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Effectiveness of LANAP over time as measured by tooth loss

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This study examines the effectiveness of the laser-assisted new attachment procedure (LANAP) as measured by tooth loss, comparing data to published studies using conventional surgical treatment modalities for the primary treatment of Types III and IV periodontitis.

Retrospective data from 107 patients presenting with Types III and IV periodontitis were gathered and evaluated. All patients received LANAP periodontal therapy as their primary surgical treatment according to the FDA-cleared LANAP protocol. The patients averaged 6.2 years post-treatment. The data were compared to several published studies for outcome classification and tooth loss over time.

The effectiveness of LANAP as a primary treatment method for Types III and IV periodontitis compares very favorably with

conventional surgical treatment modalities concerning tooth loss and stability over time, need for surgical retreatment, and outcome classification.

Dentistry continues to develop less invasive means of providing patient care without sacrificing results. Less invasive treatment of periodontitis, with reduced postoperative morbidity yet equal results in tooth retention over time is an important goal. LANAP treatment for moderate and advanced periodontitis provides a less invasive treatment alternative for the dentist and patient to consider as a part of informed consent.

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Periodontitis is a complex disease process involving bacterial, inflammatory, and immunologic components. Treatment modalities have been developed over the years to control pathogenic bacteria and inflammation, mitigate the damage caused by the disease process, stabilize the existing attachment level, and, ultimately, try to regenerate lost periodontal attachment.

While many surrogate variables (such as probing depth changes, clinical attachment level changes, gingival index, bleeding on probing, radiographic bone levels, and so forth) are used to evaluate treatment success, the ultimate goal of periodontal therapy is tooth retention. The main criterion for determining treatment success over time is tooth loss.¹⁻³ This is an important factor for the clinician and the patient to consider when discussing treatment recommendations, prognosis, and expectations.

A variety of periodontitis treatment methods, both nonsurgical

and surgical, have been evaluated and shown to be effective for most patients when followed by regular, long-term maintenance procedures, ongoing evaluation, and provision of additional and/or different treatments as needed.^{4,5}

In the last decade, laser-based therapies have been proposed for the treatment of periodontitis, usually as an adjunct or additional step in traditional procedures. A specific direct laser treatment protocol, the laser-assisted new attachment procedure (LANAP), has received FDA clearance for a regenerative outcome (FDA 510K No. K030290; July 26, 2004). A recent study including human histology demonstrated that LANAP consistently resulted in new attachment consisting of new connective tissue, cementum, and bone.⁶

The purpose of this study was to evaluate tooth survival over time in patients previously treated with LANAP and followed for at least three years, and to compare that data to previously published studies

of tooth survival utilizing conventional nonsurgical and surgical treatment methods.

Materials and methods

Data collected during the treatment and periodontal supportive therapy phases of 107 patients in a private periodontal practice were evaluated. All patients presented at the initial periodontal examination with ADA Type III or IV periodontitis affecting at least 70% of their remaining teeth, with a recommendation of surgical periodontal treatment for root debridement and pocket reduction.

Under local anesthesia, a pulsed, free-running Nd:YAG laser (PerioLase MPV-7, Millennium Dental Technologies) is used as part of the specific LANAP surgical protocol that includes use of the laser in short pulse durations to selectively remove pocket epithelium and reduce bacterial load, root debridement with ultrasonic and hand instruments coronally from bone level, use of the laser at longer pulse durations

Table 1. Tooth survival.

	Tilt	Wood <i>et al</i> ⁹	McFall ¹⁰	McLeod <i>et al</i> ²
No. of patients	107	63	100	114
No. of patients with Type III periodontitis	34 (32%)	63 (100%)	37 (37%)	42 (37%)
No. of patients with Type IV periodontitis	73 (68%)	0 (0%)	63 (63%)	72 (63%)
Percentage of patients receiving surgical therapy	100%*	82.5%	63%	55.3%
Average years maintaining therapy	6.2	13.6	19	12.5
No. of teeth removed pretreatment	41 (1.5%)	NR	NR	88 (3%)
No. of teeth in study	2,696	1,607	2,627	2,811
No. of teeth per patient	25.2	25.5	26.2	25.4
No. of teeth lost during maintenance treatment	81 (3.0%)	115 (7.2%)	299 (11.4%)	220 (7.8%)
No. of teeth lost to periodontitis	46 (1.7%)	88 (5%)	259 (9.8%)	152 (5.4%)
No. of teeth lost to periodontitis per patient	0.43	1.2	2.6	1.9

*Per LANAP treatment protocol

Table 2. Teeth lost during the maintenance phase.

