“The Latest in Smooth”

-Smirnoff Vodka advertisement

Dental Endoscope

DentalView Perioscopy

AHC

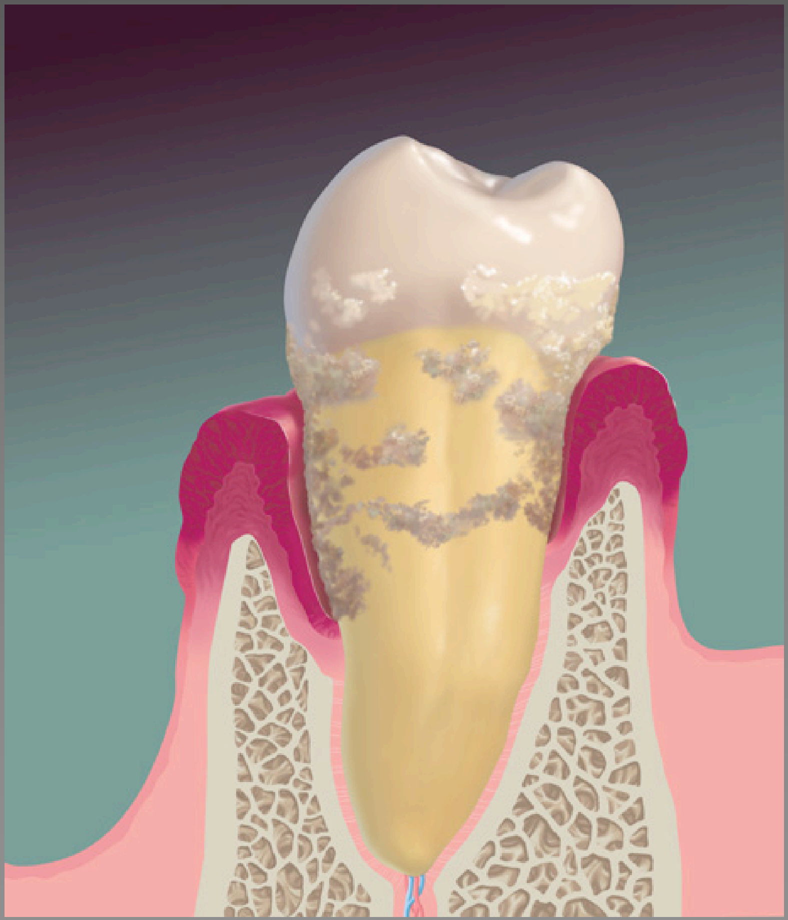
JYS

Dental Endoscope

- Perioscope
  - Magnification 22x to 48x
  - Alternative to surgery in localized sites after post non-surgical therapy
  - New definition of “clean”
  - Eliminates “blind instrumentation”

DentalView Perioscopy

DentalView Perioscopy



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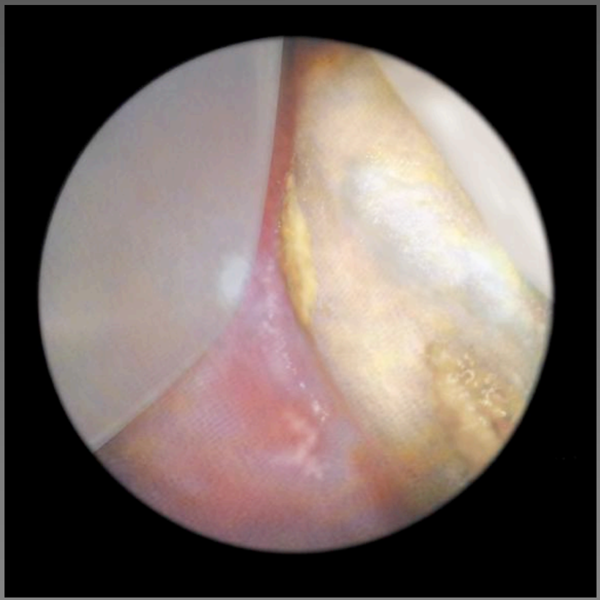

