



## LASER DENTISTRY

# Laser ENAP for Periodontal Ligament (PDL) Regeneration

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“The clinician will be met with new possibilities as a paradigm shift is inevitable for periodontal practice in the next millennium.”<sup>1</sup>

In a recent article we wrote about laser excisional new attachment procedure (ENAP)<sup>2</sup> using a free-running (FR) pulsed Nd:YAG laser for bone regeneration in the furcation area of two molar teeth.<sup>3</sup> However, if causing bone induction was all that was accomplished, then the goal of new attachment has not been achieved. In fact, if the rate of bone induction is too rapid or aggressive in nature, it is possible that root resorption and/or ankylosis could occur and prevent the formation of a new attachment apparatus.<sup>4,5</sup> So fundamentally, the goal is bone induction and regeneration of a new attachment apparatus.

The concept of new attachment is found in its definition as the deposition of new cementum, bone, and periodontal ligament (PDL) imbedded by functionally oriented fibers into bone and cementum.<sup>6</sup> The clinical reality of new attachment formation in humans was conclusively demonstrated histologically almost 10 years ago.<sup>7</sup> Any procedure with a goal of regenerating a new

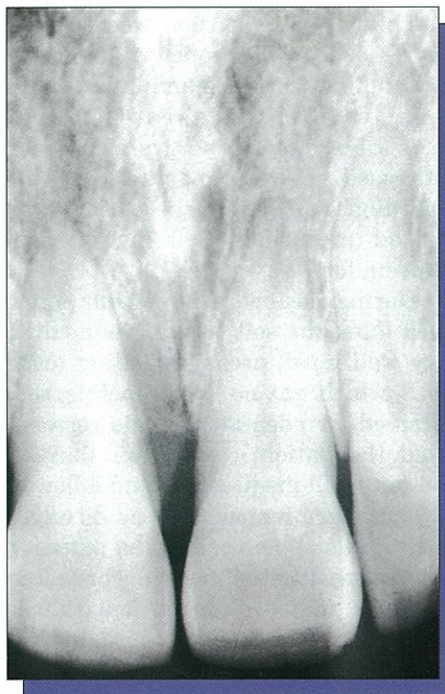


Figure 1.

attachment, ie, autogenous bone grafting, guided tissue regeneration, and scalpel ENAP, must meet this definition.

Two clinical case studies of moderate to severe periodontal defects in two different anterior teeth demonstrating the regeneration of the periodontal ligament

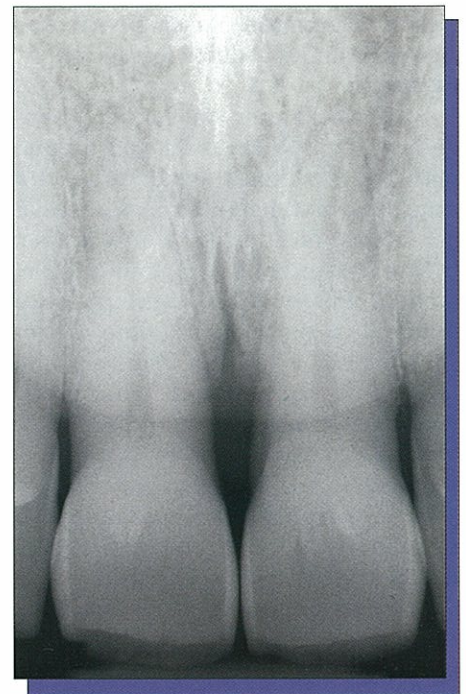


Figure 2.

and bone using a true FR pulsed Nd:YAG laser are discussed here.

### MATERIALS AND METHODS

In each of the case studies presented, a FR pulsed Nd:YAG laser was used. At different stages in the laser ENAP

method, variable pulse durations, repetition rates, and energy outputs were exercised. A future article will detail the sequence and explain the different parameters. Such a discussion now is lengthy and beyond the scope of these case studies.

### CASE 1

A 67-year-old male presented for a consultation, exam, and treatment planning. Review of his medical health revealed a history of hypertension and pericarditis, atrial fibrillation, prostate cancer, organic heart murmur, and non-insulin-dependent diabetes (type II adult onset). His medications/regimen included dyazide (diuretic), corgard (beta blocker), digoxin (cardiac glycoside), radiation treatment (no chemotherapy), and an antibiotic pre-medication.

