This issue of *Wavelengths* continues the series featuring individual laser wavelengths or, in this case, the diode family of surgical lasers. The previous issue (Summer 2000, Vol. 8 No. 3) featured the argon laser. Each edition will include an introduction, clinical case studies, research abstracts, and selected bibliography. It is hoped that the reader will thus be able to accumulate a good working knowledge of all dental lasers.

The diode laser has a solid active medium; in fact, it is a solid state semiconductor laser that typically uses some combination of gallium, arsenide, and other elements such as aluminum and indium to change electrical energy into light energy.

The available surgical diode laser wavelengths for dental use range from about 800 nm to 980 nm, placing them at the beginning of the near infrared invisible nonionizing spectrum. Each instrument delivers laser energy fiberoptically in continuous wave and gated pulsed modes. Ordinarily the fiber is applied in contact with the target soft tissue for ablating, incising and excising procedures.

The optic fiber needs to be cleaved and prepared before initial use and sometimes during the procedure to ensure the efficient operation of the laser. Generally it is essential that the fiber be conditioned prior to intraoral surgical use. This process, also called initiating, conditioning, or priming, involves the deposition of a thin layer of dark pigment on the end of the fiber, producing a “hot tip” effect. Water-soluble black ink, dark-colored note pad, articulating paper, or articulating film are most commonly used, and the fiber is gently rubbed or tapped on the pigmented surface while the laser is energized. For some diode laser models, glass-like tips are available that can be placed on the end of the fiber for certain applications.

All of the diode wavelengths are highly absorbed by pigmented tissue, although hemostasis is not quite as rapid as with the argon laser. The diode lasers’ absorption depth in water, especially those diodes near 800 nm wavelength, is several times greater than the Nd:YAG (1064 nm) laser.

The diode lasers are relatively poorly absorbed by tooth structure so that soft tissue surgery can be safely performed in close proximity to enamel. As with any surgical laser, the use of the diode surgical laser on bone is contraindicated and care should be taken when using the laser in close proximity to osseous tissue (such as reducing a frenum overlying the cortical plate). In addition, implants readily absorb the laser’s thermal energy and contacting the implant with the fiber tip may result in pitting and failure of the implant.

The diode is an excellent soft tissue surgical laser and indicated for cutting and coagulating gingiva and mucosa and for soft tissue curettage, or sulcular debridement. Care must be taken when using the continuous emission mode because of the rapid thermal increase in the target tissue. The chief advantage of the diode lasers is their small size. The units are very portable, compact, easily moved with minimum setup time, and are the lowest priced surgical lasers currently available. These instruments have become popular with many clinicians for aesthetic soft tissue contouring, both as a definitive treatment and in conjunction with restorative dentistry.

Separate and quite distinct from the surgical uses of the diode laser is another treatment modality. Commonly referred to as Low Level Laser Therapy or biostimulation, laser light — typically, diode or HeNe (632.8 nm) wavelengths — with output power in the range of 1-100 milliwatts, is aimed at tissue to both reduce inflammation and to stimulate healing. This topic will be covered in another issue of *Wavelengths*.

Yet another application for a visible red diode laser (655 nm wavelength) is for use as an aid in the diagnosis of dental caries. Such a system depends upon laser-induced fluorescence, a phenomenon which occurs when some types of tissue re-emit a portion of the laser light they absorb as light of different wavelengths. When carious enamel is irradiated with certain diode wavelengths, the resulting fluorescence can be measured and quantified, thus aiding in the diagnosis of dental caries.
Editor’s Introduction

James D. Klim, DDS illustrates a case of diode laser-assisted gingival recontouring, presented in full clinical case study format. He performed the initial sculpting; afterward, the patient underwent orthodontic treatment; and then the laser was again used for final contouring. Note the measuring of the available tissue and the sounding of the underlying bone.

Case Overview
Decreasing excessive gingival display using soft tissue recontouring with a diode laser, orthodontic intrusions and retractions, followed with Empress veneers from maxillary first premolar to first premolar to improve small tooth size relationship and establish ideal smile principles.

