



# **BENEFITS FROM DENTAL LASERS IN PERIODONTAL TREATMENT**

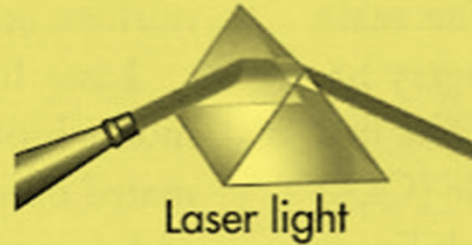
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Goce Delcev University- Stip  
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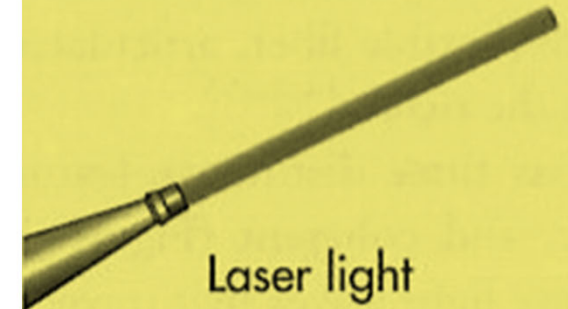
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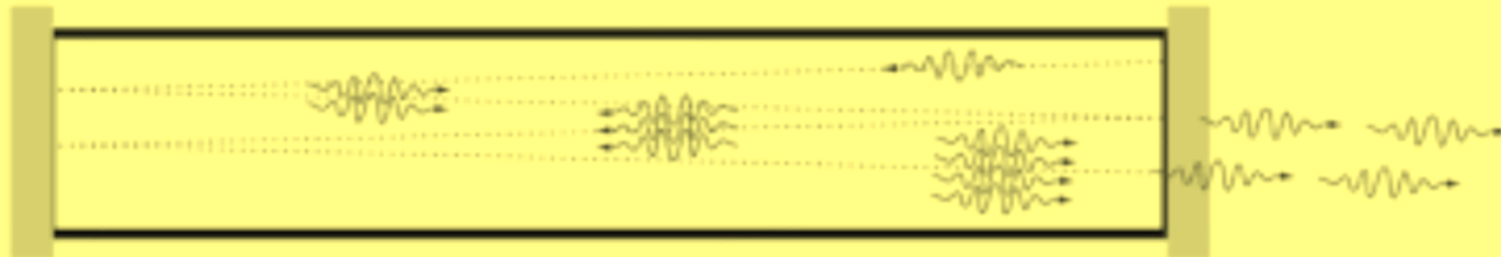
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**THE MOST  
IMPORTANT  
ADVANTAGE**

**DUE TO TRANSMISSION AND SCATTERING EFFECTS, LASER BEAMS CAN REACH AREA THAT CANNOT BE REACHED BY CONVENTIONAL METHODS**

Light Amplification by Stimulated Emission of Radiation



100% reflective  
mirror

99% reflective  
mirror

100% reflective  
mirror

99% reflective  
mirror

## COMMON LASER TYPES USED IN DENTISTRY

Laser type	Construction	Wavelength(s)	Delivery system(s)
Argon	Gas laser	488, 515nm	Optical fiber
KTP	Solid state	532nm	Optical fiber
Helium-neon	Gas laser	633nm	Optical fiber
Diode	Semiconductor	635, 670, 810 830, 980nm	Optical fiber
Nd:YAG	Solid state	1064nm	Optical fiber
Er,Cr:YSGG	Solid state	2780nm	Optical fiber
Er:YAG	Solid state	2940nm	Optical fiber, waveguide, articulated arm
CO2	Gas laser	9600, 10600nm	Waveguide, articulated arm

