

Crown troughing with the 810 nm diode laser

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_Introduction

In the past four to five years, there has been a dramatic increase in interest among general dentists both in North America and internationally in dental lasers. Diode lasers in particular have been demonstrated to be ultraportable, reliable and cost-effective wavelengths, which allows them to become the "soft tissue handpiece" in every operatory. Laser technology is an attractive and increasingly popular alternative to traditional methods (cord and electrosurgery) for the management of soft tissue in fixed prosthodontic procedures. The literature has suggested laser gingivectomies are the most popular soft-tissue procedure¹, but after that, laser crown troughing is probably the second most commonly sought-after reason to purchase a soft-tissue diode laser.

When crown troughing with the diode laser is compared with the traditional techniques, many clinicians find the laser to be easier and quicker than "packing cord." Often, clinicians who are looking to replace their electrosurgery units, which cannot be used safely around metals intraorally²⁻⁵, discover that the diode laser can be used safely around adjacent restorations that are metal (amalgam and gold), as well as for dental implants.⁶⁻¹³

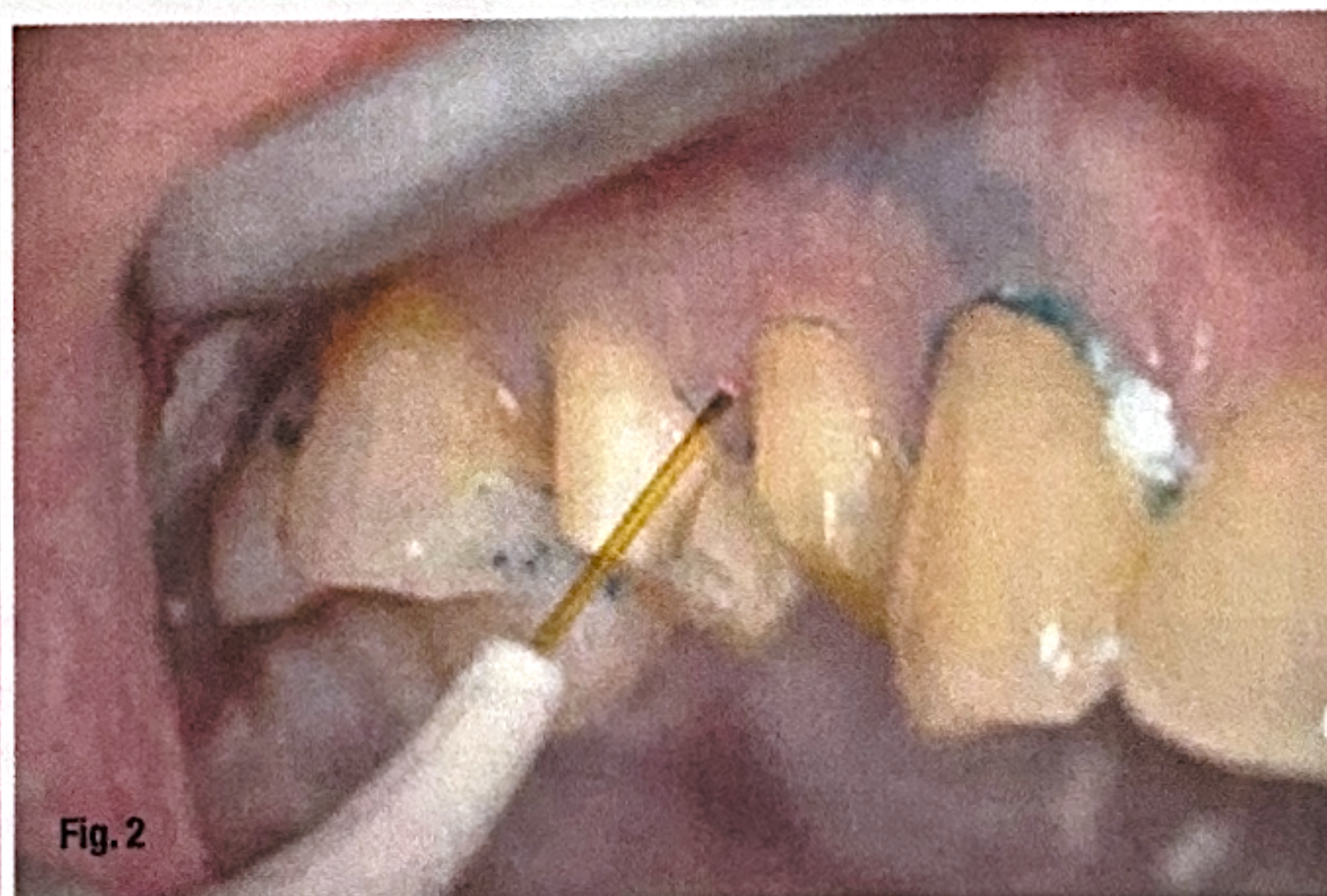
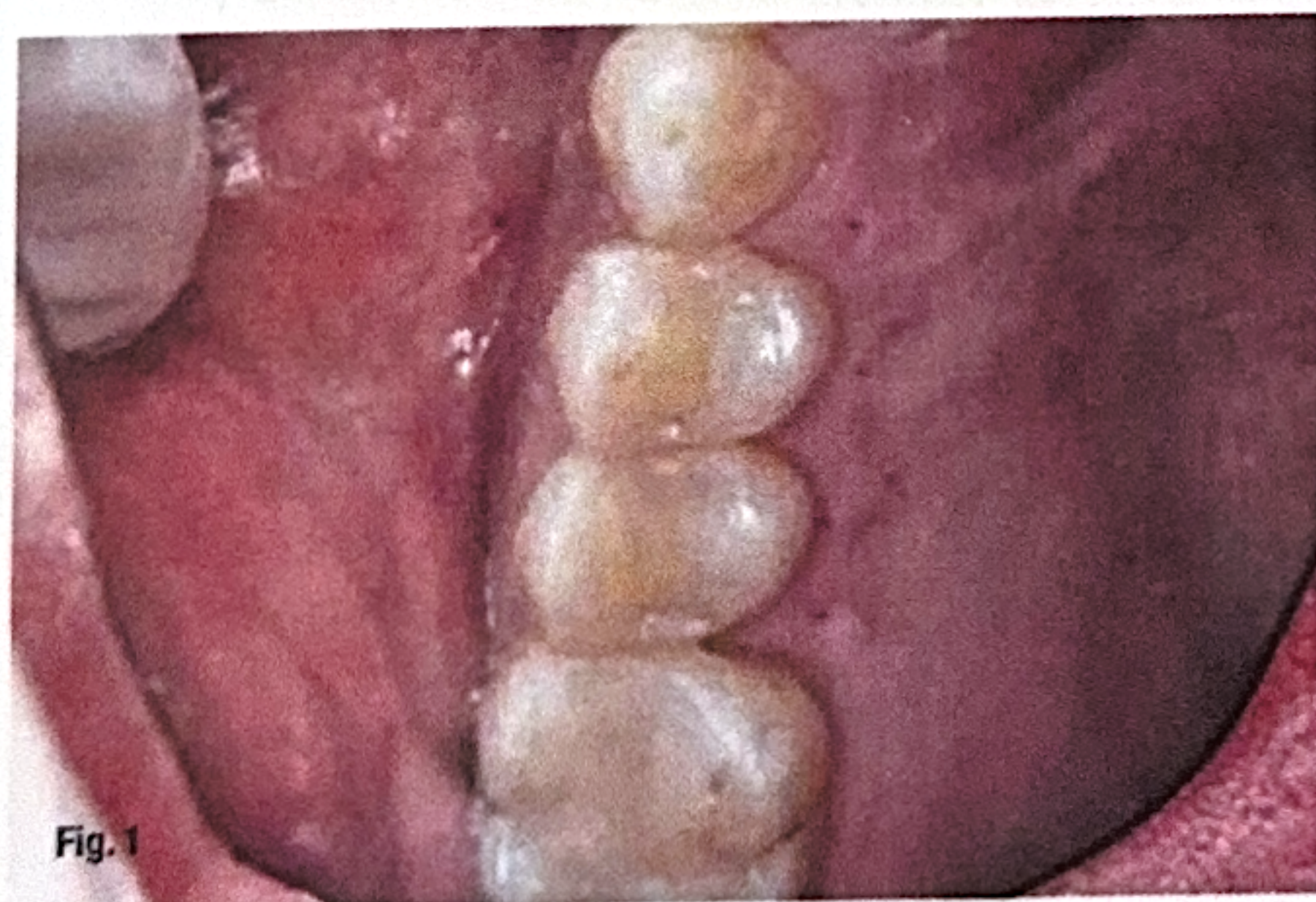
CAD/CAM dentists using CEREC or similar digital impression techniques will routinely use the reliable, small, portable diode laser to enhance the gingival trough prior to powdering their preparation before the optical impression. The safety of using lasers for tissue retraction has been documented by Gherlone et al,¹⁴ who found lasers (diode and Nd:YAG) to yield less bleeding and less recession than either double cord or electrosurgery techniques. Their interesting conclusion was that the laser techniques were in fact "less traumatic to the periodontal tissues." When considering using the diode laser for anterior restorations, it is useful to know that Goharkhay et al concluded that the diode laser has a "remarkable cutting ability and the tolerable damage zone," and due to its "excellent coagulation ability" it is a useful alternative in soft-tissue surgery of the oral cavity.¹⁵