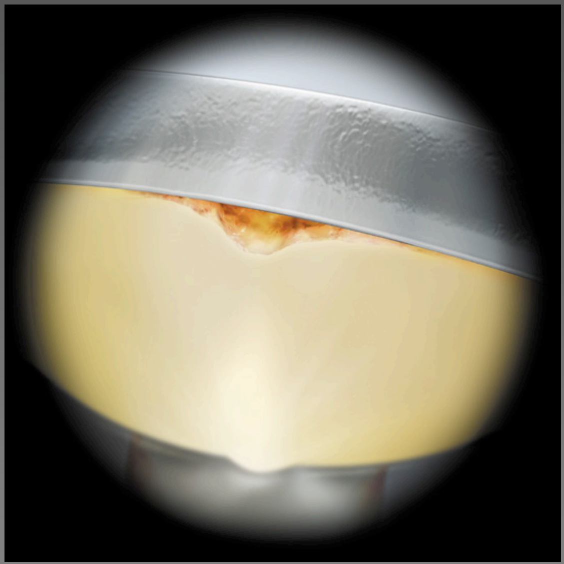

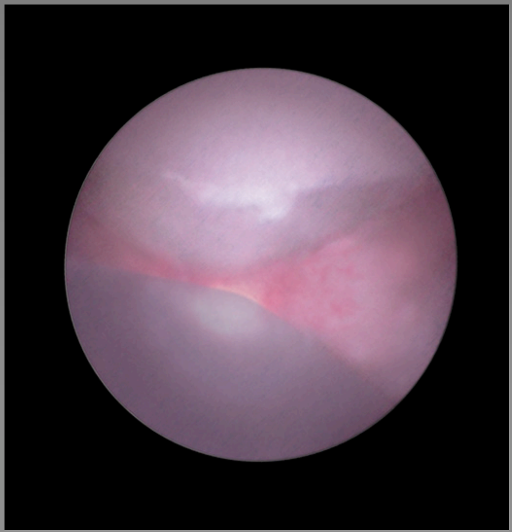

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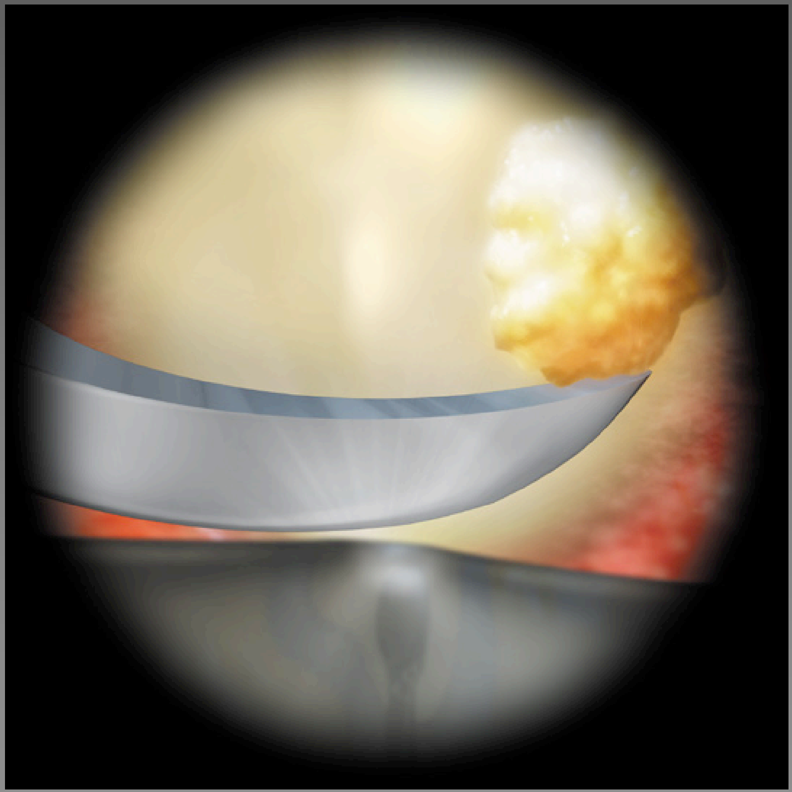