Pretreatment
A. Diagnostic Tests
1. Clinical Exam
   • 17-year-old female. No sign of any medical abnormalities or concerns.
   • Dental history: Natural adult dentition with beautiful virgin teeth with no history of clinical evidence of caries. No evidence of periodontal disease, TMD or neural-muscular disorder. Anterior maxillary and mandibular tooth spacing of 4 mm on lower arch and 6 mm on upper arch.
   • Skeletal and dental class I jaw relationship.
   • Mounted Study Models to Hamular-Incisive Papillae Plane (HIP).
2. Tooth Vitality
   • All teeth presented vital relative to thermal assessment, percussion, and healthy apices on FMX and panorex.
3. Hard Tissue Tests
   • Dentition well intact with no signs of unusual mobility or decay.
   • Evidence of small tooth size related to skeletal size and tooth exposure during social expressions of smiling and speaking.
   • Adequate canine and anterior guidance during lateral function.
4. Radiographic Exam
   • Periapical radiographs showed no signs of bony or dental lesions. Bone density is within normal limits.
5. Soft Tissue Tests
   • Soft tissue evaluation was within normal limits with 2-3 mm periodontal pocketing throughout the mouth.
   • Gingival display of 5 mm.
   • Incisal edge to resting lip is 8 mm.
6. TMD Test
   • TMD testing within normal limits

B. Diagnosis and Treatment Plan
1. Diagnosis
   • Excessive gingival display is a result of several factors: Protrusive labial maxillary alveolar ridge relative to upper lip, slightly hypertoned upper lip, insufficient clinical crown length, and altered passive eruption characterized by excessive gingival width with normal bony crest to CEJ relationship.
   • Small tooth size relative to dental arch and cranial base.
2. Treatment Plan
   • Determine indicated clinical crown length relative to clinical arch (gingival margin to incisal edge), golden proportions and other smile design principles. Raising the cervical zenith profile by 4-5 mm will meet the smile aesthetic objectives.
   • Intrusion and retractive orthodontic mechanics would be necessary, so that the labial alveolar bone will relax lingually. This will place less bony base support on lip soft tissue during smiling, thereby lowering the maxillary lip smile curtain.
   • Needle probing (bone sounding) under local anesthesia was used to measure the CEJ and relativity to the bone. A measurement of 5-6 mm of free gingival margin to the alveolar bony crest with an average reading of ~ 3 mm to CEJ was determined. Based on these measurements, clinical crown lengthening could be performed with the diode laser.
   • Final tooth vertical and horizontal size dimensions will be accomplished with ceramic veneers.
3. Possible Treatment Alternatives
- Significant improvements could be accomplished with just gingivectomy. However, pro-
trusive upper lip profile would not be improved.
- Total space closure with orthodontics would result in less than ideal tooth size proportions
and leave a retruded smile profile. Lateral skeletal evaluation does not support the extreme of maxillary orthopedic surgical alterations.
- Gingivectomy could be performed with conventional surgical blades or electrosurgery.

4. Indications for Laser
- This is an ideal situation for laser gingivectomy. Using the laser with conservative energy
will result in a very predictable and stable healing. The laser is ideal for labial bevel-
ning and contouring to establish ideal gingival emergence profile, and has minimal interac-
tion with tooth structure.

5. Contraindications for Laser
- Contraindication for gingivectomy would be inadequate keratinized tissue and crest of
bone at the CEJ. Under these circumstances, other surgical options of osteoplasty and gin-
gival repositioning would be used.

6. Informed Consent
- Verbal consent was established with patient. Due to minor age, written and verbal consent
was received from both parents.

Treatment
A. Objective
- Decrease excessive gingival display by soft tissue recontouring and elevation with a diode
laser, establish tooth position with orthodontic intrusions and retractions, and establish
ideal smile principles with veneer restorations. (Figure 1)

B. Laser Operating Parameters
- A diode laser (Aurora, Premier Laser Systems, Irvine, California), 812 nm, 400-micron
fiber, continuous wave mode at 1.0 Watt for 3 minutes at initial appointment. Second con-
touring appointment, same laser parameters, treatment time 6 minutes.

C. Treatment Sequence
- Diagnostic waxing to establish ideal clinical crown width and height.
- Bone sounding under local anesthetic. (Figures 2-3)
- Laser contouring and shaping of soft tissue, molar to molar, paying close attention to
maintaining adequate final biological width. (Figure 4)
- Mesial-distal composite addition for projected final M-D width of canine to canine.
- Full orthodontic bracketing second molar to second molar. Clinical spacing was closed,
relative to diagnostic composite placement, using closing loops retraction mechanics.
Primary orthodontic care spaced over 13 months. (Figure 5-6)
- Immediately following debracketing, final soft tissue contouring with diode laser was per-
fomed. (Figure 7)
- Upper anterior teeth were then mocked-up with composite for final smile design analy-
sis and impressioned for provisionals.
- Preparations from #5-12 were accomplished using principle of preparation design for
Empress veneers.
- Final bonding of #5-12 using 5th generation adhesive protocol. Tooth #4 and #13 were fin-
ished with direct composite veneers. Final veneers established ideal anterior lateral and pro-
trusive guidance. The angle of guidance was built in harmony with the condylar eminence
angles.
- Following bonding, clear overlay retainers were fabricated and delivered for post-ortho-
dontic stabilization.