Dental radiographs revealed moderate to severe horizontal and vertical bony defects throughout the dentition. Periodontal charting showed 4- to 8-mm deep pockets. Tooth No. 9 had a 9-mm defect on the mesial facial, mesial lingual, and central facial aspects and a class I fremitus. Laser ENAP was suggested and scheduled for the following week.

One week later, the patient complained of a toothache in and around tooth No. 9. Clinical exam revealed a large periodontal abscess on the mesial and central facial aspects of tooth No. 9. The tissue was red and purple, swollen, and cyanotic. Light pressure produced a purulent exudate. Laser ENAP on the upper left maxillary and lower left mandibular quadrants, including tooth No. 9, was initiated as scheduled. The fremitus on tooth No. 9 was addressed, and the patient was given prescriptions for amoxicillin, 500 mg; anaprox, 275 mg; and chlorhexadine gluconate, 0.12% each for 7 days.

Another week later, the patient was seen for a postoperative evaluation and to continue laser ENAP on the two untreated quadrants. Clinical exam of the postoperative area showed the soft tissue had improved, but the healing was not satisfactory, especially around tooth No. 9. The tissue around tooth No. 9 was red, inflamed, and edematous. Disappointed with the healing, we discovered the patient was taking the amoxicillin, but he was not taking anaprox or rinsing with chlorhexadine

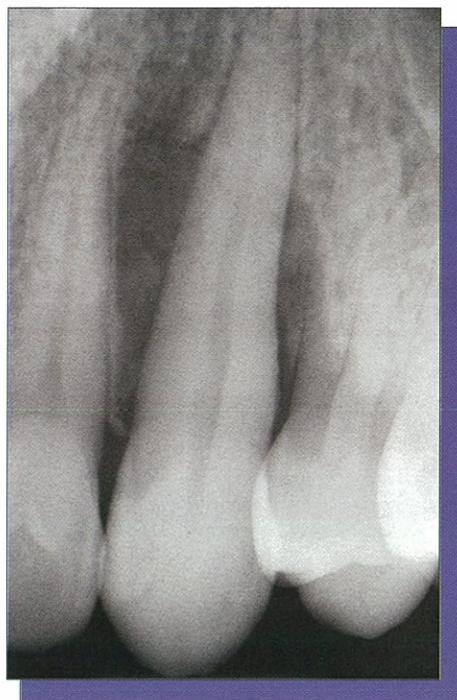


Figure 3.

gluconate or warm salt water. If amoxicillin was being taken, the poor healing called into question the efficacy of the antibiotic for the patient.

The patient was then treated with laser ENAP of the upper right maxillary and lower right mandibular quadrants. Tooth No. 9 was re-treated with laser ENAP, and the fremitus was addressed. Because of the concerns regarding amoxicillin, the patient was instead prescribed 300 mg of clindamycin for 7 days.

During postoperative evaluation 1 week later, the soft tissue was healing very well in all areas, including tooth No. 9, which was no longer mobile, red, inflamed, or edematous. This corroborated the patient's assertion that he had taken all medications and followed all home-care instructions as directed. During this appointment, the patient's teeth were treated for chlorhexadine gluconate brown stain with a rubber cup and pumice on all supragingival areas.

Two months later, the patient was seen for a periodontal maintenance visit including periodontal probings, a review of oral home care, dispensing of a proxabrush and dental tape, and the removal of chlorhexadine gluconate brown stain with a rubber cup and pumice. Evaluation indicated the patient was rinsing with chlorhexadine gluconate regularly, taking home care



Figure 4.

more seriously. The periodontal charting revealed significant overall improvement in periodontal probing depths (bleeding on probing was isolated). Tooth No. 9 measured 4 mm on the mesial facial aspect, while all other probing sites on the tooth measured 3 mm. A periapical radiograph was taken of tooth No. 9, and fremitus was no longer present in teeth Nos. 8 and 9.