Perioscope Benefits

- Enables improved diagnostic & therapeutic capabilities through a minimum invasive way to view the subgingival root surfaces
  - Reduce guesswork of diagnosis & treatment
  - Enables DH to deliver enhanced therapy

AHC JYS

Perioscope Benefits

- Patients seek & accept high-tech non-invasive treatments
  - Patients can view problematic areas
  - Alternative to patients who do not have surgery due to finances, fears, disablilities, or medical issues.

Perioscope Concerns

- Significant financial investment in a high-tech visual device
  - Delicate, fragile precision parts

- Revamp hygiene practice to include expanded services can impact scheduling
  - Time intensive treatment

Perioscope Concerns

- Need to develop revenue models
- Large learning curve for clinician
  - Monitor usage
  - Interpreting images - detection
  - New instruments – micro instrumentation

LASERS

Light Amplification by Stimulated Emission of Radiation

AHC

Laser Dental History

- 1997 first laser, Er:YAG, was approved for cutting enamel & dentin
- 2000-2001 soft tissue approval including sulcular debridement
- 2002 endodontic usage
- 2003 bone recontouring
- 2004 periodontal procedures & bony crown lengthening

Access Magazine December 2006

Lasers for Hygiene

- Diodes and Nd:YAGs
  - Safer for closed-flap site therapy
  - Does not groove root surfaces with proper technique
  - Does not have interaction on root surface because they require pigmentation and hemoglobin to interact with any oral tissue
  - Safe around titanium implants

Ablation

- Defined as “surgical cutting” or “vaporization” by laser
- Less tissue damage compared to electrosurgical devices
- Less post-treatment discomfort

Laser Curettage

Why do you use it?

What are you trying to accomplish?

Laser Curettage

How effective for bacterial reduction?

Laser Curettage

How effective for pocket reduction?

Laser Curettage

How do you bill for this procedure?

Table 1.

Results of the Computer-Based Literature Search by Journal Title for Articles on Lasers and Periodontics

Journal Name	Number of Published Articles (1990 to 2005)
Compendium of Continuing Dental Education	5
Dental Clinics of North America	13
Dental Economics	8
Dentistry Today	15
International Journal of Periodontics & Restorative Dentistry	3
Journal of the American Dental Association	3
Journal of Clinical Laser Medicine and Surgery	7
Journal of Clinical Periodontology	12
Journal of Dentistry	1
Journal of Dental Research	2
Journal of the International Academy of Periodontology	3
Journal of Oral Laser Applications	22
Journal of Periodontology	39
Journal of Periodontics and Esthetic Dentistry	1
Journal of Periodontal Research	5
Lasers in Dentistry: Proceedings of SPIE	25
Lasers in Surgery and Medicine	30
Periodontology 2000	2
Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics	2
Quintessence International	1
Miscellaneous	79
Total number of published articles	278

Table 2.

Number of Published Articles on Lasers in Periodontics Listed by Experimental Design in Order of Decreasing Clinical Relevance

Experimental Design	Number of Published Articles	Percentage of Total
Randomized, blinded, controlled, longitudinal, clinical trials	3	1.1
Cohort or longitudinal studies	20	7.2
Case-controlled studies	12	4.3
Non-controlled case studies	25	9.0
Descriptive studies	44	15.8
In vivo animal studies	27	9.7
In vitro laboratory studies	59	21.2
Reviews of the literature	88	31.7
Total number of articles	278	100.0

Table 3.

