which can be used advantageously for delivering the laser energy to the inner surface of, for example, an ulcerated lesion.

As mentioned previously, this wavelength has the longest history of use in general dentistry, and the following clinical case studies will demonstrate the value of this laser instrument in clinical surgical practice for intraoral soft tissue surgery:

- Dr. Gary Griffin treats a case of gingival cosmetic contouring (p. 16).
- Dr. Robert Barr treats a case of restorative dentistry with gingival contouring and tissue retraction (p. 17).
- Dr. John Graeber treats a case of cyclosporine-induced gingival hyperplasia (p. 18).
- Dr. Douglas Gilio presents an excisional new attachment procedure case using a continuous wave Nd:YAG laser (p. 19).
- Dr. Bill Siminovsky treats a young child for delayed eruption (p. 20).
- Dr. Ambrose Chan performs a laser gingivectomy procedure (p. 21).
- Dr. Alan Wells treat a case of dilantin hyperplasia (p. 22).

Readers are reminded of other recent issues of Wavelengths which featured additional intraoral soft tissue surgical cases involving the Nd:YAG laser:


**Highlights**

- **Gary Griffin, DMD**
  Louisville, Kentucky
- **Robert E. Barr, DDS**
  San Jose, California
- **John J. Graeber, DMD**
  East Hanover, New Jersey
- **Douglas A. Gilio, DMD**
  Visalia, California
- **Bill Siminovsky, DDS**
  Ithaca, New York
- **Ambrose L. Chan, BDS**
  Caringbah, NSW, Australia
- **Alan C. Wells, DDS**
  Sapulpa, Oklahoma
Nd:YAG Laser Cosmetic Contouring

Gary Griffin, DMD, Louisville, Kentucky

Pretreatment

A. Diagnostic Tests

1. Clinical Examination
A 32-year-old black female presented with a history of recent teeth whitening. The patient was very happy with her whitening results; however, now that she was smiling a lot more, she thought her front teeth looked rather “square” and that she had a “gummy smile.” The patient’s medical history was noncontributory.

2. Tooth Vitality
Teeth #7-10 tested vital with electronic pulp tester.

3. Hard Tissue Tests
There was no evidence of any hard tissue lesions visually or with probe.

4. Radiographic Exam
Radiographic exam was within normal limits: no carious lesions, bone loss or abscesses were evident on the vertical bite-wings of teeth to be treated.

5. Soft Tissue Tests
No bleeding on probing. Topical lidocaine was applied apical to teeth #7-10 (0.50 cc of 2% lidocaine 1:100,000). A perio probe was used to sound the bone. It was determined that 1-1/2 mm of apical gingiva could be removed from teeth #7 and 10, and that 2-1/2 mm of apical gingiva could be removed from teeth #8 and 9. The tissue was of a fibrotic nature.

B. Diagnosis and Treatment Plan

1. Diagnosis
Based on the wants of the patient and with enough gingiva to recontour, the diagnosis was excessive gingival tissue with compromised aesthetics. Teeth #7 and 10 both measured 6 x 6 mm long and wide. Teeth #8 and 9 were 8 x 8 mm long and wide as well, giving all of them a square appearance. (Figure 1)

2. Treatment
Increase the length-to-width ratio by gingival recontouring using the Nd:YAG laser.

3. Possible Treatment Alternatives
Conventional recontouring with scalpel or electrosurgery.

4. Indications for Laser
Excess gingiva causing an esthetic problem for the patient.

5. Contraindications for Laser
Inappropriate use of the laser to remove too much tissue would cause another esthetic problem.

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

Treatment

A. Objective
The reason for the laser surgery was to remove or recontour the cervical areas of teeth #7-10 and to expose the natural anatomy of these teeth and leave the gingival complex in good health.

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, 1.5 W
2. Repetition Rate: 15 Hz
3. Fiber Diameter: 320 microns
4. Exposure: Several “paint brush” type of strokes of 5-10 second duration
5. Wavelength: 1064 nm

C. Treatment Sequence
The patient was anesthetized with 0.75 cc 2% lidocaine, 1:100,000 epinephrine. Appropriate protective eyewear was worn, and the laser safety signs were posted. The laser was energized and several brushlike strokes were made in a path predetermined by probing and tooth anatomy. The gingiva was recontoured facially and blended into the interproximal, being careful not to involve the papilla. (Figure 2)

D. Management of Complications
The patient was seen 10 days postoperatively, and there were no surgical complications.

E. Surgical Prognosis
Prognosis is good.

F. Treatment Record
Notation about the laser use was placed in the patient’s record. Included were notes about type of laser used, operating parameters, and postoperative instructions.