D. Management of Complications
- There were no unusual complications. Patient reported minimal discomfort.

E. Surgical Prognosis
- Prognosis is very good. Final tissue lines remained very stable during provisional phase
of three weeks and post bonding of the veneers. Over a period of several months, a slight
rebounding of free gingival margin was noted. This actually played in the favor of com-
plete aesthetic design by covering the undetectable supra-gingival margins.

F. Treatment Record
- Treatment recorded with written documentation, study models and 35 mm photographs.

G. Patient Management
- Following initial and preparation phase when the laser was used, the following medicaments were
use: Perioguard — twice a day application with Q-tip; Oxyfresh mouth rinse — twice a day;
Oxyfresh gel — three times a day; and Motrin 600 mg four times a day for three days.

H. Postoperative Instructions
- Patient was instructed in proper protocol for post-treatment symptoms and the manage-
ment of medicaments.
Follow-up Care

A. Side Effects and Complications
- No unusual side effects or responses for the type of treatment performed. The patient did comment that she didn’t realize how easy the laser surgery would be with basically no pain following the procedure.

B. Assessment of Treatment
- Patient returned for a 1-week evaluation of the soft tissue, and healing was progressing normally.
- Veneers were bonded 4 weeks post-op, and the tissue was healthy with no inflammation.
- 8-week post-op appointment showed healthy tissue and stable occlusion. (Figures 8-9)
- As the photographs demonstrate, significant decrease in gingival display was accomplished using the blended treatment modalities of orthodontic retraction/intrusion, laser soft tissue recontouring and final ceramic veneers. The most important aspect of this treatment is that the patient was thrilled and very grateful for the final results.

C. Long-Term Results
- As of 10 months, the soft tissue lines have remained very stable. By abiding to the principles of occlusal design, smile design and honoring the parameters of healthy periodontal design, a beautiful result was accomplished.

D. Healing Assessment
- Total healing has taken place. All teeth involved have remained vital with no indication of nerve irritation during or after the laser and veneer treatment. It is interesting to note that there has been a slight rebound of the free gingival margin that covers the prepared supragingival margins (prepare ~ 0.2 - 0.3 mm above the lased tissue crest). When this post-laser effect is used properly, veneers and crowns can be prepared and finished supragingival, without ever packing a cord, knowing that slight tissue rebounding will eventually further enhance the final aesthetic result.

E. Discussion
- It has been well documented that laser soft tissue recontouring is very stable when abiding to the principles of surgical periodontal alterations. The advantage of the laser is predictability in tissue stability, no blood, fast healing with virtually no pain. How can you beat that in patient perception? When it comes to our professional image with our clients and the community, these high-tech approaches elevate our reputation and image way beyond the usual and customary. This is the essence of a “win-win” relationship.

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Figure 9: Eight weeks postoperative alternate view.

Biography and Disclosure

Dr. James D. Klim is in general practice in Santa Rosa, California. A 1948 graduate of Loma Linda University, he has been awarded fellowship in the Academy of General Dentistry, and is an accredited member of the American Academy of Cosmetic Dentistry. He is a clinical instructor at the Las Vegas Institute for Advanced Dental Studies.
David B. Fox, DMD presents a clinical case involving multiple frenectomies in which the patient, a 52-year-old male, presents with lip strain when he smiled. The diagnosis was multiple frenum attachments high on the mandibular alveolar ridge. There were three such areas: one gingival to tooth #20, one gingival to tooth #24, and one gingival to tooth #28. The patient agreed to undergo frenectomies and Dr. Fox received permission to utilize a different power setting for each surgical site. A diode laser (Aurora, Premier Laser Systems, Irvine, California) was used with a bare, initiated, 400-micron diameter fiber in continuous wave mode. The output power was 1.6 W at tooth #20 area, 1.4 W at tooth #24 area, and 1.2 W at tooth #28 area; each area was exposed to the laser energy for 30 seconds. Topical anesthesia (Dyclone) was applied to each soft tissue site, but the patient requested an injection of local anesthetic as the surgery progressed in area #20. The patient experienced some discomfort and postoperative sensitivity in the highest power area, but all three surgical sites show identical health and healing at 90 days. A continuous-wave emission mode can rapidly ablate the target tissue, but the rapid temperature rise can lead to collateral thermal damage and increased postoperative discomfort. These three treated areas thus demonstrate the basic principle of using the least amount of energy or power to accomplish the treatment objective.