Characteristics of Laser Wavelengths Used in Clinical Dentistry

Laser Type	Common Abbreviation	Wavelength	Waveform	Delivery Tip	Reported Periodontal Applications
Carbon dioxide	CO_2	10.6 µm	Gated or continuous	Hollow waveguide; beam focused when 1 to 2 mm from target surface	Soft tissue incision and ablation; subgingival curettage
Neodymium:yttrium-aluminum-garnet	Nd:YAG	1.064 µm	Pulsed	Flexible fiber optic system of varying diameters; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage and bacterial elimination
Holmium:yttrium-aluminum-garnet	Ho:YAG	2.1 µm	Pulsed	Flexible fiber optic system; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage and bacterial elimination
Erbium:yttrium-aluminum-garnet	Er:YAG	2.94 µm	Free-running pulsed	Flexible fiber optic system or hollow waveguide; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage; scaling of root surfaces; osteoplasty and ostectomy
Erbium, chromium:yttrium-selenium-gallium-garnet	Er,Cr:YSGG	2.78 µm	Free-running pulsed	Sapphire crystal inserts of varying diameters; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage; osteoplasty and ostectomy
Neodymium:yttrium-aluminum-perovskite	Nd:YAP	1,340 nm	Pulsed	Flexible fiber optic system; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage and bacterial elimination
Indium-gallium-arsenide-phosphide; gallium-aluminum-arsenide; gallium-arsenide	InGaAsP (diode) GaAlAs (diode) GaAs (diode)	Diodes can range from 635 to 950 nm	Gated or continuous	Flexible fiber optic system; surface contact required for most procedures	Soft tissue incision and ablation; subgingival curettage and bacterial elimination
Argon	Ar	488 to 514 nm	Gated or continuous	Flexible fiber optic system	Soft tissue incision and ablation

Table 4.

Laser Treatment of Chronic Periodontitis: Summary of Longitudinal Clinical Trials and Cohort Studies

Table 4. (continued)

Laser Treatment of Chronic Periodontitis: Summary of Longitudinal Clinical Trials and Cohort Studies

Study (listed in chronological sequence)	Type of Laser	Number of Patients	Length of Study (days)	Initial PD (mm)	Decrease in Subgingival Bacteria: Laser Versus Control	Mean Reduction in PD: Laser Versus Control (mm)	Mean Gain in CAL: Laser Versus Control (mm)	Percentage of Decrease in BOP: Laser Versus Control	Comments
Rydén et al.[112]	GaAs diode	10	28	NA (gingivitis study)	No statistical difference between treatment groups.	NA	NA	No statistical difference between test and controls.	Total dose of 1 J/cm^2 over 4 minutes; laser did not influence the inflammatory reaction of the marginal gingival in an experimental human gingivitis model. Controls were untreated.
Finkbeiner[116]	Argon	30	138	4 to 5 6 to 7 8 to 9	NA	1.62 versus NA 2.85 versus NA 3.30 versus NA	NA	75% versus NA	Used 0.4 W and 0.3-mm-diameter optical fiber with a 20- to 30-second exposure; no control group.