G. Patient Management
The patient tolerated the procedure well and had no ill effects.

H. Postoperative Instructions
The patient was instructed to use a soft brush and brush lightly around the surgery site. The patient was advised to take over-the-counter pain medications of choice, if necessary.

Follow-Up Care

A. Side Effects and Complications
There were no complications.

B. Assessment of Treatment
The patient was seen at 10 days and 1 month to check for healing and possible gingival relapse.

C. Long-Term Results
At the six-month evaluation, no gingival regrowth was noted, and probing was within normal limits with no bleeding. (Figure 3)

D. Healing Assessment
At the six-month evaluation, healing was complete. The patient was very pleased with the results.

Figure 1: Preoperative view.

Figure 2: Immediately postoperative.

Figure 3: 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 Laser Gingival Crown Lengthening and Tissue Retraction for Impressions

Robert E. Barr, DDS, San Jose, California

Pretreatment

A. Diagnostic Tests

1. Clinical Exam
This is a case of a 40-year-old female in good health. The patient presented to have her upper and lower anterior teeth restored due to excessive abrasion. The upper anterior teeth had existing restorations. Head and neck, oral pathology, and cancer screening all were within normal limits.

2. Tooth Vitality
All teeth tested normal.

3. Hard Tissue Tests
Existing crowns on all teeth except lower anterior. The crowns had exposed metal margins and recurrent decay. There was normal mobility.

4. Radiographic Exam
No periapical pathology, little or no bone loss around teeth, no endodontics. Four implant restorations, recurrent anterior decay.

5. Soft Tissue Tests
Class type 2 periodontal disease with pockets no more than 4 mm in the anterior and bicuspid areas. There were only a few 5 mm pockets in the molar areas.

6. Other
Occlusion was Class I and TMJ was normal.

B. Diagnosis and Treatment Plan

1. Diagnosis
Failing restorations on teeth #6-11, recurrent decay. Excessive wear and loss of tooth structure on #23-26. Unaesthetic gingival tissue around upper anterior teeth. (Figure 1)

2. Treatment Plan
Laser gingival crown lengthening and laser tissue retraction for impressions for new crown restorations.

3. Possible Treatment Alternatives
No treatment.

4. Indications for Laser
The pulsed Nd:YAG can safely and efficiently remove gingival tissue for contouring and tissue retraction.

5. Contraindications for Laser
Inappropriate use of the laser could cause an irreversible esthetic result. Precautions must be taken to avoid prolonged exposure of laser energy to root structure.

6. Informed Consent
Informed consent was obtained.

Treatment

A. Objective
Restore the teeth to better health and form a more pleasing cosmetic appearance with crown lengthening and new porcelain crowns.

B. Laser Operating Parameters:
- Pulsed Nd:YAG laser (PulseMaster, American Dental Technologies), wavelength 1064 nm, 320 micron fiber
- Gingival contouring - 30 mJ, 80 pulses per second, 2.4 Watts of power
- Gingival troughing - 30 mJ, 60-70 pulses per second, 1.8-2.1 Watts of power
- Total exposure duration - 5 minutes.

C. Treatment Sequence
Smile design for tooth length and form, 2% lidocaine with 1:100,000 vasoconstrictor, laser gingival reduction and contouring (Figure 2), removal of old crowns, build-up for final preparation, laser tissue retraction for final impression (Figure 3), temporization. Second appointment in 14 days for crown delivery.

D. Management of Complications
There were no complications.

E. Surgical Prognosis
Excellent.

F. Treatment Records
Completed with notation of the use of the laser at the operating parameters specified above.

G. Patient Management
The patient tolerated procedures well. Vitamin E placed on all laser surgical areas. The patient was given one 600 mg Motrin tablet and a prescription for Motrin and was dismissed.

H. Postoperative Instructions
The patient was advised to rinse with warm salt water, apply vitamin E to surgical sites twice a day, and take medication as necessary for pain.

Follow-Up Care

A. Side Effects and Complications
No side effects or complications were observed or reported.

B. Assessment of Treatment
Healing was uneventful and crowns were placed with no marginal change in the surgical areas.

C. Long-Term Results
The patient seen at 2 weeks post-op (Figure 4) and 3 months later.

D. Healing Assessment
Excellent prognosis with patient’s home care.

Figure 1: Preoperative view.

Figure 2: Gingival crown lengthening, immediately postoperative.

Figure 3: Laser tissue retraction for impression, immediately postoperative.

Figure 4: Two-week postoperative view.

