Restorative Dentistry using the Waterlase™ hard-tissue and soft-tissue laser system

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With the advent of minimally invasive Dentistry, there has been a paradigm shift, moving away from metal restorations and toward adhesive dentistry and the conservation of tooth structure. Alternatives to the drill for tooth preparation have become bug news. The dental laser has emerged as a powerful tool in this progression, helping dentist to prepare hard and soft tissue. Laser technology has helped to address such high-speed hand piece related issues as vibration- and heat-induced micro fractures, the removal of unnecessary tooth structure, and dentin with out a smear layer.

The Waterlase system is a dual-purpose hard- and soft-tissue laser. It is able to cut hard tissue effectively and, at the appropriate setting, to cut and coagulate soft tissue precisely with direct laser energy.

Following are step-by-step procedures for using the Waterlase laser system in four different dentistry cases. All of these clinical cases were accomplished without anesthesia, because the cutting mechanism of the laser in hard tissue does not involve heat or vibration. In the cases involving soft-tissue applications, the hemostasis provided by the system is an excellent adjunct in using technique-sensitive materials requiring a dry field for placement.

Fig. 1 A restoration requiring caries removal and macro-etching.

Fig. 2 Remove caries from incisal edges.

Fig. 3 Place restorative material.

Caries removal, macro-etching of incisal enamel

Fig. 1 shows the preoperative view of a restoration that requires caries removal and macro etching of the incisal enamel of the lower incisors**.**

1. Set the Waterlase laser to a low power setting of approximately 2W.
2. Because hard tissue is being prepared, set the water setting at 75% and the air setting at 90% which are recommended parameters for cutting enamel.
3. Macro-etch enamel with the laser.
4. Remove caries from the incisal edges of the lower anterior teeth, with the end of the tip about 1 mm off contact with the incisal edge (Fig. 2) Note: The water, in conjunction with laser energy, is the cutting agent. Total treatment time is 40 seconds. Anesthesia is not necessary.
5. Etch the restoration using 32% phosphoric acid for 10 seconds.
6. use Kerr Optibond Solo Plus bonding agent, and place Kerr Point 4 restorative material (Fig. 3) Note: because there is no smear layer, the bond is enhanced.

Fig. 4 A restoration requiring caries removal with gingivectomy.

Fig. 5 Remove carious dentin

Fig. 6 Retention of the composite is excellent.

Caries removal, gingivectomy

Fig. 4 shows the preoperative view of a restoration that requires gingivectomy prior to caries removal.

1. Apply topical anesthetic gel to gingival.

2. Perform the gingivectomy using the laser at a power setting of 1.5W. Note: Because the laser is used in direct contact mode to cut the tissue, the water setting is decreased to 7% and the air is set to 11%. This differs from a hard-tissue-cutting, in which higher water and air settings are used, because water is not used to act as the cutting mechanism in soft-tissue applications of this laser. At soft-tissue settings, the water and air act as a cooling mechanism for the laser as it cuts tissue.

Remove just enough gum tissue to expose sound tooth structure and provide a clear, accessible, and visible margin for the restoration apical to the decayed area. Note the precise cut of the tissue and coagulation. There is a minimal zone of necrosis and no need for periodontal dressing; post-operative bleeding and discomfort are minimal.

3. Remove caries using the laser setat 2W, with the water set to 55% and the air set to 65%, the recommended settings for carious dentin (Fig. 5). Note: This hard-tissue cut is made slightly off contact with the carious dentin. Increasing the water setting (along with a concomitant increase in air to direct the water toward the laser tip) enables the water to act as the cutting agent in an off-contact mode. Again, anesthesia is not necessary.

4. Complete the restoration as in the previous case. The macro-etch of the laser cut, lack of a smear layer, and the restorative material all contribute to the strong composite retention (Fig. 6)

Fig. 7 A restoration requiring placement of occlusal composite restorations.

Fig. 8 Macro-etching on the prepared surface is evident.

Fig. 9 The completed restoration

5. Complete the restoration as in the previous cases, with acid etching, bonding agent, and restorative material (Fig. 9) *Note:* The laser's precise, directional, easy-to-control, end-cutting mechanism eliminates the risk of advertent or non-directed cutting in hard as well as soft tissue.

Crown preparation, gingival re-contouring

Fig. 10 shows the preoperative view.

Gingival recontouring using laser was desired in this case on teeth 7 through 10. The patient declined orthodontic treatment, and chose to have full coverage Ivoclar Empress crowns on the maxillary arch.

1. Set the laser in soft-tissue cutting mode: 1.5W with 7% water and 11% air.
2. Cut the tissue directly with the laser; again, the water and air act as cooling agents only.
3. Trim the gingival margins apically to allow for a more esthetic result for the final restoration (Fig. 11). Note the hemostasis.
4. Administer local anesthesia and perform the crown preparations in a conventional manner. Take final impressions during the visit.
5. Place direct provisional restoration (Fig. 12).

The finished case, with crowns seated two weeks later, is shown in Fig.13. There was no tissue regrowth or recession in the two weeks between the procedure and placement of the final restoration, nor after three-month follow-up.

Fig. 10 A restoration requiring crown replacement and gingival recontouring.

Fig. 11 Trim the gingival margins

Fig. 12 Place direct provisional restorations.

Fig. 13 The completed restoration.

Back