Donald J. Coluzzi, DDS demonstrates another case of diode laser-assisted tissue contouring for better cosmetics. The patient, a 27 year old, presented with his “gummy” smile. The diagnosis was of healthy tissue with 1-2 mm pockets; probing and bone sounding revealed that 5 mm of attached gingiva was present. The treatment plan was to simply remove excessive gingiva so that the clinical crowns would appear lengthened, and to sculpt the tissue for physiological health. No restorations were planned. The DioLase ST (American Dental Technologies, Corpus Christi, Texas) diode laser, with an emission wavelength of 800-830 nm, was used. A bare, initiated, 400-micron diameter fiber contacted the tissue with a power setting of 1.0 W, continuous wave. Topical anesthesia was applied, and air was constantly applied to the surgical site. The treatment time was 1 minute per tooth, for a total of 6 minutes of laser exposure. The postoperative course was comfortable for the patient, and 60 days postoperatively the patient enjoyed a new smile and the tissue tone was excellent. This case illustrates the relative ease of removing excessive tissue with the diode laser, and as an additional benefit the wavelength can be used safely around enamel without any interaction.
Claus P. Neckel, MD, DDS shows the diode laser’s use in oral medicine applications. His clinical application is to remove excessive tissue present as a result of medical therapy and disease, especially blood clotting disorders. The particular patient shown has a history of thromboembolic incidents, is on anticoagulative therapy, and has diabetes mellitus. The gingival hyperplasia is rampant, and the treatment objective was to excise the hypertrophic tissue and to establish a physiologic sulcular depth (fig. 18, 19). The tissue removal was divided into two segments, left and right mandible. The laser used was the Ora-Laser 01 IST (Oralia GmbH, Konstanz, Germany). The lower right tissue was excised under local anesthesia with a 600-micron diameter fiber using 1.8 W, continuous wave mode. There was moderate charring on the tissue, with good hemostasis (fig. 20). The lower left tissue was excised at the next appointment under local anesthesia using a 400-micron diameter fiber with 1.4 W, continuous wave mode, and there was minimal tissue charring compared to the right side (fig. 21). Postoperatively, the patient experienced little swelling or excessive bleeding, but had moderate pain on the right side, and almost no pain on the left side. The patient was able to better perform oral hygiene on the left side compared to the right side (fig. 22, 23). At week 10 on the right side and week 6 on the left side, the tissue was stable (fig. 24, 25).

The laser procedure was very beneficial because of the excellent hemostatic ability of the diode wavelength. It is interesting to notice the difference in tissue response to a higher power setting (on the right side) although the power density would be lower than the left side, due to the use of a larger diameter fiber. The long-term prognosis for the patient is guarded, due to the medical condition and the medication. If there is tissue regrowth, the excisional procedures can be performed again with the laser. The patient’s oral hygiene is one very important factor in minimizing the tissue inflammatory response to bacterial plaque.
Michael D. Swick, DMD demonstrates the use of the diode laser for removing and reshaping the soft tissue. Dr. Swick shows a case of a 20-year-old male who had previously been treated with direct composite resin veneers and desired improved cosmetics. The diagnosis was healthy but excessive gingival tissue. Pocket depths were 1-2 mm with an abundance of attached tissue, and the maxillary anterior frenum would be very close to the margin of the attached gingiva at its proposed new level (fig. 13). The patient consented to the treatment plan, including recontouring the gingiva, a frenectomy, and placement of new porcelain veneers. Dr. Swick’s instrument is the Ceralas D15 (CeramOptec, East Longmeadow, Massachusetts) (980 nm) diode laser, used with bare, uninitiated, 600-micron diameter fiber. The laser settings were 10 W in a pulsed mode, with emission of 0.2 sec on followed by 0.1 sec off repeatedly for approximately 9 minutes. Dr. Swick used continuous high-volume water spray on the target tissue. He explains his technique in the accompanying article, where he uses very high fluences for the laser emission coupled with a copious water spray to absorb a majority of the excess thermal energy. Local anesthetic was injected and the surgery proceeded (fig. 14, 15, 16). Immediately following the laser soft tissue procedure, the teeth were prepared for porcelain veneers and were temporized. The patient was seen for an evaluation at one week and the veneers were placed three weeks postoperatively. The patient returned in six months, and the tissue again showed a healthy condition (fig. 17).