# WHY IT IS NECESSARY TO DO PERIODONTAL DEBRIDEMENT

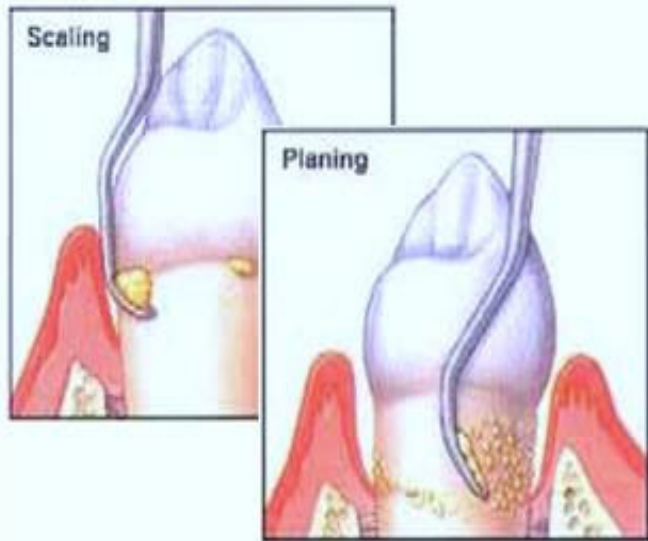
The main goal of periodontal therapy is to eliminate infection and achieve periodontal health through mechanical removal of dental plaque bacterial deposits, hard deposits and their supra- and subgingival endotoxins <sup>1-3</sup>.



**The ultimate goal of all periodontal therapy procedures is to make the treated root surface biologically compatible with the host periodontal tissues. <sup>4</sup>**

1. Badersten A, Nilveus R, Egelberg J. Effect of nonsurgical periodontal therapy. I. Moderately advanced periodontitis. J Clin Periodontol 1981;8:57-72.
2. Badersten A, Nilveus R, Egelberg J. Effect of nonsurgical periodontal therapy. II. Severely advanced periodontitis. J Clin Periodontol 1984;11:63-76.
3. Axelsson P, Lindhe J, Nystrom B. On prevention of caries and periodontal disease. J Clin Periodontol 1991;18:182-189
4. Eschler BM, Rapley JW. Mechanical and chemical root preparation in vitro: efficiency of plaque and calculus removal. J Periodontol. 1991;62(12):755-60

# ROOT SURFACE TREATMENT METHODS



Periodontal Therapy

## MANUAL INSTRUMENTATION, ULTRASOUND INSTRUMENTATION, AND LASER ASSISTED

In modern dentistry, the use of **laser-assisted periodontal therapy** for the removal of granulation tissue, inflamed or diseased epithelial tissue and bacterial deposits and calculus is recommended as an alternative or additional therapeutic modality to **conventional periodontal therapy**.

Aoki A, Sasaki KM, Watanabe H, Ishikawa I. Lasers in nonsurgical periodontal therapy. *Periodontol* 2000 2004; **36**: 59-97



# **OBJECTIVES OF PERIODONTAL DEBRIDEMENT**

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- REMOVAL OF THE SUBGINGIVAL BIOFILM**
- REMOVAL OF HARD DENTAL DEPOSITS**
- RESOLUTION OF INFLAMMATION**
- CONSERVATION OF THE DENTAL SURFACE**
- CREATION OF A BIOLOGICALLY  
ACCEPTABLE ROOT SURFACE**



COMPLETE REMOVAL OF  
BACTERIAL DEPOSITS AND  
THEIR TOXINS FROM THE  
ROOT SURFACE AND  
WITHIN THE  
PERIODONTAL  
POCKETS  
**IS NOT NECESSARILY  
ACHIEVED WITH CONVENTIONAL  
MECHANICAL THERAPY.**

Adriaens PA, Edwards CA, De Boever JA, Loesche WJ. Ultrastructural observations on bacterial invasion in cementum and radicular dentin of periodontally diseased human teeth. J Periodontol 1988;59:493.503.

**.....DEVELOPMENT OF NOVEL SYSTEMS FOR SCALING  
AND ROOT PLANING AS WELL AS FURTHER  
IMPROVEMENT OF CURRENTLY USED MECHANICAL  
INSTRUMENTS, IS REQUIRED.**

Aoki A, Sasaki KM, Watanabe H, Ishikawa I. Lasers in nonsurgical periodontal therapy. *Periodontol* 2000  
2004;36:59.97.