Ben Hatit et al.[80]	Nd:YAG	14	70	≥5	No significant difference. Reported reductions in *Tf*, *Pg*, and *Td* but not *Aa*. All microbes rebounded to baseline at 10 weeks.	NA	NA	NA	Treatment groups: 0.8 W at 10 Hz and 100 mJ/pulse versus 1.0 W at 10 Hz and 100 mJ/pulse versus 1.2 W at 12 Hz and 100 mJ/pulse versus 1.5 W at 15 Hz and 100 mJ/pulse versus scaling only (control); pulse duration was 150 microseconds, and laser was fitted with 0.3-mm-diameter optical fiber.
Radvar et al.[117]	Nd:YAG	11	42	>4	At 6 weeks, only the SRP group showed a significant reduction from baseline.	0.50 versus 1.70	NA	<10% versus 45%	Treatment groups: 50 mJ versus 80 mJ (test) versus SRP (control); pulse duration of 150 microseconds using a 0.32-mm-diameter optical fiber; energy densities were 62.9 and 99.5 J/cm^2.
Neill and Mellonig[101]	Nd:YAG	10	180	>4	No significant difference for *Pg* or *Pi*.	1.70 versus 0.50	1.1 versus 1.0	Significant difference but no data presented.	Treatment groups: SRP alone versus laser + SRP versus untreated control; 80 mJ at 25 Hz for 2 minutes; <4-mm pocket lased for 5 to 10 seconds; 4 to 6 mm lased for 20 seconds; 7 to 9 mm lased for 30 seconds; and >9 mm lased for 40 seconds.
Moritz et al.[115]	GaAs diode	50	180	3.9 versus 3.0 (mean depth in molar region)	No significant difference. 59% of lased sites had 1 log decrease versus 33% of controls; 27% of lased sites had 2 log decrease versus 17% of controls.	1.30 versus 0.40	NA	Study used papillary bleeding index: improvement in 97% of lased versus 67% of controls.	Used 2.5 W and 50 Hz, and 10-microsecond pulse duration; controls were scaling followed by H_2O_2 rinsing at 1 week and at 2 and 4 months. Tests were scaled plus lased at 1 week and at 2 and 4 months.
Liu et al.[118]	Nd:YAG	8	84	4 to 6	NA	NA	NA	NA	Laser versus SRP versus laser + SRP versus SRP + laser; 150 mJ at 20 pulses per second; determined that SRP was required to reduce levels of gingival crevicular fluid interleukin-1β.
Schwarz et al.[103]	Er:YAG	20	180	≥4	No significant difference between treatment groups.	2.00 versus 1.60	1.9 versus 1.0	77% versus 56%	Laser used at 160 mJ/pulse at 10 Hz (test) versus SRP (control).
Gutknecht et al.[81]	Nd:YAG	20	175	4 to 6	No significant difference between treatment groups.	0.85 versus 0.80 (estimated from line graph)	NA	85% versus 75% (estimated from line graph)	Used 100 mJ and 20 Hz, 100-microsecond pulse duration, 0.32-mm-diameter optical fiber, and energy density of 124 J/cm^2 at fiber tip. Control was untreated versus one-time SRP versus SRP + laser treatment of pocket once per week for 3 weeks. Measured levels of *Pg*, *Pi*, and *Aa*. Found no significant difference for *Pi* and *Aa*; difference for *Pg* was significant.