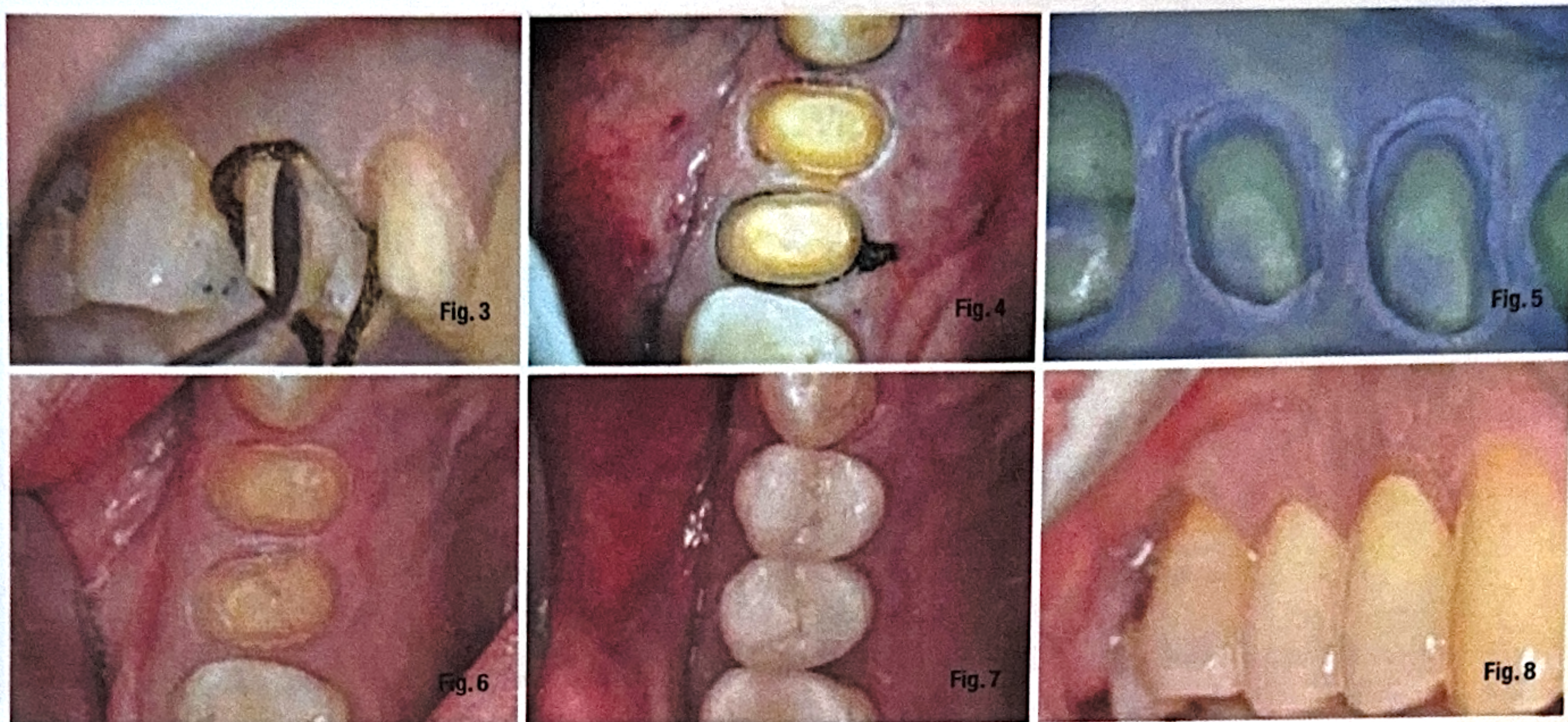
_Technique

A small learning curve exists in knowing when and how to properly use the diode laser for tissue management. The author suggests that a new user begin with posterior teeth first, where esthetic requirements are not as demanding as with indirect anterior restorations. With practice, many clinicians

Fig. 1_Pre-op view of two cracked premolars requiring crowns.
(Photos/Provided by Glenn A. van As, BSc, DMD)

Fig. 2_Diode laser troughing for first premolar (tooth #14).





will almost completely eliminate cord from their practice, particularly in the posterior segments. In critically esthetic areas where thin tissue genotypes exist, or if the patient is changing the color of the tooth significantly from the existing stump shade, then care with diode troughing must be taken.

In the author's experience, two vital keys to the successful integration of laser troughing are: adequate magnification for both the preparation of the tooth and the use of the laser (e.g., 4.0X loupes), and the judicious use of lower power settings on the diode laser (e.g., 0.6–1.1 watts of power in continuous wave).

The initial gross reduction of tooth structure is completed and the properly stripped, cleaved and initiated quartz fiber tip (or single-use initiated disposable tip) is extended just into the gingival sulcus subgingivally around 0.5–1.0 mm. Circumferentially the laser is moved with small, deft and light brushlike strokes around the preparation. These back-and-forth strokes create a slight distention of the tissue away laterally from the margin of the preparation. This lateral distention is not intended to lower the height of the tissue in an apical direction like a gingivectomy would, but simply to create a "moat" that separates tooth from soft tissue. This separation allows for room for the light-body or extra-light-body VPS impression material to capture details of the margin location.