Dr. Robert Barr graduated from Loma Linda University School of Dentistry in 1973 and is a general practitioner in San Jose, California. He has used multiple laser wavelengths since 1990 and has achieved Advanced Proficiency in argon and Nd:YAG wavelengths. He also participated in the Educators Course in October 1998. Dr. Barr has conducted education and training courses for American Dental Technologies, BioLase Technology, and Premier Laser Systems, for which he received a fee for those services. He has purchased various lasers at full price and has use of other lasers for training purposes. He has no financial interest in any dental laser manufacturer.
Nd:YAG Laser Reduction of Drug-Induced Gingival Hyperplasia

John J. Graeber DMD, East Hanover, New Jersey

Pretreatment
A. Diagnostic Tests
1. Clinical Exam
A 36-year-old white male presented for dental examination. His chief complaint was that his gum tissue was swollen. The affected area was not painful. The patient had sought care for the same problem five years previously.

2. Tooth Vitality and Hard Tissue Tests
All teeth in the affected area tested between 40 and 65 on the 0 to 80 scale on an electronic pulp tester (Analytic Technology).

3. Radiographic Exam
Radiographic examination of the affected area revealed no pathology with normal trabecular pattern of the alveolar bone.

4. Soft Tissue Tests
Clinical examination revealed extensive generalized gingival hyperplasia resulting from chronic use of cyclosporine, an organ anti-rejection agent. The patient has a history of cardiac transplantation 10 years previously. Pocket depths ranged between 4-5 mm on the facial aspects of teeth #21-27. This area had previously undergone laser gingivectomy in April 1993.

B. Diagnosis and Treatment Plan
1. Diagnosis
Gingival hyperplasia.

2. Treatment Plan
Retreatment of the affected area and one other localized area along with a review of oral hygiene instructions and a post-treatment re-evaluation. Re-evaluation postoperative visits occurred at 3-day, 18-day, 3-month, and 6-month intervals. Premedication for endocarditis prophylaxis with 3 grams of amoxicillin one hour pre-operatively was given per cardiologist recommendation. The patient showed excellent progress. All pockets in the treatment area were reduced to 1 mm.

3. Possible Treatment Alternatives
Treatment alternatives of conventional surgical techniques were rejected by the patient because he had previous positive experiences with the laser.

4. Indications for Laser
Indications for laser gingivoplasty include a clear need for sutures; less intra- and postoperative pain; and bactericidal benefit of the Nd:YAG wave-length. The patient understands that improved oral hygiene measures, and 3-month recall visits for long-term maintenance on the drug cyclosporine. The long-term prognosis is guarded due to the overgrowth probability and need for repeated treatments.

5. Contraindications for Laser
There were no contraindications for the proposed treatment. The patient had been given cardiologist clearance for all dental procedures provided no epinephrine was used and appropriate premedication was taken.

6. Informed Consent
The patient gave verbal informed consent.

Treatment
A. Objective
The treatment objective was pocket depth reduction and improved gingival contour for teeth #21-27 using a pulsed Nd:YAG laser (dLase 300 Plus, American Dental Technologies). Local anesthesia was achieved using transdermal lidocaine only for five minutes pre-operatively (Noven Pharmaceuticals). (Figures 1-2)

B. Laser Operating Parameters
A total of 2.0 - 2.5 Watts of power at a 40 hertz repetition rate was utilized. The fiber diameter was 600 microns and wavelength was 1064 nm. Exposure duration was 4 minutes.

C. Treatment Sequence
After the patient’s mouth was prerinsed with chlorhexidine 1.4% (Peridex), the laser was used to ablate the hypertrophic tissue to 4 mm from the surface of the tissue toward the underlying bone. Initially the power was set at 2 Watts and was increased to 2.5 Watts as more fibrous tissue was encountered. (Figures 3-4)

D. Management of Complications
The charred layer was wiped off occasionally during treatment to avoid heating and exposing the underside to excessive heat build-up. There was very little intra- or postoperative bleeding due to the laser coagulation. Postoperative discomfort was minimal.

E. Surgical Prognosis
Surgical prognosis was excellent but it is expected that occasional retreatments may become necessary due to the continued indefinite use of the drug cyclosporine.

F. Treatment Record
The treatment record indicated gingivoplasty included the facial surfaces of teeth #21-25 utilizing the Nd:YAG laser at up to 2.5 Watts with a 600-micron fiber tip for 4 minutes.

G. Patient Management
The patient was successfully managed with transdermal lidocaine and reported no discomfort during the procedure.

H. Postoperative Instructions
Postoperative instructions included gentle brushing and flossing, twice daily rinsing with chlorhexidine mouthwash, and daily application of 3% hydrogen peroxide after the third day. Ibuprofen was recommended 400 mg every four hours as needed for pain. The patient was contacted in the evening and reported experiencing no discomfort or bleeding.

Follow-Up Care
A. Side Effects and Complications
There were no side effects or complications.

B. Assessment of Treatment
Follow-up care included post-op visits at 3 days, 18 days (Figures 5-6), and 3 months. At 3 months, all operated pocket depths measured 1 mm. Normal stippling, texture and color was present (Figures 7-8). The patient reported no sensitivity or abnormal symptoms.