Table 4. (continued)

Laser Treatment of Chronic Periodontitis: Summary of Longitudinal Clinical Trials and Cohort Studies

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Study (listed in chronological sequence)	Type of Laser	Number of Patients	Length of Study (days)	Initial PD (mm)	Decrease in Subgingival Bacteria: Laser Versus Control	Mean Reduction in PD: Laser Versus Control (mm)	Mean Gain in CAL: Laser Versus Control (mm)	Percentage of Decrease in BOP: Laser Versus Control	Comments
Sjöstrom and Friskopp[119]	Nd:YCG (1,061 nm versus 1,064 nm for Nd:YAG)	27	120	≥4	NA	1.4 versus 1.4	NA	Gingival bleeding index showed no difference between treatment groups.	Treatment groups: laser + SRP + laser (test) versus SRP only (control); laser used at 7 W and 20 Hz with pulse length of 250 microseconds.
Yilmaz et al.[113]	GaAs diode	10	32	4	No significant difference between treatment groups.	0.23 for laser only; 0.49 for SRP only; 0.66 for laser + SRP	NA	17% for laser only; 50% for SRP only; 60% for laser + SRP	Treatment groups: laser only versus laser + SRP versus SRP alone versus oral hygiene instructions alone; laser used at power density of 1.6 J/cm^2 on days 1, 2, 4, 7, 9, and 11 using methylene blue dye as a photosensitizer.
Miyazaki et al.[102]	Nd:YAG	18	84	≥5	NA	1.43 for Nd:YAG; 1.36 for scaling; 1.00 for CO_2	0.50 for Nd:YAG; 0.57 for scaling; 0.31 for CO_2	43% for Nd:YAG; 34% for scaling; 16% for CO_2	Treatment groups: Nd:YAG laser alone versus CO_2 alone versus ultrasonic scaling alone; Nd:YAG laser used at 100 mJ/pulse and 20 Hz for 2 minutes; CO_2 laser used at 2 W for 2 minutes.
Schwarz et al.[104]	Er:YAG	20	365	≥4	No significant difference between treatment groups.	2.0 for laser + SRP; 1.7 for laser only	Both treatments had 1.6-mm gains in CAL.	14% for laser + SRP; 16% for laser only	Treatment groups: laser + SRP (test) versus laser only (control); laser used at 160 mJ/pulse at 10 Hz.
Schwarz et al.[105]	Er:YAG	20	2 years	≥4	No significant difference between treatment groups.	1.60 versus 1.30	1.40 versus 0.70	64.3% versus 46.2%	Laser used at 160 mJ/pulse at 10 Hz versus SRP; this article reports the long-term results of the Schwarz et al.[103] study.
Borrajo et al.[100]	InGaAsP diode	30	42	NA	NA	NA	0.81 versus 0.85	72% versus 53%	SRP versus SRP + laser; 2 W, 100-millisecond pulse length, 50 Hz, 2-mm-diameter optical fiber.
El Yazami et al.[109]	Nd:YAP	22	180	5.5 test, 5.2 control	NA	2.80 versus 1.30	2.60 versus 1.10	67.1% versus 51.2%	70 mJ and 30 Hz; SRP (control) versus SRP + laser (test).
Harris et al.[120]	Nd:YAG	75*	180	4 to 6 7 to 9	NA	1.55 versus NA 3.44 versus NA	NA	NA	Laser power ranged from 3.0 to 4.8 W depending on operator; 1 minute/tooth exposure delivered a total energy of 1 to 15 J/mm of PD. LANAP protocol. Study also includes data from the Neill and Mellonig[101] study. Controls were historic, i.e., compared to other studies.
Sculean et al.[106]	Er:YAG	20	180	≥4	NA	1.52 versus 1.57	1.11 versus 1.11	23% versus 31%	Laser used at 160 mJ/pulse and 10 Hz (test) versus ultrasonic scaling (control).
Schwarz et al.[107]	Er:YAG	22	180	8.6	NA	4.00 versus 4.1	3.2 versus 3.3	35% versus 26%	Access flap surgery + laser debridement + enamel matrix protein derivative (test) versus access flap surgery + SRP + enamel matrix protein derivative (control); laser used at 160 mJ/pulse and 10 Hz.
Sculean et al.[108]	Er:YAG	23	180	7.8	NA	3.7 versus 3.2	2.6 versus 1.5	62.5% versus 59%	Laser used at 160 mJ/pulse and 10 Hz (test) versus flap surgery and debridement of root and defect (control).
Ambrosini et al.[110]	Nd:YAP	30	90	4.1	No significant difference between treatment groups.	1.50 versus 1.30	1.00 versus 1.10	85.7% versus 85.7%	SRP only (control) versus SRP + laser (testy); bacteria tested by DNA probe: *Aa*, *Pi*, *Pg*, *Tf*, and *Td*; laser parameters were 10 W and 0.2-mm-diameter optical fiber.

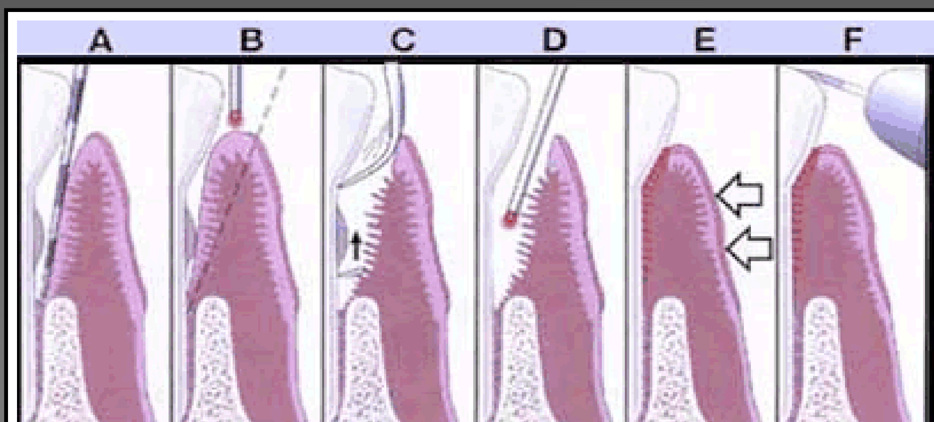
Table 1.