# DENTAL LASERS





In search for more efficient and less difficult instrumentation investigators have PROPOSED LASERS as alternatives or adjuncts for scaling and root planning.

Schwarz F, Sculean A, Georg T, Reich E. Periodontal treatment with an Er:YAG laser compared to scaling and root planing. A controlled clinical study. *J Periodontol* 2001;72:361-7.

Aoki A, Ando Y, Watanabe H, Ishikawa I. *In vitro* studies on laser scaling of subgingival calculus with an erbium: YAG laser. *J Periodontol* 1994;65:1097-106.

Ando Y, Aoki A, Watanabe H, Ishikawa I. Bactericidal effect of erbium YAG laser on periodontopathic bacteria. *Lasers Surg Med* 1996;19:190-20.



LASERS ARE ONE OF THE MOST PROMISING NEW INNOVATIONS FOR NON-SURGICAL PERIODONTAL TREATMENT DUE TO TISSUE MODIFICATION, DETOXIFICATION, AND BACTERICIDAL EFFECTS.

**The Erbium group lasers are one of the mostly studied lasers in periodontics.**

- Aoki A, Sasaki KM, Watanabe H, Ishikawa I (2000) Lasers in non-surgical periodontal therapy. J Periodontol 36:59–97 (2004)
- Maciulskiene V, Kelbauskiene S (2007) A pilot study of Er,Cr:YSGG laser therapy used as adjunct to scaling and root planing in patients with early and moderate periodontitis. Stomatologija 9:21–26
- Amid R, Kadkhodazadeh M, Fekrazad R, Hajizadeh F (2012) Effect of hand, ultrasonic scaler and erbium-doped yttrium aluminum garnet (Er:YAG) laser on the morphology of root surfaces with periodontitis: a comparative in vitro scanning electron microscopy study. J Lasers Med Sci 3:122–126

## EXCELLENT ABLATION EFFECT OF THE ER:YAG LASER ON BOTH SOFT AND HARD TISSUES

Contemporary literature indicates that the use of lasers in periodontal therapy has a significant effect leading to **INHIBITION OF BACTERIEMIA**,<sup>1</sup> **excavation of the EPITHELIUM OF THE PERIODONTAL POCKET**, **effective REMOVAL OF SUBGINGIVAL CALCULUS**<sup>2</sup> and **IMPROVEMENT OF PERIODONTAL REGENERATION** without damaging the surrounding bone and pulp tissue and without producing on smear layer.<sup>3,4,5,6</sup>

1. Pinero J. Nd: YAG-assisted periodontal curettage to prevent bacteria before cardiovascular surgery. *Dent, Today* 1998;17:84-7.

2. Gold SI, Vilardi MA. Pulsed laser beam effects on gingiva. *J Clin Periodontol.*, 1994;21:391-6.

3. Romanos GE. Clinical applications of the Nd: YAG laser in oral soft tissue surgery and periodontology. *J Clin Laser Med Surg.*, 1994;12:103-8.

4. Eberhard J, Ehlers H, Falk W, Açil Y, Albers HK, Jepsen S. Efficacy of subgingival calculus removal with Er: YAG laser compared to mechanical debridement: An in situ study. *J Clin Periodontol.*, 2003;30:511-8.

5. Israel M, Rossmann JA, Froum SJ. Use of the carbon dioxide laser in retarding epithelial migration: A pilot histological human study utilizing case reports. *J Periodontol.*, 1995;66:197-204

6. Takeda FH, Harashima T, Kimura Y, Matsumoto K (1999) A comparative study of the removal of smear layer by three endodontic irrigants and two types of laser. *Int Endod J* 32(1):32-39

# ER:YAG LASER IS ONE OF THE MOST STUDIED LASERS IN PERIODONTOLOGY <sup>12</sup>

Its wavelength is close to the largest absorption peak by water, minimizing thermal side effects when using appropriate laser parameters.