C. Long-Term Results and Healing Assessment
The long-term prognosis is guarded due to the long-term maintenance on the drug cyclosporine. The patient understands that improved oral hygiene measures, and 3-month recall visits for periodontal maintenance will reduce the tissue overgrowth probability and need for repeated treatment. Note that there was a five-year period between treatments for this particular area.

Dr. John J. Graeber graduated from University of Medicine and Dentistry of New Jersey in 1972. He maintains a private practice devoted to the use of lasers and air abrasion. He lectures on both treatment modalities for the Institute for Advanced Dental Technologies. Dr. Graeber is a charter member of ALD (Advanced Proficiency) and member of the ADA, AGD, ASDA and AAFD. Dr. Graeber is a lecturer for American Dental Technologies (ADT) for which he receives compensation for each seminar presented. He is a consultant for Air Techniques, for which he receives no compensation.
ENAP Procedure Using the Nd:YAG Laser with Contact Tip

Douglas A. Gilio, DDS, Visalia, CA

Pretreatment
A. Diagnostic Tests
1. Patient History and Clinical Examination
A 35-year-old white male was referred for treatment of moderate periodontal disease by his general practitioner. The patient was in good health and used tobacco occasionally. He had not been seen by a general dentist in more than 5 years. He had no allergies and was not using any medications on a regular basis. During the initial exam, his blood pressure was 128/82, pulse rate 78. The clinical examination revealed probe depths of 4-5 mm, heavy calculus, generalized bleeding with minimal probe pressure, and edematous tissue.

2. Tooth Vitality
All the teeth were vital, and the patient had no teeth with root canal therapy.

3. Hard Tissue Tests
All teeth were nonmobile, and no active caries was seen on radiographs or during the clinical exam. The bone levels showed minimal horizontal loss.

4. Radiographic Exam
Normal trabecular pattern of bone was evident with no indication of osseous defects. No other pathology was seen.

5. Soft Tissue Exam
Tissues were swollen and edematous. Bleeding on probing occurred easily. Other soft tissue parameters were normal.

B. Diagnosis and Treatment Plan
1. Diagnosis
The patient presented with generalized moderate to advanced periodontal disease. (Figure 1)

2. Treatment Plan
A treatment plan was developed for the patient to undergo two successive periodontal laser surgical sessions. On each session an upper and lower quadrant would be treated. A laser excisional new attachment procedure (ENAP) with ultrasonic and hand scaling would be performed on each quadrant. Before active treatment, the patient would be provided with oral hygiene instructions and monitored until good home care and personal hygiene techniques were demonstrated. Some minimal gingival improvement was seen; however, this case needed treatment in order to remove the source of infection and inflammation and allow for resolution of the acute disease process.

3. Possible Treatment Alternatives
• Open flap surgery with osseous recontouring and apical flap repositioning
• Full-mouth scaling and root planing only, with anesthesia.

The patient felt comfortable with a middle-of-the-road treatment plan after discussing treatment options and pros and cons of each method. He requested that laser ENAP treatment be provided.

4. Indications for Laser
a. Reduced bleeding
b. Faster surgical procedure
c. Suturing eliminated
d. Faster healing
e. Less perception of pain from a reduced surgical entry
f. Reduced bacteria in surgical site post-treatment
g. Less stressful on patient and surgeon.

5. Contraindications for Laser
None.

6. Informed Consent
Written and verbal consent was obtained.

Treatment
A. Objective
The treatment objective was full-mouth laser ENAP surgery in order to reduce pocket depth and remove hard calculus deposits and granulation tissue from the periodontal defects.

B. Laser Operating Parameters
A 20-Watt Nd:YAG laser (Pegasus, Premier Laser Systems) was used with a conical contact tip. A power setting of 4 Watts in continuous mode was used during this procedure. Wavelength was 1064 nm. The eschar was removed during the scaling and root planing treatment phase with an ultrasonic device.

C. Treatment Sequence
A total of two carpules of 2% Xylocaine with 1:100,000 epinephrine was used for anesthesia in each quadrant. A mandibular block injection with labial anesthesia was provided for the lower quadrants. The upper quadrants were anesthetized with infiltration of the anterior superior alveolar, middle superior alveolar, and posterior superior alveolar, as well as the lesser palatine on the posterior aspect of the maxilla through the tuberosity area into the soft palate. Once appropriate anesthesia was provided, the usual safety precautions were observed, including the wearing of laser safety eyewear and oral masks.