Cause	No. of teeth	Percentage of all lost teeth	Percentage of all teeth in study
Periodontal disease	46	56.8	1.71
Decay/nonrestorable	13	16.0	0.48
Supereruption/unopposed	10	12.3	0.37
Endodontic	8	9.9	0.30
Tooth fracture	4	5.0	0.15

to finish debriding the epithelium and decontaminate the pocket, use of the laser at long pulse durations to thermally induce clotting within the pocket, and occlusal adjustment and splinting as needed to eliminate traumatic occlusal forces and to stabilize mobile teeth.^{7,8}

Postoperative monitoring, hygiene support, and maintenance are similar to that for conventional periodontal surgery patients. Supportive perio-

dontal therapy, re-evaluation, and modulation of treatment are provided according to patient needs and can vary from two- to six-month intervals for continuing care. All teeth deemed to have a hopeless periodontal or restorative prognosis were removed prior to or at the time of LANAP treatment. The number of teeth so removed is noted but not included in the results of the study. Patients were placed on regular periodontal recall

for supportive care following the single definitive LANAP treatment.

The following categories of data were evaluated and included in this study: Periodontal case type; number of teeth present at the initial examination; number of teeth present at time of initial LANAP treatment; number of teeth present at most recent examination; number of months since initial LANAP treatment; number of teeth lost since initial LANAP treatment; loss due to periodontal disease; loss due to decay/nonrestorable; loss due to endodontic problems; loss due to fracture; loss due to supereruption/unopposed; and number of teeth receiving LANAP retreatment.

Results

The records of 107 consecutively treated patients who had been under periodontal maintenance care for at least three years were evaluated for this study. Thirty-four patients (32%) had an initial diagnosis of moderate periodontitis (ADA Type III), while 73 patients (68%) had an initial diagnosis of advanced periodontitis (ADA Type IV). The average number of years of periodontal maintenance treatment after initial LANAP treatment was 6.2 years (range of 3.0–9.25 years). Appointment intervals for periodontal maintenance care varied according to patient need within a range of two to six months.

Table 1 compares the data collected in this study with that from similar published studies on tooth loss in patients who received other periodontal surgical therapies. Tooth loss per patient for the LANAP group was 0.43 teeth per patient. A total of 81 teeth (3%) were lost during the maintenance phase of periodontal care after initial LANAP treatment, with purported causation shown in Table 2.

Table 3. Teeth lost to periodontal disease by pretreatment periodontitis type.

	Type III	Type IV
No. of teeth lost	3	43
Percentage of all teeth lost	6.5	93.5
Percentage of all teeth in study	0.1	1.6
Percentage of tooth loss by case type	0.3	2.5

There was a dramatic difference in tooth loss between initial cases for Types III and IV periodontitis. **Patients with Type IV periodontitis at initial diagnosis were approximately eight times more likely to lose any individual tooth compared to those with Type III periodontitis (Table 3).**

A total of 280 teeth (10.4%) in 42 patients required additional, site-specific LANAP retreatment as part of ongoing care. The decision to retreat was based on recurrence of infection and progression of pocket depth. **These data also exhibited a dramatic difference based on case type (Table 4). Patients with Type IV periodontitis required LANAP retreatment 3.5 times more often than patients with an initial diagnosis of Type III periodontitis.**

Table 5 compares average tooth loss data with five previously published studies in the periodontal literature. The Wood *et al* and McFall studies are referenced in the American Academy of Periodontology (AAP) position paper, *Guidelines for periodontal therapy*.⁹⁻¹¹

After patient data were collected, patients were grouped according to treatment outcome classifications described by Hirschfeld & Wasserman, with groupings based on the number of teeth lost during active

Table 4. Surgical (LANAP) retreatment during the maintenance phase.

