Lasers in the cosmetic restorative practice. From gingival troughing to cavity preparation

Dental lasers once offered limited soft-tissue applications to a very small group of trailblazing practitioners. Today, the dental laser affords the general practitioner and specialist alike an array of applications that are already an integral part of everyday practice—composite curing, gingival curettage, and cavity preparation to name just a few. Although the percentage of dentists who regularly employ lasers remains small, it is growing slowly and steadily. The two most frequently mentioned concerns expressed by dentists considering the purchase of a laser have been cost and limited utility. But with prices coming down and the ability to cut enamel and dentin, the future looks bright for lasers in dentistry. In this article, Dr. Robert A. Lowe highlights some of the specific cosmetic and restorative applications of different types of lasers.

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Today, we are at a threshold—laser technology is beginning to profoundly impact the day-to-day practice of cosmetic and restorative dentistry. Now FDA-approved for use on soft and hard tissues, the number of uses for this instrument increases every day. Most recently, laser technology has been approved for use in performing root canal therapy. This article will discuss some of the latest uses for lasers in the practice of clinical dentistry and show how this amazing technology is allowing us to better treat our patients.

Lasers in the cosmetic practice

Lasers have been used for some time to perform soft-tissue procedures in the dental practice. A diode laser can be used to perform various surgical procedures including: 1) esthetic gingival recontouring, 2) sulcular curettage in periodontal pockets, 3) excisional biopsy, 4) gingival troughing to aid in final impression making, and 5) frenectomy, to name a few. The zone of necrosis is so slight around a diode laser incision that healing is very predictable, even more so than electrosurgery, which is critical in the esthetic zone.

Diode lasers are also used in the process of tooth whitening. Laser photons initiate a photochemical activator to hasten the response to whitening agents—specifically hydrogen peroxide.

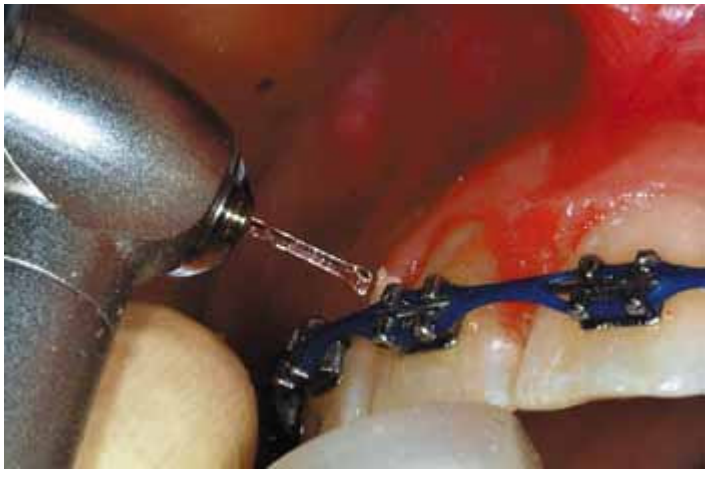
Water-cooled lasers now are available for use on hard tissues—enamel, dentin, and bone. Lasers can be effectively used to remove decay and prepare a cavity for restoration with resin restorative materials. A nice feature about performing operative dentistry with a water-cooled laser is that when used on dentin, it causes an interruption of the sodium/potassium pump at the neuron level, making it possible to use the laser without anesthesia in many cases. For some patients, this is a major breakthrough.

Among the operations that can be performed are: 1) Class I, II, III, and V cavities, 2) dentin desensitization, 3) enamel etching, 4) osseous recontouring

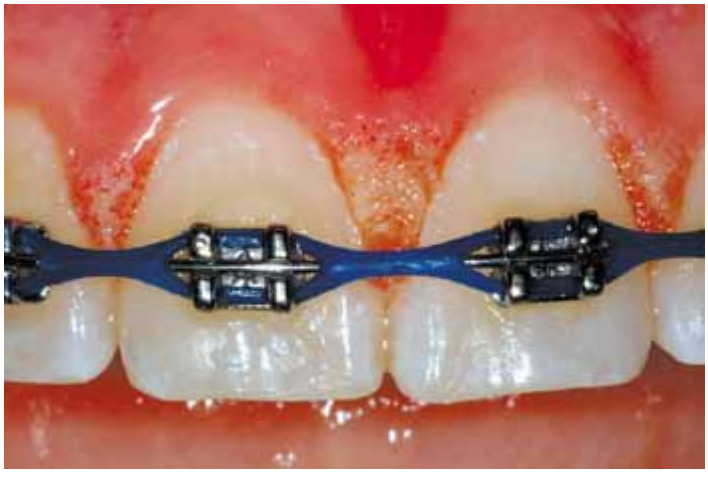
during gingival surgery, and 5) osseoectomy during tooth/root extraction or ridge recontouring. When these procedures are performed, the laser wound yields a sterile surface that promotes healing with less postoperative discomfort.

