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PERIODONTICS

Laser ENAP for Periodontal Bone Regeneration

By Robert H. Gregg, DDS; Delwin K. McCarthy, DDS

Many laser dentists have been using lasers with fiber optics for laser curettage, and demonstrating improved clinical indices and reduced pocket depths. Occasionally, laser users report sporadic and anecdotal instances of endogenous bone regeneration many months or years postoperatively following laser treatment of a periodontal pocket. However, confusion persists about laser periodontal procedures because of ongoing peer-reviewed articles that often fail to indicate current FDA clearance status,[1] proper laser fiber optic orientation to the tooth,[2-4] or the laser emission mode directed to the target tissue.[5]

In clarification, the FDA approved the first free-running pulsed (FR) Nd:YAG for laser curettage in March 1997, according to an FDA 510(k) clearance letter, Sulcular Debridement, written by Dr. M. Yessik on March 10, 1997.

However, laser dentists have been using this configuration in the gum pocket since 1988.[6-8] The technique is not perpendicular to the root surface,[9] but parallel to and along the long axis of the tooth. The root surface itself is not ever irradiated in focal contact. The tissue effects of an Nd:YAG laser are completely dependent on the emission mode, whether the laser emission is electronically pulsed in millionths of a second, or if it is a garden hose of photons pouring into the tissues. Free-running pulsed (FR) Nd:YAG lasers deliver photons in the microsecond range or millionth of a second. Microsecond pulsed (FR) Nd:YAG fiber optic lasers have a depth of absorption that is approximately one half the diameter of the fiber being used. For example, a 400-µm fiber has a depth of absorption equal to one half the diameter of the fiber, which is equal to 200 µm or 0.2 mm. Continuous wave (CW) Nd:YAG fiber optic lasers have a depth of penetration from 1 to 2 mm or more.[10,11]

Figure 1.

Figure 2.

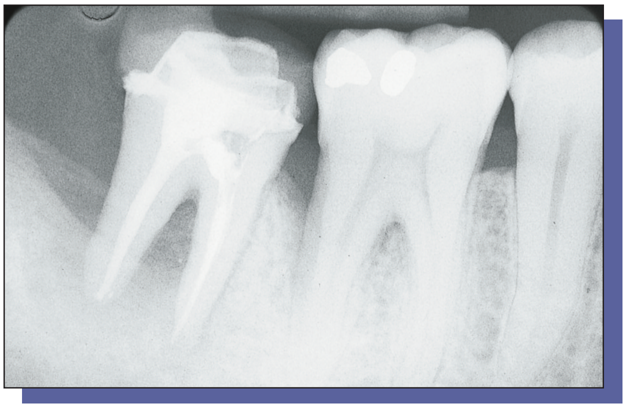

Figure 3.

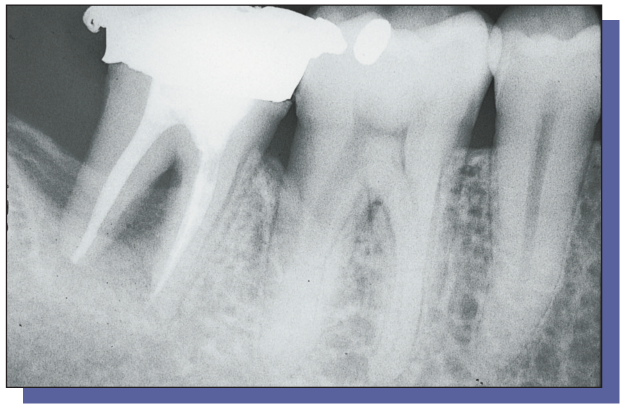

Figure 4.

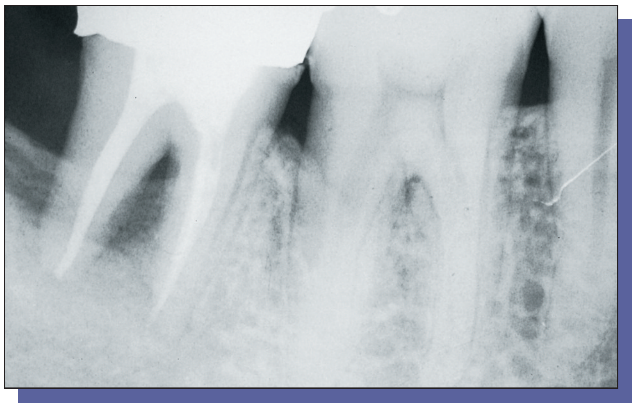

Figure 5.

Figure 6.

Figure 7.