	Type III periodontitis	Type IV periodontitis	Total
No. of patients	14	28	42
No. of teeth	38	242	280
Percentage of teeth retreated	13.6	86.4	100
Percentage of all teeth treated	4.0	13.9	N/A

Table 5. Average tooth loss.

	Tilt	Hirschfeld & Wasserman ¹	McFall ¹⁰	Wood <i>et al</i> ⁹	McLeod <i>et al</i> ²	Goldman <i>et al</i> ⁵
Study years	6.2	22	19	13.6	12.5	22
No. of patients	107	600	100	63	114	211
Percentage of tooth loss (all reasons)	3.0	8.4	11.4	7.2	7.8	13.4
Percentage of tooth loss due to periodontitis	1.7	7.1	9.8	5.0	5.4	NR

Table 6. Patient response to periodontal therapy (by percentage).

	Hirschfeld & Wasserman ¹ (n = 600)	McFall ¹⁰ (n = 100)	Goldman <i>et al</i> ⁵ (n = 211)	Wood <i>et al</i> ⁹ (n = 63)	Pearlman ³ (n = 172)	McLeod <i>et al</i> ² (n = 114)	Tilt (n = 107)
Well-maintained	83.2	77	62	54	82	84.2	90.6
Downhill	12.7	15	28	7	14.5	13.2	9.4
Extreme downhill	4.2	8	10	2	3.5	2.6	0

periodontal therapy and during the maintenance phase of periodontal therapy: Well-maintained (0-3 teeth lost); downhill (4-9 teeth lost); or extreme downhill (10 or more teeth lost).¹ Table 6 shows a comparison of cases treated with LANAP with those reported by other authors.

Of the 107 patients in the current study, 17 (15.9%) were smokers. Three of these patients were

diagnosed with Type III periodontitis prior to treatment, while the other 14 were diagnosed with Type IV periodontitis. These patients, however, accounted for only 12% of the teeth that required surgical retreatment during the maintenance phase and for only 10.9% of all teeth lost to periodontal disease during the maintenance phase. **Only one of the 107 patients required full-mouth**

retreatment with LANAP during the study period.

Discussion

The decision to remove or surgically retreat one or more teeth is, by its nature, subjective. These decisions are made with the consent of the patient and are based on clinical experience, data collection over time, and the patient's comfort and functional needs. All studies analyzing treatment effectiveness, as measured by tooth loss, share these limitations.^{1,2,4,5,9,10,12} However, these decisions are made at least in part by considering data on tooth loss from other treatment modalities and from the AAP *Guidelines for periodontal therapy*.¹¹

Data from the current study were compared to similar retrospective studies on tooth loss, which consisted of patients in maintenance care from 12.5–22 years. A direct comparison between the studies cannot be made, as data from the present study average 6.2 years post-treatment. Tooth loss will continue to occur as maintenance years increase. However, the present rate of tooth loss in this study is favorable and in good proportion to similar studies considering the maintenance time differences.

Overall tooth loss, tooth loss related to periodontal disease, and patient response to periodontal therapy are within an acceptable range for the time frame of this study.

The majority of lost teeth were attributed to a small number of

patients. In comparison to patients with Type III periodontitis, patients with Type IV periodontitis had a 350% increase in surgical retreatment needs (with LANAP) and an 800% increase in teeth lost to periodontal disease. Early disease diagnosis, definitive disease treatment, and diligent, long-term maintenance care are the keys to helping patients with periodontal disease maintain their teeth.

Summary

As a well-defined treatment protocol, with human histologic validation, and with initial and intermediate success similar to that of previous periodontitis treatment modalities, LANAP can be beneficial for both dentists and patients and should be considered as a treatment option.^{1,2,9} As with other therapies, more data regarding LANAP effectiveness, both short- and long-term, is needed.

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