The laser with contact tip was used with 4.0 Watts in continuous mode. The 1.8 mm-diameter, 17 mm-long conical tip was placed into the gingival sulcus and used to perform an ENAP or laser gingival curettage. The benefits of the technique include excellent visibility providing faster removal of calculus and fine control for tissue removal (Figures 2-3). Elapsed time of laser application per quadrant was 2.5 - 3 minutes, depending upon access and degree of inflammation. After the contact laser phase was completed, ultrasonic and hand instrumentation of root surfaces were performed. The root surfaces were visually evaluated by air-water syringe pressure into the sulcus. If any remaining stain or calculus was seen, it was quickly removed. A final check was made before case completion. The procedure time was approximately 45 minutes per quadrant.

D. Management of Complications
The patient was placed on Anaprox 550 mg 4 times daily for 1 week. (Usually after 2-3 days, no further medications are required for postoperative discomfort. My patients are routinely covered with a Peridex rinse for 2 weeks post-treatment, 2-3 times a day rinse for approximately 1 minute.) There were no complications.

E. Surgical Prognosis
Excellent.

F. Treatment Record
Notation in the patient’s record was as follows: Nd:YAG laser was used for ENAP procedure, 4.0 Watts continuous power via contact tip. Routine procedure, no complications. Approximate laser time, 4 minutes. Excellent result is predicted.

(Continued on page 23)
Maxillary Buccal Frenectomy and Operculectomies with a Free-Running, Pulsed Nd:YAG Laser

Bill Siminovsky, DDS, Ithaca, New York

Pretreatment

A. Diagnostic Tests

1. Clinical Exam
An 8-1/2-year-old white male child presented with his mother who indicated a concern that the maxillary central and lateral incisors had not yet erupted. The patient was healthy and had a good appetite. His weight and height were normal for his age. His maxillary incisors had not yet erupted; his mandibular incisors showed a normal eruption pattern. The patient’s medical history indicated that his primary teeth were extracted at age 3 due to severe decay.

2. Tooth Vitality
Not necessary.

3. Hard Tissue Tests
Palpation of anterior maxilla revealed detection of crowns of central incisors.

4. Radiograph Exams
A full set of radiographs was taken. Radiographs revealed embedded teeth #7, 8, 9, and 10. Tooth #1 was abscessed. #S showed a carious lesion (DO), #L also showed a carious lesion (DO).

5. Soft Tissue Tests
Intermittent pressure exerted on the frenum revealed a heavy band of tissue with a broad fanlike base attaching into the palatine papilla which blanched when pressure was applied.

B. Diagnosis and Treatment Plan

1. Diagnosis
Thick, low buccal frenum, unerupted maxillary incisors.

2. Treatment Plan
Maxillary buccal frenectomy and operculectomies to remove tissue and allow eruption of the central incisors.

3. Possible Treatment Alternatives
   • Scalpel surgery would require suturing and contact with any hard tooth structure.
   • Electrosurgery.
   • Other soft tissue lasers such as argon, diode, holmium and carbon dioxide.
   • Free-Running, Pulsed Nd:YAG Laser

4. Indications for Nd:YAG Laser
Nd:YAG laser is indicated for incising, excising and coagulating intraoral soft tissue.

5. Contraindications for Laser
There are no contraindications for soft tissue surgery using the Nd:YAG laser; caution must be used to avoid prolonged contact with bone and tooth structures.

6. Informed Consent
Clinical diagnosis, treatment, indications and benefits of laser use, laser safety, contraindications, and possible treatment alternatives were discussed with the mother, who gave verbal informed consent to perform the procedures with the laser. The safety requirements for laser applications discussed included: protective eyewear for patient, assistant, dentist and observers; laser safety sign; high-volume evacuation; and prevention of specular reflection.

Treatment

A. Objective
To perform a maxillary buccal frenectomy and operculectomies with the Nd:YAG laser in order to reduce the frenum and remove tissue from the incisal one-third of the labial and lingual crowns to allow for eruption of teeth #8 and #9.

B. Laser Operating Parameters
A pulsed Nd:YAG laser (dlase 300 Plus, American Dental Technologies) with a wavelength of 1064 nm and a 320-micron fiber providing a beam diameter of 320 micrometers in contact tip mode was used at the following settings:

- Frenectomy:
  1. 20 pps, 100 mj/pulse, 2.0 W for 40 seconds
  2. 20 pps, 125 mj/pulse, 2.5 W for 10 seconds
  3. 40 pps, 100 mj/pulse, 4.0 W for 90 seconds, intermittently

- Operculectomy:
  4. 40 pps, 100 mj/pulse, 4.0 W for 120 seconds (#8)
  5. 40 pps, 100 mj/pulse, 4.0 W for 90 seconds (#9)

C. Treatment Sequence

1. Full sets of radiographs and preoperative photos were taken. (Figure 1)

2. Dyclone as a topical anesthetic was placed using cotton pellets.

3. Four drops of 2% lidocaine with epinephrine 1:50,000 were injected into the frenum.

4. Protective eyewear was provided.

5. Laser was test fired.

6. Laser was used at the settings indicated above in contact tip mode. (Figures 2-3)

During the frenectomy, the laser fiber was held vertically to the frenum and a painting motion was utilized at the same time. The tip was grasped and stretched outward to provide maximum tension on the frenum. Initially, the laser was used at setting 1. Due to the thickness of the frenum, it was necessary to change the power settings and repetition rates indicated above.