Esthetic laser contouring

When adequate amounts of free gingiva are present, laser contouring (gingivectomy) can increase cervico-incisal heights of clinical crowns to create esthetic symmetry. In the maxillary anterior region, it is esthetically pleasing to have the cervico-incisal heights of the central incisors be slightly higher than the lateral incisors and the canines slightly higher than both. As long as biologic width is not violated (2 mm for connective tissue and epithelial attachments and 1 mm for minimal sulcus depth), amounts of free gingiva in excess of the 1-mm minimal sulcus depth can be excised for esthetic reasons. Figures 1 and 2 show a patient with gingival hyperplasia secondary to orthodontic appliances. The dental laser can be effectively used around the metallic appliances to remove the excessive gingival tissue and improve the patient's esthetics.



(1) This preoperative view shows a water-cooled laser (Waterlase: Biolase Technologies) being used to contour excess gingival tissue around orthodontic brackets.



(2) A view of the maxillary central incisors is shown postoperatively.

Another patient is shown during preparation for porcelain veneer restorations. Her maxillary central incisors have disparate gingival heights. A diode laser is used to correct the tissue level above tooth 9 prior to making final impressions. Because of the minimal zone of necrosis as a result of the laser wound, healed tissue levels will be very predictable and impressions can be taken immediately after laser surgery (Figures 3-6).

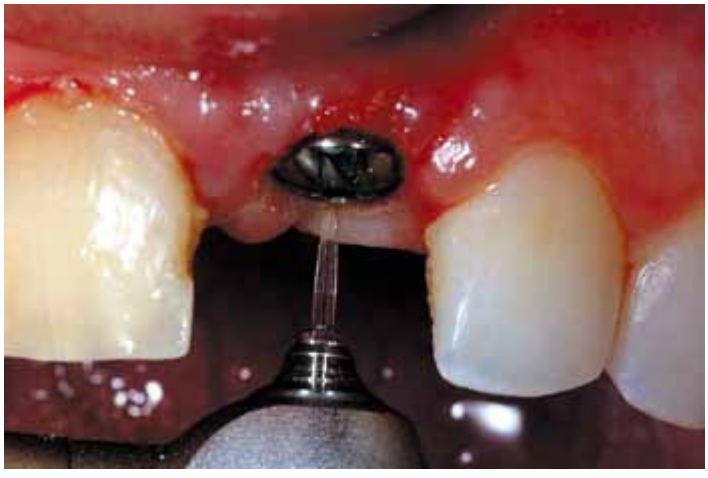
(3) After measuring the depth of the gingival sulcus to determine the amount of free gingiva, the tip of the perio probe is used to mark the gingival zenith.

(4) The diode laser (Twilight: Biolase Technologies) is used in a controlled sweeping motion to contour the gingival crest.

(5) The postoperative result after cleansing the surgical area with hydrogen peroxide. Note the minimal zone of necrosis present.

(6) The final impression for the patient's porcelain veneer restorations is taken immediately after the laser correction.

Another valuable use for laser technology is the removal of excess gingival tissue around healing abutments and fixture platforms of dental implants. Being able to perform this procedure bloodlessly without a scalpel is very convenient for the restorative dentist during the impression and restoration phase of implant reconstruction. The use of a laser, unlike electrosurgery, is safe around metallic surfaces such as titanium or metal restorative materials. Figures 7 through 10 show the dental laser being used to contour tissue around dental implants.



(7) The water-cooled laser (Waterlase: Biolase Technologies) is used around a titanium healing abutment to remove excess gingival tissue prior to removal for a fixture level impression.

(8) The gingival area around the implant healing abutment is shown postoperatively after preparation of the adjacent teeth for porcelain restorations.

(9) Excess gingival tissue around the fixture platform is removed using a water-cooled laser (Waterlase: Biolase Technologies) prior to placement of the impression coping (Implant Innovations). This will ensure a positive seat of the transfer coping, permitting an accurate impression of the external hex orientation.

(10) The impression coping (Implant Innovations) is oriented and placed on the implant prior to the registration of final impressions.