One of the benefits of carefully using the laser for tissue recontouring is that an impression for restorative treatment can be taken at the same appointment as the surgical procedure. The tissue response is so predictable that the final restoration’s margins retain the same tissue relation as at the time they were prepared.

**Cosmetic Diode Laser Gingivectomy with Frenectomy**

*Michael D. Swick, DMD • Allison Park, Pennsylvania*

![Figure 13: Preoperative view.](image1)

![Figure 14: Laser surgery underway.](image2)

![Figure 15: Immediately postoperative view of gingivectomy.](image3)

![Figure 16: Immediately postoperative view of frenectomy.](image4)

![Figure 17: Six-month postoperative view.](image5)

**Biographies and Disclosures**

**Dr. Fox** is a general practitioner in Louisville, Kentucky and a 1985 graduate of the University of Louisville. He continued his education by attending a GPR program in Rochester, New York in 1986. Dr. Fox is an adjunct clinical faculty member of the University of Louisville School of Dentistry. His practice concentrates on comprehensive aesthetic treatment involving the use of dental lasers. He was a lecturer for Premier Laser Systems for which he received an honorarium.

**Dr. Swick** practices general dentistry in Conneaut Lake, Pennsylvania and concentrates on micro dentistry techniques with micro abrasion and lasers. He has been working with lasers for five years. He is a member of the ALD, ADA, PDA, Crawford County Dental Society, a fellow candidate in the AGD, and a fellow in the ASLMS. He is also secretary and on the board of directors of the SFAD and is an associate in the Texas Institute for Advanced Dental Studies. He is a lecturer, trainer, and researcher for CeramOptec. He receives compensation on a per diem basis and for expenses.

**Dr. Neckel** maintains a full-time private practice limited to maxillofacial surgery, periodontology and implantology in Bad Neustadt, Germany. He is a former member of the staff of the Department of Maxillofacial Surgery of Julius-Maximilians University of Wurzburg. He is a graduate of the Master Class of Advanced Periodontics and Implant Dentistry of the University of California, Los Angeles. He conducts hands-on courses for Oralia GmbH, Konstanz, Germany.

**Dr. Coluzzi** is in general practice in Redwood City, California. He is a past president of the Academy of Laser Dentistry, has Advanced Proficiency in Nd:YAG and Er:YAG wavelengths, and is a certified dental laser educator. He conducts education and training for the Institute for Advanced Dental Technologies and for Continuum Biomedical. He receives a fee for those services. He has purchased various lasers at full price and has purchased one laser for an extended study at a lower price. He has no financial interest in any dental laser manufacturer.
A Char-Free Technique
for the Ceralas D15 Diode Laser

Michael D. Swick, DMD
Allison Park, Pennsylvania

Editor’s Note: At first glance, Dr. Swick’s “char-free” technique for the Ceralas D15 diode laser in which he uses relatively high power levels (6 W with a 400 micron fiber and 8 W with a 600 micron fiber; up to 15 W with different pulse settings) appears to violate the primary tenet of safe dental laser use, namely “always use the least amount of power or energy to reach your treatment objective.” Dr. Swick observes that his initial “displeasure with tissue effects” led him to develop his technique. His case study (page 19) demonstrates that with the proper experience and caution, excellent results can be obtained.

It should be emphasized that Dr. Swick’s technique specifies pulse mode (not continuous wave mode) with copious water spray, noncarbonized fiber tip, and rapid fiber movement. He also underscores a number of important caveats to what can be a technique-sensitive procedure. It is not a technique for the beginning laser user.

When compared to the more conventional, lower-power diode laser surgical applications, key advantages to Dr. Swick’s technique include a char-free surgical site (of particular value in visible, cosmetic areas), and rapid cutting ability. Possible drawbacks include the need for copious water spray, the need to administer local anesthetic, and adherence to stricter guidelines.

Have you had any similar experiences in using higher power and water spray with other wavelengths? Do you have other methods to minimize a char layer without resorting to higher power levels with simultaneous water spray? Wavelengths will publish your comments, experiences, and suggestions in subsequent issues. The editors will also continue to scan the scientific literature for evidence-based research in support of such techniques.

The advent of this technique, called the Swick Technique by the employees of CeramOptec, came about from my displeasure with the tissue effects that I was obtaining early on with the 980 nm Ceralas D15 diode laser. The training I received was based on historical techniques used with the gated pulse Nd:YAG and 810 nm diode lasers, using a carbonized fiber. The 980 nm diode, with its higher absorption in water, has properties which can be utilized to deliver char-free ablation if the technique is altered.