The total time for the troughing circumferentially should be around 45 to 90 seconds, and careful analysis of the laser/tissue interaction should reveal minimal to no charring of the soft tissue, which can create postoperative discomfort and greater risk of gingival recession. If the laser is put in pulsed mode (comfort mode), the tissue has time to relax between

pulses, mitigating any iatrogenic effects of heat buildup. Pulsed mode may also be used in situations where topical anesthetic only is desired as the sole method of anesthetic, such as in the preparation and tissue management of a previously endodontically treated tooth.

After the initial laser trough has been completed, the clinician can refine the preparation and place the final margin equigingivally on solid tooth structure or slightly subgingival on the facial for esthetics. Hydrogen peroxide in a Dental Infusor (Ultradent) or a wet cotton pellet can be scrubbed on the soft tissue to remove any white tissue tags (slight thermal damage), which may accidentally droop onto the margin. Increased lateral distention of the tissue trough may be needed at times with anterior tissue troughing. This can be accomplished by using materials such as Expasyl or Traxodent, which are injected briefly into the sulcus, and these products can not only help with crevicular fluids or slight bleeding but help to physically distend the tissue away further from the margins. Vigorous rinsing of the sulcus to remove these products after 90 to 120 seconds will yield a clean, dry and well-delineated margin, and the final impression can be taken. Provisional restorations should be evaluated to make sure that they do not extend into the sulcus, which can iatrogenically cause the tissue to recede. Careful removal of temporary cement completes the initial appointment.

The patient returns for final insertion of the crown in 10 to 14 days, and upon removal of the provisional crown, the tissue appears healthy and situated exactly where the laser troughing placed it at the first appointment. In cases of poorly fitting provisional crowns, some soft tissue "bounce back" may lead to the margin being covered by soft tissue. Typically the

Fig. 3_Cord packing for comparison on maxillary second premolar (tooth #15).