Several findings are noteworthy when comparing the preoperative X-ray of tooth No. 9 (Figure 1) with a postoperative X-ray taken 3 months later (Figure 2). The preoperative X-ray shows the loss of bone from the mesial aspect of tooth No. 9 to the border of the intermaxillary suture (median line), extending almost two thirds the root length in an apical direction. It also shows an absence of PDL space. At the approximate junction of the mid- and apical-one-third of the root, the PDL space and increased bone density continuing around the root apex is evident. There also appears to be some thickening of the PDL in the apices of the maxillary central incisors (teeth Nos. 8 and 9).

The posttreatment X-ray of the medial aspect of tooth No. 9 shows bone fill to the intermaxillary suture and apex of the previous defect. There is also evidence of PDL space in the previous defect to the crestal and alveolar bone. The lack of PDL thickening at the

apices of teeth Nos. 8 and 9 suggests that fremitus was eliminated.

## CASE 2

A 40-year-old male presented for a second opinion, consultation, full-mouth X-ray exam, and treatment planning. His primary concern was the scheduled removal of the upper left maxillary canine (tooth No. 11). The patient's previous dentist told the patient the tooth was hopelessly pathologic and could not be saved. The patient's medical history revealed nothing noteworthy; however, his dental history revealed a considerable amount of dental treatment (crowns, silver amalgam fillings, and a bridge to replace a missing tooth) performed bilaterally on the posterior teeth. Full-mouth X-rays showed three teeth with root canal therapy (one failing) and generalized vertical bony defects throughout the mouth.

A preoperative X-ray of tooth No. 11 indicated a deep vertical and three-wall circumferential defect on the mesial lingual to distal lingual aspect. The defect extended from the crestal bone at the cemento-enamel junction down the coronal aspect to the apical border of the middle one third of the root (Figure 3). Clinical examination revealed tooth No. 11 to have a class III mobility (apically mobile) and an extremely hard fremitus. Palpation of any area around tooth was tender to very painful.

One week later, periodontal charting following local anesthesia demonstrated bony defects and periodontal pocketing measuring 16 to 19 mm around the tooth. Laser ENAP was performed on all four quadrants, and the fremitus was addressed on tooth No. 11 with occlusal and incisal stabilization 2 weeks later.

At 1 month, postoperative examination showed tooth No. 11 was again in fremitus, which was immediately addressed. The tooth had stabilized in apical motion but was still moderately (class II) mobile. Light periodontal probing indicated a 9-mm periodontal pocket on the distal facial and distal lingual. Laser curettage was performed without anesthesia to further induce the regeneration of bone and the PDL.

At 3 months postoperative, a periodontal maintenance visit including fine scaling and root planing was performed along with laser curettage. The fremitus on tooth No. 11 was assessed, continuing to improve to a class I fremitus. It was noted that the patient was maintaining good oral hygiene.

At 6 months postoperative, following a second periodontal maintenance visit, laser ENAP was performed a second time (tooth No. 11 only). The pockets were 7 and 8 mm on the distal facial and distal lingual of the tooth respectively, while all other pockets on the tooth were 3 mm or less. It showed no fremitus and was very stable. Periapical radiographs at 6 months demonstrated dramatic regeneration of new attachment apparatus as indicated by a distinct lamina-dura and clearly evident PDL space (Figure 4). The tooth is currently very stable.

## DISCUSSION

As in our previous article on laser ENAP, no flaps, grafts, membranes, barriers, or sutures were used around the teeth.<sup>3</sup> The most reliable and genuine indicator for assessing the regeneration of periodontal tissues is histology. In the absence of histological assessment, other "surrogate" measurements must be used.<sup>8</sup> As clinicians, we are not in a position to conduct his-

tological studies on the results we have obtained from our patients. Histologic confirmation of our results using our technique will come when those responsible for conducting such studies (university-based clinical investigators) decide to do so.

While the radiographic findings in these two case studies may not provide irrefutable proof of new attachment formation, they are, along with periodontal probings, the clinical evidence of a new PDL.<sup>8</sup> It is possible that in either case study we obtained reattachment, repair, or long junctional epithelium between newly regenerated bone and root surface, not new attachment. We plan on discussing the differences between these possibilities and new attachment in a later article. However, from a clinical perspective, these may be distinctions without a difference because the result in either case is the regeneration of new bone with an apparent new clinical PDL.♦

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