After vaporization of the frenum, the operculectomies were performed starting with setting 4 to expose tooth #8 and then setting 5 to expose tooth #9. The laser was held perpendicular to the tissue and an incision was made to expose the crowns of unerupted teeth. Care was taken to avoid contact with any hard tooth structure.

Water spray and high-volume evacuation were consistently utilized during both procedures to allow for cooling of the tissue as well as patient comfort.

(Continued on page 23)
Nd:YAG Laser Gingivectomy
Ambrose L. Chan, BDS, Caringbah, NSW, Australia

Pretreatment
The chief complaint is the aesthetic disharmony of the 4 maxillary anterior teeth and the badly discolored right central incisor.

A. Diagnostic Tests
1. Clinical Examination
A 48-year-old female presented with negative medical history. Her chief complaints were the aesthetic disharmony of the four maxillary anterior teeth and the badly discolored right central incisor. Intraoral examination revealed generalized incisal tooth wear (which may have suggested bruxism), and gingival and tooth disharmony of her upper anterior teeth. Tooth #8 had a history of uncomplicated fracture from a facial trauma and was previously restored with a pin-retained composite crown.

2. Tooth Vitality
Tooth #8 and others tested vital with CO2 testing.

3. Hard Tissue Test
The anterior teeth were free from mobility, caries, fracture, or percussion sensitivity. TMD test was negative.

4. Radiographic Exam
Free of bony pathology or caries. No sign of root resorption or calcification.

5. Soft Tissue Test
Normal healthy oral tissue. Peridontal probing revealed an excess of gingival tissue (0.5-1.5 mm, due to passive gingival eruption) of the maxillary anterior teeth that could be removed to restore the gingival symmetry without affecting the integrity of the biological width.

6. Other Tests
Diagnostic trial was set up to demonstrate the estimated amount of tissue removal.

B. Diagnosis and Treatment Plan
1. Diagnosis
Gingival excess with excessive tooth wear. Color and shape disharmony of the upper anterior teeth. (Figure 1)

2. Treatment Plan
Remove excessive gingival tissue with a laser to restore the symmetry of gingival height. Place four porcelain veneers to restore the hard tissue harmony of the upper anterior teeth. Manage the bruxism with an upper occlusal splint.

3. Possible Treatment Alternatives
• Orthodontics.
• No orthodontics, remove excess tissue with a scalpel.
• No gum reshaping, provide prosthetic restorations with compromised aesthetics.

4. Indications for Laser
Aesthetics can be corrected using the Nd:YAG laser because of its fiber-optic precision and high absorbancy into the gingival tissues.

5. Contraindications for Laser
Possible thermal injury to both soft and hard tissue if laser were to be used inappropriately.

6. Informed Consent
Both written and verbal consent was obtained prior to treatment. Also discussed was the possibility of endodontic therapy for #8 because of the past dental history.

Treatment
A. Objectives
• To restore both anterior soft and hard tissue symmetry and aesthetics.
• To protect the dentition from further tooth wear due to parafunctional habits.
• The ultimate goal would be to restore the self-image and confidence of the patient.

B. Laser Operating Parameters
Laser: Free-running pulsed Nd:YAG (dLase 300 Plus, American Dental Technologies)
• Wavelength: 1064 nm
• Average Power: 2 W
• Repetition Rate: 20-60 Hz
• Energy/Pulse: 33-100 mJ
• Exposure Time: 8 minutes
• Total Energy: 960 J
• Beam Diameter: 320-micron optic fiber.