LASER BONE INDUCTION

The first report of intentional bone regeneration was of a lower first molar following laser irradiation using a pulsed FR Nd:YAG laser in the periodontal defect, while simultaneously using a paraffin suspension of tetracycline and metronidazole injected into the pocket once a week for several months. Dr. Hector Martinez demonstrated approximately 7 to 10 mm of endogenous bone regeneration, and a complete fill of a through-and-through facial-lingual bony furcation defect.[12] At laser study clubs and laser academy meetings subsequent to this, other laser dentists and investigators reported bone regeneration using various techniques, but all were sporadic and unpredictable. The following 2 clinical case studies demonstrate how significant bone regeneration can be achieved using a specific technique that evolved after more than 9 years of development and refinement that yields reproducible if not predictable bone regeneration in moderate to severe periodontal bony defects.

CASE REPORT NO. 1

A 39-year-old male was seen for consultation, exam, and treatment planning. His medical history revealed an aortic valve replacement and he was taking the anticoagulant, coumadin, and tenormin for hypertension. Dental radiographs revealed a mesio-angular impaction of the right mandibular third molar, a 2-cm periapical radiolucency on the right mandibular second molar, and a 7-mm vertical radiolucency on the distal of the right mandibular first molar and furcation radiolucency (Figure 1). The patient's primary complaint was pain on the lower right. The differential diagnosis was cystitis, irreversible pulpitis, and/or chronic periodontitis.

The patient was referred to an oral surgeon for extraction of tooth No. 32 and debridement and biopsy of tooth No. 31.

Tooth No. 32 was extracted and a fibrous and granulation-like tissue was curetted from the lower right second molar area. The histopathology report performed 2 weeks later indicated the diagnosis was, "compatible with apical radicular cyst." Microscopically, there was no evidence of malignancy. According to the same report, the histomorphology was compatible with an inflamed dentigerous cyst or nonspecific chronic periodontitis. Clinical-radiographic correlation was required to confirm the diagnosis.

Two months later, the patient presented with renewed pain in the lower right area of Nos. 30 and 31. A radiograph indicated a persistence of the periapical radiolucency on tooth No. 31 and an enlarged, vertical radiolucency on the distal of the right mandibular first molar and furcation radiolucency (Figure 2).

Root canal therapy (RCT) was initiated on tooth No. 31. An initial laser excisional new attachment procedure (ENAP) was performed on teeth Nos. 30 and 31. The RCT was completed 2 weeks later. Eighteen days after that procedure, laser ENAP was performed on the maxillary and mandibular right quadrants including No. 31. A 3-month postoperative X-ray was taken (Figure 3). No post was placed, however the build-up and crown were completed 2 months later (Figure 4).

The 14-month postoperative laser ENAP periapical radiograph was taken of teeth Nos. 30 and 31 (Figure 5). The radiograph shows regeneration of endogenous osseous tissues and absence of a radiolucency on the distal of the right mandibular first molar and furcation area on tooth No. 30. The periapical and perifurca region around tooth No. 31 shows bony regeneration possibly related to oral surgery and endodontics, and possibly independent of laser ENAP and periodontal root planing. No flaps, grafts, membranes, barriers, or sutures were used around tooth No. 30 to achieve the regenerative results.

CASE REPORT NO. 2

A 49-year-old female was seen for consultation, exam, and treatment planning in June 1995. Her primary complaint was she could not chew on her left side. The patient's medical history was unremarkable, while her dental history revealed a maxillary anterior bridge and 3 small amalgam restorations in the posterior teeth. Full-mouth radiographs demonstrated generalized vertical bony defects throughout her mouth.

A preoperative radiograph of tooth No. 14 indicates a large furcation radiolucency (Figure 6). Periodontal charting demonstrated a 9-mm bony defect in the buccal furcation. The upper left maxillary quadrant was treated with laser ENAP. A few months later, the lower left mandibular quadrant was treated with laser ENAP.

The patient presented for her postoperative follow-up evaluation, but failed to return again for more than a year. At that visit, clinical inspection demonstrated poor oral hygiene and noncompliance with post-treatment recommendations for periodontal maintenance visits. The tissues around tooth No. 14 were coated with bacterial plaque and the marginal gingiva were red and inflamed. Periodontal probing of the buccal furcation could only produce a 2-mm measurement with greater than 14 g of pressure. It was discontinued after substantial blanching had occurred. With reservation and curiosity, a periapical radiograph of tooth No. 14 was obtained. The radiograph demonstrated 7 mm of endogenous bone regeneration in a patient who was noncompliant and who practiced poor oral hygiene (Figure 7).

DISCUSSION

Hundreds of patients during the past 4 years have been treated using the laser ENAP technique or subgingival curettage with a contact laser fiber and with the intent of pocket reduction and bone regeneration. The results have been and continue to be very encouraging. Other laser dentists who have been trained to perform laser ENAP have reproduced similar results, and have reduced the necessity for scalpel periodontal surgery for pocket elimination, and bone grafts and barrier membranes for bone induction.

University clinical investigators no longer need to delay a controlled, blinded, prospective, longitudinal split-mouth study comparing apically positioned flaps and osseous recontouring to quadrant laser ENAP for the treatment of moderate to advanced periodontal disease.✦

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