Fig. 4_Occlusal view of #15 cord and #14 laser trough.

Fig. 5_PVS impression of both teeth show clarity of marginal detail on both teeth.

Fig. 6_Two week healing view of preparations at cementation appointment show both teeth healing well.

Fig. 7_Occlusal view of LAVA crowns on premolars.

Fig. 8_Facial view shows no recession on either premolar crown.

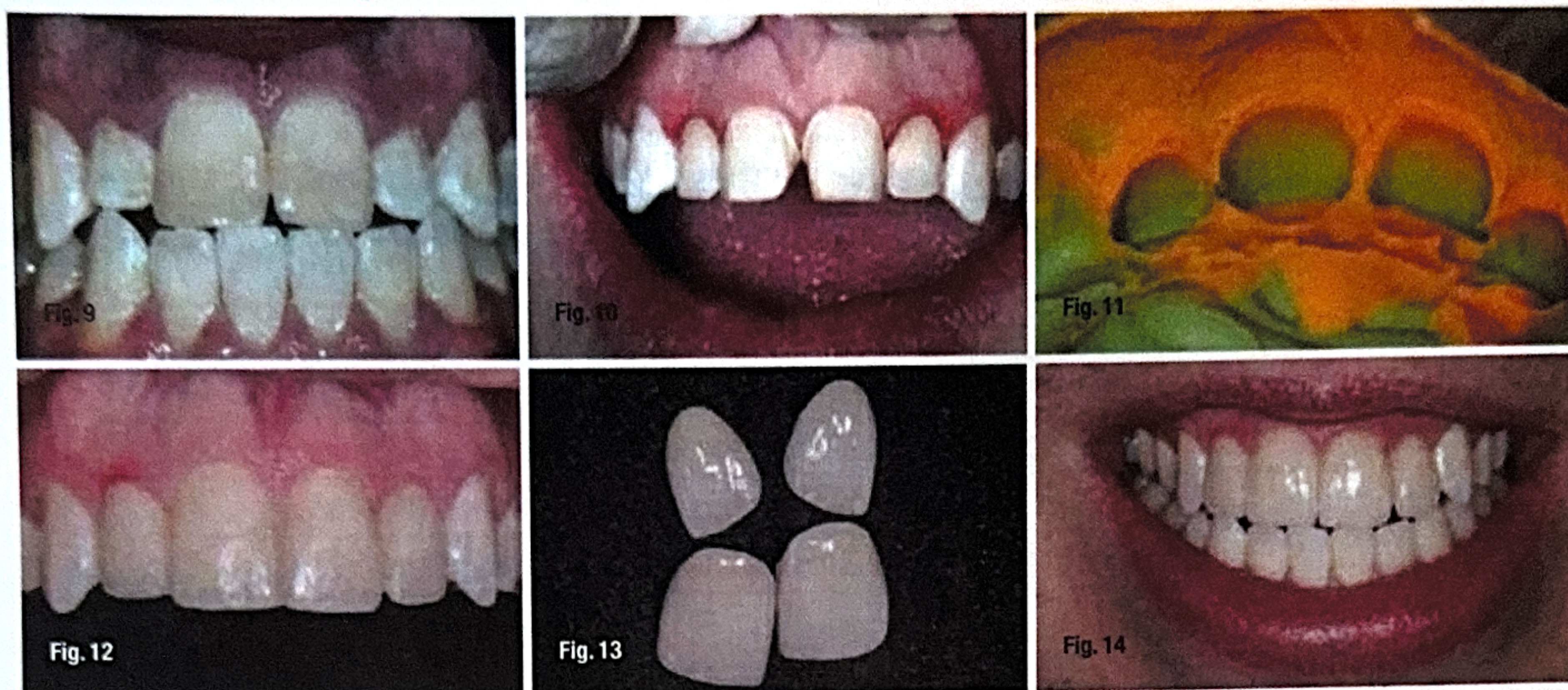


Fig. 9_Preoperative view of maxillary incisors with poor hard- and soft-tissue symmetry and old composite restorations.

Fig. 10_After gingival recontouring on maxillary lateral incisors, preparation of veneers and laser troughing on four incisor teeth.