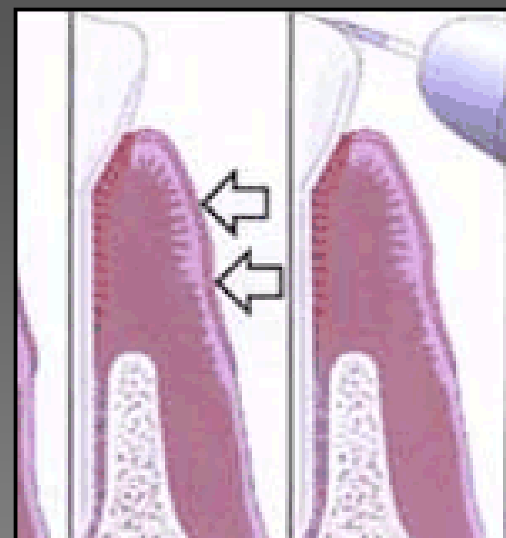
PD, Gingival Recession, and CAL Values for Both Treatment Groups at Baseline and After 3 to 60 Months

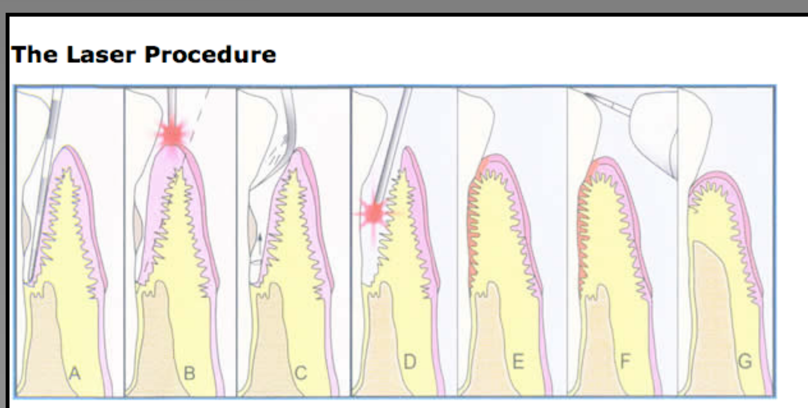
	PD (mm)		Recession (mm)		CAL (mm)		CAL Gain (mm)	
Time (months)	Control	Laser	Control	Laser	Control	Laser	Control	Laser
Baseline	5.78 ± 0.82 (N = 438)	5.63 ± 0.95 (N = 438)	0.58 ± 0.30	0.61 ± 0.25	6.36 ± 2.00	6.14 ± 1.80		
3	2.92 ± 0.70 (N = 438)	2.82 ± 0.70 (N = 438)	0.89 ± 0.45	0.81 ± 0.43	3.81 ± 1.06	3.66 ± 0.91	2.82 ± 0.46	2.85 ± 0.38
6	2.88 ± 0.51 (N = 438)	2.46 ± 0.42* (N = 438)	1.12 ± 0.50	0.95 ± 0.40*	3.90 ± 0.80	3.41 ± 0.65*	2.16 ± 0.29	2.57 ± 0.24*
12	2.67 ± 0.43 (N = 438)	2.50 ± 0.46* (N = 438)	1.15 ± 0.47	0.90 ± 0.40*	3.65 ± 0.67	3.30 ± 0.62*	2.03 ± 0.18	2.44 ± 0.35*
24	2.82 ± 0.43 (N = 438)	2.63 ± 0.36* (N = 438)	1.17 ± 0.50	0.98 ± 0.42*	3.97 ± 0.55	3.43 ± 0.50*	1.97 ± 0.26	2.29 ± 0.23*
36	2.85 ± 0.46 (N = 438)	2.70 ± 0.33* (N = 438)	1.20 ± 0.60	1.04 ± 0.50*	4.10 ± 0.73	3.63 ± 0.61*	1.91 ± 0.31	2.22 ± 0.28*
48	2.88 ± 0.40 (N = 420)	2.82 ± 0.53 (N = 432)	1.24 ± 0.60	1.12 ± 0.67	4.02 ± 0.93	3.89 ± 0.61	1.88 ± 0.21	1.90 ± 0.27
60	2.91 ± 0.55 (N = 414)	2.84 ± 0.43 (N = 426)	1.25 ± 0.45	1.2 ± 0.39	4.05 ± 0.85	3.97 ± 0.89	1.76 ± 0.33	1.72 ± 0.26

