



#1442

Periodontal Treatment using the Er,Cr:YSGG Laser

B. Dyer¹, E. C. Sung^{2*}, .

¹Department of Periodontics, University of Texas, Houston,

²Division of Advanced Prosthodontics, Biomaterials, and Hospital Dentistry, UCLA School of Dentistry.

UCLA School of Dentistry

Introduction:

Dental lasers have been recently introduced in the treatment of periodontal disease. It has been shown that lasers treatment of periodontal disease can be positive. While there are no reports on the use and benefits of the erbium, chromium:yttrium-scandium-gallium-garnet (Er,Cr:YSGG) laser (Waterlase MD, Biolase Technology, Inc., Irvine, CA) for periodontal therapy, properties of this 2.78µm middle infrared wavelength together with anecdotal clinical data have motivated use and documentation of cases by clinicians within the periodontal community. This laser has hard and soft tissue applications, including periodontal therapy. This study is a retrospective analysis on the effectiveness of the Er,Cr:YSGG laser.

Objective:

The purpose of this study was to evaluate the effectiveness of Er,Cr:YSGG laser by measuring the clinical changes in probing depth (PD) and clinical attachment level (CAL) in pockets treated with conventional therapy with assistance of Er,Cr:YSGG laser.

Materials and Methods:

- 126 teeth from 16 patients with pockets measuring 4-9mm and treated with the Er,Cr:YSGG laser were selected for the study.
- Baseline data were collected prior to treatment and followed every 3 months for 2 years.
- Treatment included mechanical debridement with a ultrasonic scaler followed by Er,Cr:YSGG therapy.
- Er,Cr:YSGG setting:
 - 1.0 Watt setting with fluence of 16.99 J/cm²
 - 30 Hz repetition rate
 - 20% Water spray
 - 11% air
 - 500 micron mz tip at length of 14mm
- Upon completion, the lasered surface were covered with Sooth-n-Seal™ to seal the gingiva to the teeth.
- The exclusion criterias included subjects that received antibiotics and anti-inflammatory medication in conjunction to periodontal therapy.
- All data gathered were analyzed using ANOVA with p<0.05 for significant differences.

Results:

All laser treated pockets demonstrated a significant reduction in pocket depth when compared to baseline. At the end of the study (2 year mark), the average PD was 3.2 ± 1.1 mm for the 4-6 mm pocket group (Figure 1a) and the 7-9 mm pocket group had a mean PD of 3.7 ± 1.2 mm (Figure 1b) . CAL also improved with the mean CAL at 3.1 ± 1.1 mm for the 4-6 mm group and 3.6 ± 1.2 for the 7-9 mm group. The overall reduction were 1.9 mm and 4.0 mm respectively (Figure 2).

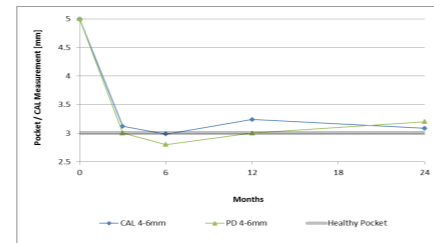


Figure 1A. Mean PD gain over time in 4-6 mm pockets compared to the normal 3 mm pocket depth.

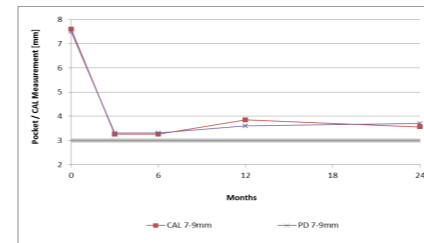


Figure 1B. Mean PD gain over time in 7-9 mm pocket compared to the normal 3 mm pocket depth.