Fig. 11_View of Aquasil (DENTSPLY) impression of veneer preparations showing clarity of margins.

Fig. 12_Provisionals at two weeks of healing show nice tissue response.

Fig. 13_View of EMax veneers ready for insertion.

Fig. 14_Two-week healing of veneers with patient smiling.

Fig. 15_High-mag view of healing of tissue shows superb response after laser troughing and cementation of veneers.

diode laser can be used with topical anesthetic and settings of 0.6 to 0.8 watts (CW) (or 1.2 to 1.6 watts pulsed) to remove any soft tissue overhanging the margins and subsequently the crown can be tried in and cemented. With careful attention to detail, the results can be identical to those obtained with traditional methods (see case below) and the diode laser will become an indispensable part of the soft-tissue management and impression-taking for fixed prosthodontics.

_Posterior crown laser troughing

This patient fractured two upper premolars that were very sensitive to chewing and required full coverage to alleviate the symptoms. The teeth were prepared for all ceramic restorations and the first premolar had the diode laser used for troughing at 0.8w CW to distend the tissue. The second premolar had tissue management completed for comparison sake with cord placed intrasulcularly. The impression shows clear margins on both preparations. The two-week healing photo shows great soft-tissue response on both teeth, and the final postoperative photos demonstrate ideal soft-tissue healing on both premolars (Figs. 1-8).



_Anterior crown (veneer) laser troughing

This patient fractured two upper central incisors playing ice hockey. The composite restorations had stained and the patient was unhappy with the shape and symmetry of the maxillary incisors. The patient accepted the proposed treatment plan, which was to prepare veneers for the maxillary incisors and to use the diode laser for tissue management and gingival recontouring.

Smile recontouring was completed with the diode laser on the lateral incisors to remove excessive gingival tissue (altered passive eruption) with a setting of 0.8 w CW for these teeth. Afterward the four incisors were prepared for EMax veneers and the 810 nm Picasso Lite diode laser was used for troughing at 0.8w CW to distend the tissue. The Aquasil impression of Light and Heavy Body PVS shows excellent marginal detail. The two-week healing of provisionals shows a wonderful soft-tissue response to the diode troughing, and the characterized veneers were bonded into place. The final esthetic outcome shows another wonderful soft-tissue response to the gingival recontouring and diode troughing that was used for this case (Figs. 9-15).

_Conclusion

The above cases and techniques are intended to demonstrate how laser troughing with the 810 nm diode laser can be used as an alternative to soft tissue management for indirect prosthodontic procedures in both the anterior and posterior dentition. With the increased number of clinicians now purchasing soft-tissue lasers for gingival recontouring and for tissue troughing, the need for detailed clinical treatment protocols for these simple, safe and desirable proce-

Step	Procedure
1	Initial gross reduction and margin placed equi-gingival with magnification.
2	Diode laser troughing: suggested settings 0.6-1.1 w CW (less in anterior)
3	Final margin placement subgingivally as needed for esthetics.
4	Hydrogen Peroxide or wet cotton pellet to remove white tissue tags
5	Lateral distention of tissue if needed (Expasyl, Traxodent).
6	Rinse and take PVS impression
7	Provisional fabrication - Careful to make sure no overhangs.

Table 1_ Clinical procedure for laser crown troughing.

dures exists. This article demonstrates how the diode laser can act as a wonderful alternative to traditional methodologies of tissue retraction that are widely espoused in the profession._

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Glenn A. van As, BSc, DMD, is the clinical director of the International Center of Laser Education at AMD Lasers (DENTSPLY), and is a founding member of the Academy of Microscope Enhanced Dentistry and a former president of the group. He has obtained standard and advanced proficiency as well as a mastership in laser dentistry from the Academy of Laser Dentistry and was distinguished with the Leon Goldman award for worldwide clinical excellence in the field of laser dentistry in 2006. An expert both in the utilization of the dental operating microscope for clinical dentistry and in the utilization of multiple wavelengths of hard- and soft-tissue lasers, he has lectured and provided workshops internationally more than 450 times on these topics. He acts as a consultant for several companies and reviews articles for PPAD and Dentaltown. He may be contacted at glennvanas@me.com.