The background for this method came from information derived from discussions with Kelly Moran of CeramOptec on the physics of the wavelength; a manual, Laser Biophysics and Safety, by Gregory T. Absten, written for the American Society For Laser Medicine and Surgery; and observations and ideas in my dental practice. The technique uses higher fluences in a pulsed mode with copious water spray to quickly ablate and coagulate tissue. The technique attempts to maintain temperatures around 100°C, where vaporization occurs, and below 200°C, where carbonization begins to occur.

The technique is based on the use of an uncarbonized, activated fiber and copious water spray. The uncarbonized fiber allows the laser to cut and coagulate by using photobleaching and photocoagulation rather than the hot tip cautery effect of carbonized fiber methods. The water irrigation acts as a heat sink to modulate the thermal events, allowing the tip of the fiber to cool between pulses. This should control the heat to a range in which vaporization occurs without carbonization.

Histological evaluations of human tissues excised by this technique show minimal thermal effect. The depth of tissue effects at 12 W, pulsed mode, 0.1 second on and 0.1 second off in palatal tissue of anesthetized endodontically treated teeth averaged 120 microns with little or no effects to the underlying adnexa. Although it would not be practical to expect to utilize 12 W on many patients without anesthetization, it could be done in this case indicating that the collateral thermal damage was not excessive. Thermal damage was shown to be even less at 8 to 10 W. Research to establish optimum parameters with this technique is currently being conducted.

The Swick Technique:
A Recipe for Char-Free Ablation with the CeramOptec Ceralas D15 Diode Laser

• Uncharred, properly cleaved, activated fiber is used.
• Copious water irrigation is essential.
• A 400-micron diameter fiber is used in pulse mode at 6 W, 0.1 second on and 0.1 second off. A 600-micron diameter fiber is used in pulse mode at 8 W, 0.1 second on and 0.1 second off.
• Higher wattage can be used if deeper coagulation or faster cutting is desired. Higher wattage can also be used if resistant tissue is encountered.
• Experienced operators can use longer duty times, 0.2 to 0.3 second on and 0.1 second off for faster cutting if the situation allows.
• Experienced operators may also set the pulse time to 0.05 second on and .05 second off for more even and faster cutting.
• Quick pulse settings of 0.01 second on and 0.03 or 0.04 second off at 15 W can also give a good tissue effect for the experienced operator.
• Lower power settings can be employed if unanesthetized patients are feeling pain but slower cutting will result, particularly if tissues under the epithelium are involved.
• If pain occurs, more water can be utilized to decrease discomfort.
• If charring occurs, more water, a reduction of power or the duty cycle, or quicker application of the energy is required.
• If toasting (the crème brûlée effect) occurs in the underlying tissues, one of two things has happened. Either: (1) The tissue has been overheated due to lack of irrigation in which case more water is needed, or (2) The tissue has been dried out due to a slow cutting technique — too little power combined with slow fiber movements. It is also possible that very quick cutting methods with too slow of a pulse setting were used. The tissue is now devoid of water and cutting will occur only through the hot tip burning effect.
• Ablation of different tissue in different patients will often require different parameters. There is some artistry used in the determination of proper parameters for varying tissue types. The operator should always be comfortable with the energy levels selected. Beginning operators should always use the minimum levels of power needed until experience dictates otherwise.

These rules are only meant to be a guide for char-free ablation. Each individual operator is responsible for the final parameters necessary to achieve the tissue effects desired.
An in vitro thermometric study was conducted on various GaAlAs semiconductor lasers emitting at wavelengths between 750 nm and 905 nm, to verify whether these lasers produce significant heating during application to tooth structure. Measurements were conducted in vitro, using a thermal camera and a thermocouple during a 60, 120, and 180 second laser exposure.

Comparative Study of the Thermal Effects of Four Semiconductor Lasers on the Enamel and Pulp Chamber of a Human Tooth


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An in vitro study was also conducted to determine whether perceptible stimuli are experienced by patients during this time of laser treatment and to verify results of the in vitro study. The results did not conform well with the in vitro study because of uncontrollable variables. None of the patients who received irradiation treatment described any perceptible stimuli.

Selected Surgical and Diagnostic Diode Laser References

Intraoral Soft Tissue Surgery, Sulcular Debridement


Endodontics


Tooth Whitening


Caries Diagnosis