**The Er:YAG laser can be used for the treatment of periodontal hard tissues (debridement of the root surface) as well as for the treatment of soft tissues.**

Ishikawa I, Sasaki KM, Aoki A, Watanabe H. Effects of Er:YAG laser on periodontal therapy. J Int Acad Periodontol 2003; 5: 23–28.

**...DENTAL PLAQUE AND CALCULUS ARE AN IMPORTANT PART OF ANY SYSTEMIC TREATMENT OF PERIODONTAL DISEASE..**

Cobb CM (2002) Clinical significance of non-surgical periodontal therapy: an evidence-based perspective of scaling and root planing. J Clin Periodontol 29(suppl.2):6-16 ISSN 1600-2865

## **AIMS**

**- CREATION OF BIOLOGICALLY ACCEPTABLE ROOT SURFACE**

# **ROOT SURFACE after periodontal therapy**

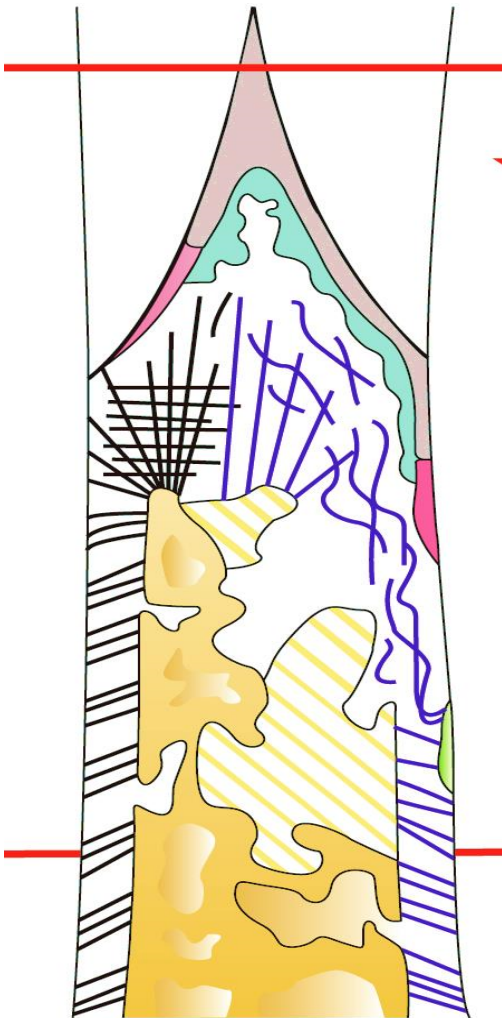
**....A BIOLOGICALLY ACCEPTABLE SMOOTH AND SOLID ROOT SURFACE IS A PREREQUISITE FOR THE MAINTENANCE OF PERIODONTAL HEALTH IN LONG TERM**

Arora S, Lamba AK, Faraz F, Tandon S, Ahad A. Evaluation of the effects of Er,Cr:YSGG laser, ultrasonic scaler and curette on root surface profile using surface analyser and scanning electron microscope: an in vitro study. J Lasers Med Sci. 2016;7 (4):243-249.