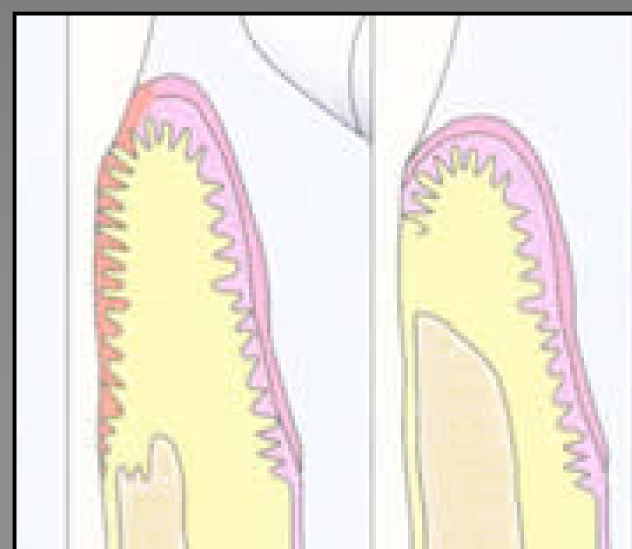
Data are mean ± SD.

LANAP





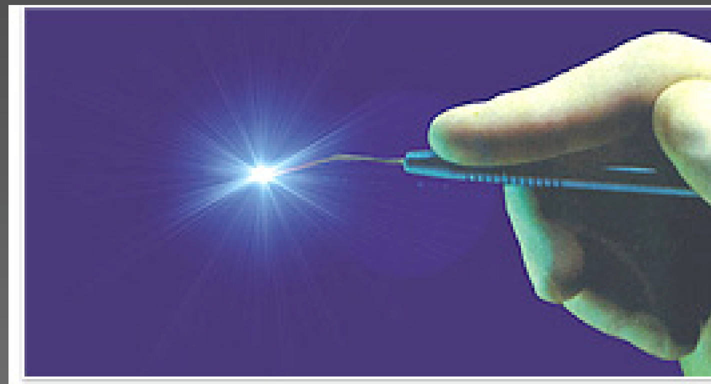




Additional Laser Usages

- Ablation of aphthous ulcers & herpetic lesions at low energy setting
  - Observations by users
    - Immediate pain relief
    - Reduced healing time
    - Less recurrence in same location
- "Laser Conditioning" (ErCr:YSGG, Er:YAG)
  - Laser numbing used for restorative
  - Can it be used for hygiene appointments
    - Place laser tip 4-6 mm from tooth surface for 90 seconds at specific setting
    - Stops sensations from traveling from tooth to brain
- Tooth whitening
- Diagnodent
    - Caries detection

Lasers



- Consensus of technique & procedure has not been established for predictable outcomes
- More long term data and research needed to develop standard protocols for widespread acceptance of concept and usage
- Comprehensive training vital for successful outcomes

Laser Curettage

- No significant bacterial reduction
- No significant pocket reduction
- No better than scaling and root planning