

Human Periodontal Regeneration Following the Laser Assisted New Attachment Procedure (LANAP)

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ABSTRACT

Objective: The Laser Assisted New Attachment Procedure (LANAP) has been developed for the sulcular debridement of periodontal pockets with the goal of obtaining new attachment. Favorable clinical results have been reported, but human histologic proof of regeneration is limited (IADR Abstract # 1735, 2003).

Methods: 6 pairs of single-rooted teeth with moderate-advanced chronic periodontitis and subgingival calculus deposits were treated. Oclusal adjustment and direct bond extracoronary splinting were performed. Under local anesthesia, a 1/4 round bur notch was placed at the apical extent of calculus as carefully as possible. One of each pair of teeth received pulsed FR Nd:YAG laser treatment of the inner pocket wall to remove the pocket epithelium (3 watts, 150-µsec, 10 hr). Both teeth were then aggressively scaled and root planed. Pockets of the test teeth were lasered again to help coagulate any blood present and to form a fibrin seal. Triple antibiotic ointment and a light cured dressing was placed. The control teeth received all of the above except the laser treatment. Patients were seen every 10 days for the first month, then at 2 and 3 months, at which time the treated teeth were removed en bloc, decalcified, and stained with H & E.

Results: All 6 of the LANAP treated specimens showed new cementum and new connective tissue attachment (and in two cases new bone and new periodontal ligament) in and coronal to the notch. Control teeth had a long junctional epithelium with no evidence of regeneration. There was no evidence of any adverse pulpal or tooth surface changes in any specimen.

Conclusion: This report supports the proof of principle that LANAP can be associated with cementum mediated new attachment and periodontal regeneration on a diseased root surface in humans.

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INTRODUCTION

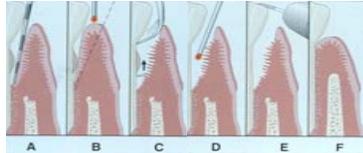
Interest in Nd:YAG laser use in periodontics is increasing. A procedure called Laser ENAP has been promoted in trade journals with examples of radiographic bone regeneration. Referred to as Laser Assisted New Attachment Procedure (LANAP) in this report, this technique of sulcular debridement has recently been approved by the FDA with a claim for new attachment. The technique utilizes a free running pulsed neodymium: yttrium-aluminum-garnet (FR Nd:YAG) laser applied twice. At the start of the procedure, sulcular wall debridement is accomplished using settings of 3 watts, 150-µsec, 10hz. After root debridement by hand and ultrasonics, a final laser application for hemostasis and coagulation with settings of 4 watts, 635-µsec, 20hz is used.

In clinical case reports, the LANAP has demonstrated improved clinical status and some radiographic evidence of bone regeneration in the areas treated. It is not known what tissues constitute the new healed interface between the soft tissues and the tooth root. Also, there is some evidence that the use of lasers in periodontal pockets may damage root surfaces, adversely affect the adjacent alveolar bone, or cause adverse pulpal changes.

PURPOSE

The purpose of this paper is to report the histologic wound healing following use of LANAP therapy of periodontal pockets, to determine the effect on the pocket wall and associated tooth root, and the repair process between the two. LANAP plus scaling and root planing was compared to scaling and root planing without LANAP in 6 patients.

LANAP Technique



LANAP technique illustrating (B) removal of pocket epithelium with free running pulsed Nd:YAG laser, (C) root surface debridement with hand and ultrasonic instruments, (D) hemostasis with different laser setting, (E) occlusal adjustment, (F) tissue adaptation to root.

MATERIALS & METHODS

Pre-treatment

- Patients w/ two similar teeth with PD & CPAL of 5-8mm
- BOP and subgingival calculus
- Teeth planned for extraction
- Informed consent
- Oclusal adjustment
- Extracoronary splinting
- SCL/RP and prophyl on other (non-TX) teeth
- Photos, xrays, clinical measurements

Treatment

- Appropriate laser precautions
- Local anesthesia
- Notch in subgingival calculus with bur
- Random selection of EXP and CTRL teeth
- Fiber tip parallel to root surface, moved slowly laterally and apically to base of pocket
 - Free running Nd:YAG applied twice
 - Sulcus wall DEBR - 3w, 150-µsec, 10hz
 - Root DEBR w/ US & HAND
 - Hemostasis- 4w, 635-µsec, 20hz
- Control teeth
 - SCL/RP only (US & HAND)

Post-treatment

- Triple AB ointment
- Light cured periodontal dressing
- Rx - NSAID x 1 day, then prn DOXY 100mg daily x 10 days 0.12% CHX rinses b.i.d.
- Followup Q 2 weeks for 3 months
- Block section biopsies
- Routine histologic processing
- Residual defects Tx'd with reconstructive procedures (all have received DI's)
- Biopsies evaluated for:
 - Nature of tissues related to the calculus notch
 - Root resorption, ankylosis, pulpal changes, INFL

RESULTS



LANAP treated

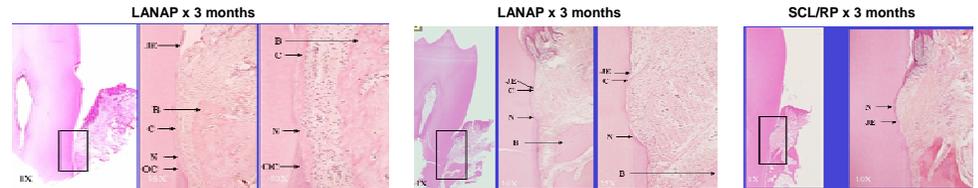
SCL / RP alone

- 3 males, 3 females (ages 26 - 54, x=45 y.o.)
- All tolerated procedures well, almost no pain meds needed post-Tx
- Clinical healing good for LANAP teeth, moderately good for SCL/RP only teeth
- Total energy applied ranged from 1411 to 3584 (mean 2400) pulses
 Mean energy = 14 J / mm pd

No root resorption, ankylosis, or pulpal changes seen

Clinical Changes	Pre-Tx	3 Months	Change
Recess	LANAP +0.2mm	+0.1mm	0.3mm
	SCL/RP +0.3mm	1.0mm	1.3mm
Probing depth	LANAP 7.3mm	2.7mm	4.6mm
	SCL/RP 8.0mm	4.3mm	3.7mm
CPAL	LANAP 7.2mm	3.0mm	4.2mm
	SCL/RP 8.3mm	5.3mm	3.0mm

Histologic Changes	Frequency (mean mm)
New CEM	LANAP 6 / 6 (1.2mm)
	SCL/RP 1 / 6 (0.1mm)
New CTA	LANAP 4 / 6
	SCL/RP 2 / 6
New Bone	LANAP 6 / 6
	SCL/RP 4 / 6



Key: N = notch in calculus; B = new bone; C = new cementum; OC = old cementum; JE = junctional epithelium

DISCUSSION & CONCLUSIONS

Proof of Principle of favorable histologic healing using LANAP protocol
 True regeneration (bone, PDL, CEM) - 2 teeth
 CEM mediated New Attachment - 4 teeth
 Mainly presence or absence criteria

This human histologic study demonstrates consistently positive histologic responses in periodontal pockets treated with the LANAP protocol
 Cementum-mediated New Attachment was a universal finding in the 6 teeth evaluated