# CREATION OF A BIOLOGICALLY ACCEPTABLE ROOT SURFACE

THE SURFACE TO BE CREATED SHOULD BE THE BASIS FOR RECREATING THE SOFT-TISSUE ATTACHMENT

- FORMATION OF A NEW ACELLULAR EXTERNAL FIBRILAR CEMENT ON THE PREVIOUSLY EXPOSED ROOT SURFACE



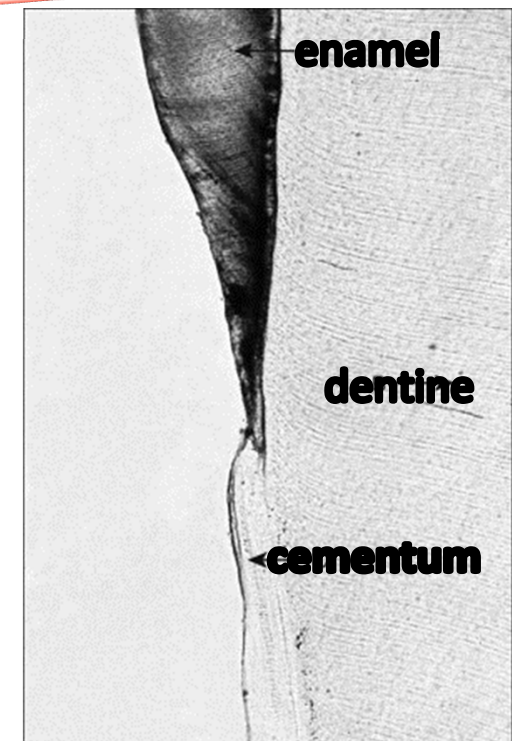
# The use of the Er:YAG laser enables the creation of better conditions for the adhesion of fibroblasts compared to the independent treatment of the root surfaces with mechanical methods

- 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 planing on the biocompatibility of periodontally diseased root surfaces in cultures of human PDL fibroblasts. *Lasers Surg Med* 2003; 33: 140–147.
- Schwarz F, Putz N, Georg T, Reich E. Effect of an Er:YAG laser on periodontally involved root surfaces: an in vivo and in vitro SEM comparison. *Lasers Surg Med* 2001; 29: 328–335.
- Feist I, Micheli G, Carneiro S, Eduardo C, Miyagi S, Marques M. Adhesion and growth of cultured human gingival fibroblasts on periodontally involved root surfaces treated by Er:YAG laser. *J Periodontol* 2003; 73: 1368–1375.



# ROOT SURFACE

**There is significantly greater cellular connectivity on in vivo laser-treated root surfaces compared to mechanically treated root surfaces**



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 planing on the biocompatibility of periodontally diseased root surfaces in cultures of human PDL fibroblasts. *Lasers Surg Med* 2003; 33: 140– 147.



## LASER CLASSIFICATION ACCORDING TO POTENTIAL HAZARDS

Class	Risk	Example
I	Fully enclosed system	Nd:YAG laser welding system used in a dental laboratory
II	Visible low power laser	Visible red aiming beam of a protected by the blink reflex surgical laser
III a	Visible laser above 1 mW	No dental examples
III b	Higher power laser unit (up to 0.5 watts) which may or may not be visible. Direct viewing hazardous to the eyes	Low power (50 milliwatt) diode laser used for biostimulation
IV	Damage to eyes and skin possible. Direct or indirect viewing hazardous to the eyes	All lasers used for oral surgery, whitening, and cavity preparation (output powers of more than 500 mW)



## **ADVANTAGES AND DISADVANTAGES OF USING LASERS IN PERIODONTAL TREATMENT**

### **• Advantages**

- Painlessness**
- Bactericidal effect**
- Prevents bleeding**
- Short duration of interventions**
- It removes only cariously altered tissue**

### **• Disadvantages**

- Expensive appliances**
- Need for additional training**
- Need for additional protection**
- Expensive consumables**



## BENEFITS

- Possibility of cutting, coagulation, ablation and vaporization of elements from target tissues
- Coagulation of small blood vessels (allowing a dry working field in surgical interventions)
- Coagulation of small lymphatic vessels (leading to reduction of post-operative edema)
- Sterilization of the tissues (because of the heat destruction of the bacterial membranes occurs)
- Reduction of the appearance of postoperative scars



# CONCLUSIONS

Dental lasers, as a modern tool, can find numerous indications in everyday dental practice. The numerous advantages that the laser possesses as a tool should be the reason for its increasing use in various types of dental interventions. Common use of lasers is reduced to a small number of interventions depending on the knowledge and routine of the clinician. By introducing modern educational programs this situation could be improved.



**Thank you for your  
attention!!  
Any questions?**