C. Treatment Sequence
• Environmental safety checks (limit access, place warning sign and minimize reflective surfaces).
• Protective eyewear for patient and all staff within the prescribed safety zone.
• High-volume evacuation is used to provide tissue cooling and plume evacuation.
• The laser was test fired with a newly cleaved fiber surface, at the operating parameter of 150 mJ / 20 Hz / 2 W, onto a piece of black paper.
• Local anaesthetic (4 ml, 2% mepivacaine and 20 microgram adrenaline, infiltration) was required.
• The predetermined final tissue height was indicated with a tissue marker to quantify the tissue to be removed (tooth #7 = 1.5 mm; #8 = 1 mm; #9 = 0.5 mm; and #10 = 0.5 mm). (Figure 2)
• The tissue was ablated with the laser with the fiber in contact with the tissue in a continuous sweeping motion, while the underlying tooth surface was guarded from thermal penetration with a metal instrument (a Zekrya gingival protector).
• Tissue coagulation was accomplished with a defocused, sweeping motion of the fiber at 33 mJ / 60 Hz / 2 W. (Figure 3)
• The porcelain veneer preparations were completed with rotary high-speed. During a 2-month healing period of the soft tissue, temporary composite veneers were constructed and secured with flowable resin without bonding agent. Excess resin was removed and no tissue dressing was required.
• After 2 months, both tissue healing and tooth vitality were examined. The temporary composite veneers were removed and the porcelain veneer preparations were redefined before the final rubber impressions were taken.
• The final porcelain veneers were cemented with resin after the patient was completely satisfied with the aesthetic and phonetic results and comfort.
• The photopolymerization of the resin was activated with an argon laser (Dental 200, HGM), at an average power of 400 mW.
• An upper occlusal splint was constructed afterward.

D. Management of Complications
No complications were experienced. The tissue was easily removed with excellent (Continued on page 23)
Nd:YAG Laser Reduction of Dilantin Hyperplasia

Alan C. Wells, DDS, Sapulpa, Oklahoma

Pretreatment

A. Diagnostic Tests

1. Clinical Exams
A 29-year-old male presented with no known allergies. He had been undergoing Dilantin treatment for 10 years for his epilepsy (600 mg twice daily). Clinical exam revealed supragingival and subgingival calculus, hypertrophic gingiva, 7-9 mm pocket depths, anterior splaying, bleeding on probing. (Figures 1-2)

2. Tooth Vitality
Radiographically, tooth vitality appeared within normal limits.

3. Hard Tissue Tests
No decay noted, no cracks noted, mandibular anteriors slightly mobile.

4. Radiographic Exam
Supragingival and subgingival calculus present, no decay, moderate bone loss, anterior splaying.

5. Soft Tissue Tests
Tongue, palate, cheeks, oropharynx all normal. Bleeding on probing.

6. Other
Occlusal analysis revealed no centric or excursive interferences.

B. Diagnosis and Treatment Plan

1. Diagnosis
Dilantin hyperplasia, case type IV.

2. Treatment
Remove hyperplastic tissue and calculus, recontour gingiva, eliminate pockets, and reduce bacteria.

3. Possible Treatment Alternative
Conventional periodontal surgery.

4. Indications for Laser
• Eliminate hyperplastic tissue for tissue health and cleansability by patient.
• Nd:YAG laser controls hemostasis and tissue ablation, reduces bacteria, works well close to the tooth, requires no sutures, and eliminates pockets.

5. Contraindications for Laser
Inadequate attached gingiva, infrabony defects, uncontrolled diabetes would be contraindications. However, none of these conditions were present.

6. Informed Consent
Oral informed consent was obtained.

Treatment

A. Objective
Remove hyperplastic tissue, recontour gingiva, eliminate calculus, reduce bacteria, eliminate pockets.

B. Laser Operating Parameters
1. Power Settings and Repitition Rate:
• 40 mJ, 100 Hz for cutting, 4 W

C. Treatment Sequence
The patient was anesthetized with 3.6 cc of 2% Xylocaine 1:100,000 epinephrine. Pocket depth was marked with a periop probe. A sulcular incision, posterior to anterior, was made with a pulsed Nd:YAG laser (PulseMaster 600 LE, American Dental Technologies). Then a scalloped incision was made at the marked level in the gingiva. The bulk of the hyperplastic tissue was then removed by hemostat. The calculus was removed with an ultrasonic scaler followed by curettes. The remaining interproximal fibrous connective tissue was ablated with the laser. Finally, the facial and lingual aspects of the gingiva were recontoured. All this was accomplished with constant suction, air, and intermittent water spray. (Figures 3-4)

D. Management of Complications
No complications were noted.

E. Surgical Prognosis
Excellent.

F. Treatment Record
Description of the laser treatment noted above was included in the patient’s record.

G. Patient Management
The patient tolerated the procedure well, and was prescribed the following: Amoxicillin 500 mg X 28 q6h, Flagyl 250 mg X 28 q6h, Darvocet N100 X 20 as required, Peripec rinse twice daily.

H. Postoperative Instructions
The patient was instructed to avoid rinsing and brushing for 12 hours and to avoid spicy foods and flossing for 48 hours. After 48 hours, resume normal diet and begin flossing.

Follow-up Care

A. Side Effects and Complications
The patient reported transient cold sensitivity.

B. Assessment of Treatment
All four quadrants were treated according to a biweekly schedule (Figures 5-6). A 3-month recall was performed.