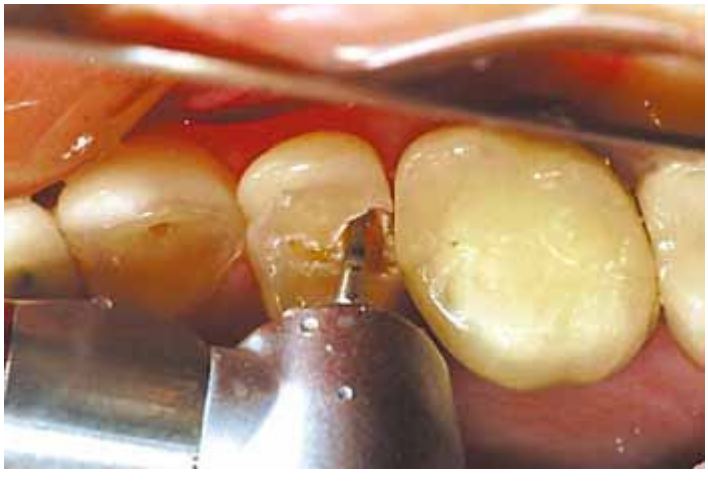
Cavity preparation

Using the water-cooled laser allows for efficient preparation of enamel and dentin when restoring teeth for operative reasons (dental decay and/or faulty restorations). The laser will effectively remove old composite material from tooth structure, although it cannot remove old metallic filling materials (amalgam). After penetration of the enamel layer, the intensity of the laser is lowered to remove dentin that is carious.

Because of the obvious effect on the dental pulp, a round bur in a slowspeed handpiece can be used to excavate decay without the use of anesthesia. The tooth can then be restored using dentin adhesives and composite resins. The etched surface left by the laser requires no additional etching and the dentin surface is rendered sterile and clean for use of dental adhesives.

Figure 11 shows the water-cooled laser being used to prepare a cavity for composite restoration. Figures 12 and 13 show the use of the slowspeed handpiece for excavation and the final preparation prior to restoration with composite resin.

(11) The water-cooled laser (Waterlase: Biolase Technologies) is shown cutting enamel and dentin on a maxillary premolar tooth that has occlusal and distal decay present.



(12) A round bur on a slowspeed handpiece is used to complete carious excavation.

(13) The disto-occlusal cavity preparation is shown after completion and isolation under rubber

dam. The dentinal surface is then lased to decontaminate and etch prior to placement of adhesive resin and composite material.

Osseous recontouring with a water-cooled laser

The use of water-cooled lasers for bony recontouring is going to make a tremendous impact on the way traditional osseous surgery is performed in dental practice. Since the laser cuts only at the end of the tip, control of osseous removal is much greater than any form of rotary instrumentation. When using diamond burs to perform gross osseous removal, there is always a chance that the rotation of the instrument will damage adjacent structures. Because the surgical laser wound is less traumatic, the risk of bony damage is significantly reduced—the laser does not create the frictional heat associated with using rotary instrumentation without proper water cooling. This translates into less postoperative discomfort and quicker healing times for the patient.

Once the bone immediately adjacent to the tooth is safely removed using the dental laser, an osteoplasty bur on a slow speed handpiece with water spray can be lightly and sporadically used to smooth and contour the lased bony interface with the adjacent untreated bone.

The diode laser is shown in Figures 14 and 15 recontouring the gingival crest prior to flap reflection, and the water-cooled laser is shown in Figures 16 and 17 performing osseous recontouring during crown lengthening surgery. Figure 18 shows the surgical provisional restorations in place after laser surgery.

(14) A diode laser (Twilight: Biolase Technologies) is used to recontour the gingival tissues and increase the cervico-incisal heights of the patient's maxillary teeth in the smile zone. The incisal edges will be shortened to maintain optimal cervico-incisal proportion yet move the teeth "in space" apically to improve a "gummy smile."

(15) After the diode laser (Twilight: Biolase Technologies) is used to sculpt the gingival zeniths, the sulcus is debrided with hydrogen peroxide.

(16) A water-cooled laser (Waterlase: Biolase Technologies) is used to perform osseous recontouring to re-establish biologic parameters after laser gingivectomy.

(17) A 1X view of the crestal bone being sculpted by the water-cooled laser (Waterlase: Biolase Technologies).

(18) Surgical provisional restorations are cemented after completion of osseous surgery. The original 12-mm length of the maxillary central incisors is preserved as the tooth (facial surface only) is moved apically via crown lengthening. The black line on the mandibular incisors represents the preoperative position of the maxillary incisal edges.

Summary

In this article, some techniques have been described using both diode and water-cooled lasers in the cosmetic restorative dental practice. As time goes on, more uses will be discovered for this wonderful adjunctive technology to aid the dentist in creating beautiful and functional smiles for patients in a more comfortable manner. nDPR

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