Initial PD [mm]	PD / CAL	Baseline		3 Months			6 Months			1 Year			2 Years		
		Mean	SD	Mean	Δ	SD	Mean	Δ	SD	Mean	Δ	SD	Mean	Δ	SD
4	PD [mm]	4.0	-	2.9	1.1	0.8	2.7	1.3	0.6	2.9	1.1	0.7	3.0	1.0	0.8
	[mm]	4.1	0.4	2.8	1.2	0.8	2.7	1.3	0.8	2.9	1.1	0.8	3.1	0.9	1.0
5	PD [mm]	5.0	-	2.9	2.1	0.8	2.7	2.3	0.6	3.0	2.0	0.8	3.2	1.8	0.8
	[mm]	5.0	0.3	3.1	1.9	1.0	3.1	1.9	1.0	3.1	1.9	0.8	3.1	1.9	0.8
6	PD [mm]	6.0	-	2.9	3.1	0.5	2.8	3.2	0.5	3.1	2.9	0.6	3.3	2.7	0.7
	[mm]	6.0	0.2	3.1	2.9	1.0	3.0	3.0	0.8	3.3	2.7	0.8	3.2	2.8	0.8
7	PD [mm]	7.0	-	3.2	3.8	0.8	3.3	3.7	0.9	3.5	3.5	0.8	3.5	3.5	1.1
	[mm]	7.1	0.3	3.3	3.8	0.8	3.3	3.8	0.8	3.5	3.5	0.9	3.5	3.5	1.0
8	PD [mm]	8.0	-	3.5	4.5	0.8	3.4	4.6	0.8	3.5	4.5	0.7	3.6	4.4	1.2
	[mm]	8.1	0.2	3.4	4.6	0.8	3.4	4.6	0.8	3.7	4.3	0.8	3.4	4.6	1.1
9	PD [mm]	9.0	-	3.6	5.4	0.5	3.6	5.4	0.5	3.5	5.5	0.5	4.0	5.0	1.0
	[mm]	9.0	0.0	3.8	5.2	0.8	3.8	5.2	0.8	4.5	4.5	0.7	3.8	5.2	1.0
4-6	PD [mm]	5.0	0.8	3.0	2.0	1.1	2.8	2.2	1.0	3.0	2.0	1.0	3.2	1.8	1.1
	[mm]	5.0	0.8	3.1	1.9	1.2	3.0	2.0	1.1	3.2	1.8	1.0	3.1	1.9	1.1
7-9	PD [mm]	7.5	0.6	3.3	4.3	0.9	3.3	4.3	1.0	3.6	4.0	1.0	3.7	3.9	1.2
	[mm]	7.6	0.6	3.3	4.3	0.9	3.3	4.3	0.9	3.8	3.8	0.9	3.6	4.0	1.2

Figure 2. Mean PD and CAL changes with respect to time

Discussion:

- The removal of the calcified deposits using conventional instrumentation will not remove the biofilm and smear layer. The risk of re-infection from bacteria and bacteria endotoxin contaminated smear layer is a possible concern.¹
- Cell adhesion to surfaces that have been infected shown to be impaired.² Studies have been published that demonstrate the ability of the Er,Cr:YSGG laser to kill bacteria in infected tissue. Schoop and Gordon et al. demonstrated the ability to disinfect deep layers of E. faecalis infected dentin when using the Er,Cr:YSGG laser.^{3,4} Other laser eradicated organisms reported in the Schoop study included the E. coli. Although these organisms are not the typical bacteria found in periodontal pocket, it is believed that the ability of this laser to kill bacteria may be extrapolated to other types, including those present in periodontal pockets.⁴
- Hakki et al., suggested that the micro-morphology of the laser prepared root surfaces may also be more suitable for repair of the periodontal attachment. However, the study suggested that additional work is needed to confirm such hypothesis.⁵

Conclusion:

The Er,Cr:YSGG laser with conventional therapy is an effective modality for treatment of moderate to advanced periodontal diseases. In this study, significant improvement in probing depth and clinical attachment level were observed during the study period.

References:

1. Polson AM, Frederick GT, Ladenheim S, Hanes PJ. The production of a root surface smear layer by instrumentation and its removal by citric acid. *J Periodontol* 1984;55: 443-446.
2. Schwarz F, Aoki A, Sculean A, Georg T, Scherbaum W, Becker J. In vivo effects of an Er:YAG laser, an ultrasonic system and scaling and root planning on the biocompatibility of periodontally diseased root surfaces in cultures of human PDL fibroblasts. *Lasers Surg Med* 2003;33: 140-147.
3. Schoop U, Kluger W, Moritz A, Nedjelic N, Georgopoulos A, Sperr W. Bactericidal Effect of Different Laser Systems in the Deep Layers of Dentin. *Lasers in Surgery and Medicine* 2004; 35:111-116
4. Gordon W, Atabakhsh VA, Meza F, Doms et al. The antimicrobial efficacy of the erbium, chromium:yttrium-scandium-gallium-garnet laser with radial firing tips on root canal dentin walls infected with Enterococcus faecalis. *J Am Dent Assoc* 2007; 138 (7): 992-1002
5. Hakki SS, Berk G, Dunder N, Sglam M, Berk N. Effects of root planing procedures with hand instrument or erbium, chromium:yttrium-scandium-gallium-garnet laser irradiation on the root surfaces: a comparative scanning electron microscopy study. *Lasers in Med Sci* 2010;25(3):345-53.