C. Long-Term Results
Hypertrophic gingiva was eliminated as well as supragingival and subgingival calculus, and the gingiva was recontoured. Long-term prognosis is excellent, pending ongoing maintenance therapy.

D. Healing Assessment
There were no noted tissue tags, no remaining calculus, normal pockets, no bleeding on probing, and decreased mobility. The patient was placed on 3-month recall and was informed of the requirement of ongoing maintenance therapy. At three months, the patient was maintaining oral health.

Dr. Allen Wells received his undergraduate training at the University of Oklahoma and completed his DDS in 1981 at the University of Oklahoma College of Dentistry. He retired from the U.S. Navy Reserve Dental Corps in 1984. Dr. Wells is the staff dentist at St. John Hospital, Sapulpa, Oklahoma. He has been involved in laser dentistry since 1987 and received Advanced Proficiency laser certification from the Academy of Laser Dentistry in 2000. Dr. Wells does not receive any financial remuneration from any corporations.
ENAP Procedure Using the Nd:YAG Laser with Contact Tip  
Douglas A. Gilio, DDS, Visalia, CA  • (Continued from page 19)

G. Patient Management  
The patient was reassured during the treatment as to progress. Postoperative instructions were provided and he was advised to call if any problems were perceived. He was called the first evening regarding his progress and was reassured.

H. Postoperative Instructions  
The patient was advised to:  
• use an ice pack the first 24 hours, on and off alternately for 15-minute intervals  
• use frequent saline rinses  
• use Peridex rinse 2-3 times per day  
• continue regular oral hygiene habits  
• refrain from hot or spicy and citrus foods; however, if desired, such foods can be eaten if no discomfort is felt.

The Anaprox provided excellent analgesia for this patient and was discontinued after 3 days.

Follow-Up Care  
A. Side Effects and Complications  
There were no side effects or complications.

B. Treatment and Healing Assessment  
The patient was seen 2 weeks postoperatively. Healing was normal and no tissue complications were seen. Oral hygiene was stressed. The patient was advised to continue Peridex rinses and released.

C. Long-Term Results & Healing Assessment  
The patient was seen again after 4 weeks and surface healing was generally completed (Figures 4-5). Home care was encouraged and its importance was discussed before the patient’s release. Peridex rinse was no longer needed.

Home care is always the issue postoperatively. The importance of the 3-month recall visit was emphasized.

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.

Maxillary Buccal Frenectomy and Operculectomies  
with a Free-Running, Pulsed Nd: YAG Laser  
Bill Siminovsky, DDS, Ithaca, New York  • (Continued from page 20)

D. Management Of Complications  
No complications were encountered during treatment.

E. Surgical Prognosis  
Excellent. (Figure 4-7)

F. Treatment Record  
Written in the patient record were clinical diagnosis, laser operating parameters, and details of treatment as described above.

G. Patient Management  
The patient was comfortable during the procedure and did not request additional anesthetic.

H. Postoperative Instructions  
Instructions were given to the mother and patient as follows:  
• Avoid eating spicy foods that could irritate

hemostasis. The placement of temporary and final restorations was uneventful.

E. Surgical Prognosis  
Excellent. Tissue removal was accomplished with great precision and desirable bactericidal effects. An excellent gingival profile and aesthetic restoration resulted in full patient satisfaction.

F. Treatment Record  
A description of the laser treatment and operating parameters as described above was placed in the patient’s record.

G. Patient Management  
Nonsteroidal anti-inflammatories were taken 24 hours prior to the operation. Local

anaesthetic was used during the treatment.

H. Postoperative Instructions  
• Diet - avoid hot/spicy foods  
• Analgesics - panadel and nonsteroidal  
• Home oral care - mouth rinse  
• A courtesy patient call was made on the patient as follows:

• (Continued from page 19)

... (Continued from page 20)

... (Continued from page 21)

Nd:YAG Laser Gingivectomy  
Ambrose L. Chan, BDS, Caringbah, NSW, Australia  • (Continued from page 21)

Dr. Bill Siminovsky is a 1982 graduate of New York University School of Dentistry. He began using the Nd:YAG laser in 1990 in Ithaca, New York where he practiced general dentistry from 1985 to 1997. He received Advanced Proficiency in 1996 and participated in the first Educator Course in 1998 and the second Educator Course in 2000. He is an Academy of Laser Dentistry recognized Standard Proficiency Course Provider. In 1999, Dr. Siminovsky began offering his consulting services on lasers through his company Dental Laser Consultants. He is not affiliated with any laser manufacturer, but has provided consulting services in the past for CeramOptec and Lares Research.

Dr. Ambrose Chan is in private dental practice 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 Nd:YAG, argon, Er:YAG, carbon dioxide and diode lasers.

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