IMMUNOHISTOCHEMICAL AND HISTOMORPHOMETRIC ANALYSIS OF EARLY PHASE OF WOUND HEALING FOLLOWING LOW INTENSITY LEVEL ER:YAG LASER ASSISTED POCKED DEBRIDEMENT

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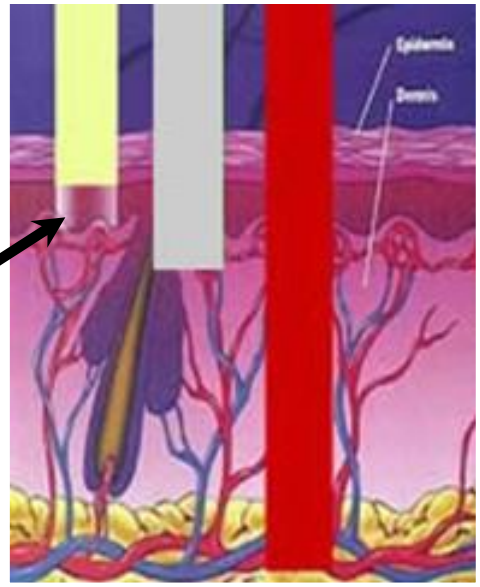
TOPIC 1

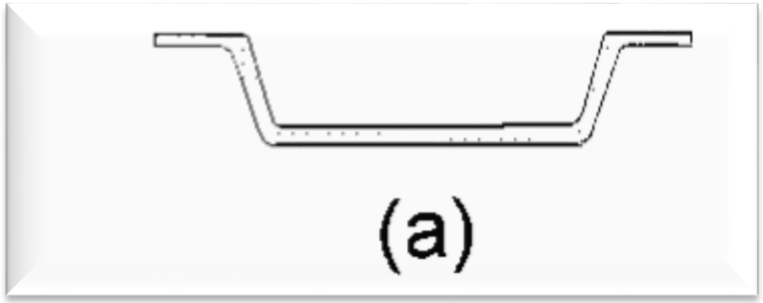
HAVE THE ABILITY TO EFFECTIVELY ABLATE, INCISE AND EXCISE BIOLOGICAL TISSUE: SOFT and HARD
The" ALL TISSUE LASER".

WHY ER:YAG LASER?

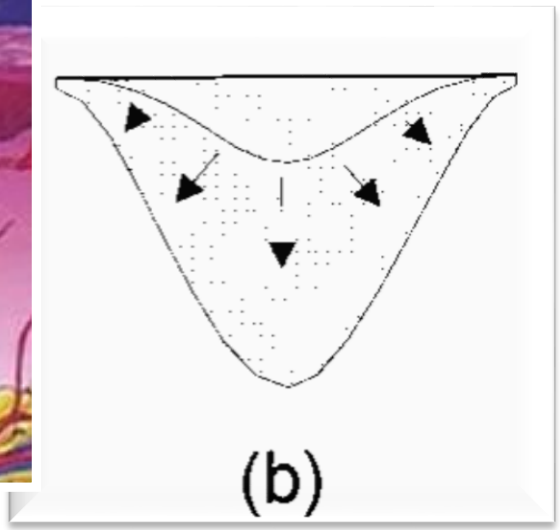
PENETRATION DEPTH OF ER:YAG LASER OF ONLY A FEW mm ALLOWS FOR PRECISE CONTROL OF THE DESIRED EFFECT ON TISSUE.

Er:YAG
Highest absorption





When applying a laser **pulse energy above the ablation threshold, precise removal of upper layers** can be achieved with almost no thermal deposition.



When **thermal effects** are desired (coagulation, heating of collagen fibers), the laser **energy** is reduced **below the ablation threshold** and an **increased repetition rate** is applied. Heat will be spread into deeper layers by thermal diffusion.

HOW IT HAPPENS?

AS THE ER:YAG LASER ENERGY INTERACTS WITH THE HARD TISSUE MATRIX, WATER ABSORBS THE LASER ENERGY AND PHOTOTHERMAL REACTION TAKES PLACE,

THE STEAM GENERATED WITHIN THE HARD TISSUE MATRIX IS ASSOCIATED WITH A VOLUMETRIC EXPANSION AND GREATLY INCREASED PRESSURE WITHIN THE MATRIX,

THIS IN TURN PRODUCES MICROEVAPORATIVE EXPLOSIONS THAT RESULT IN A THERMALLY DRIVEN, MECHANICAL ABLATION OF THE TOOTH STRUCTURE.[6]

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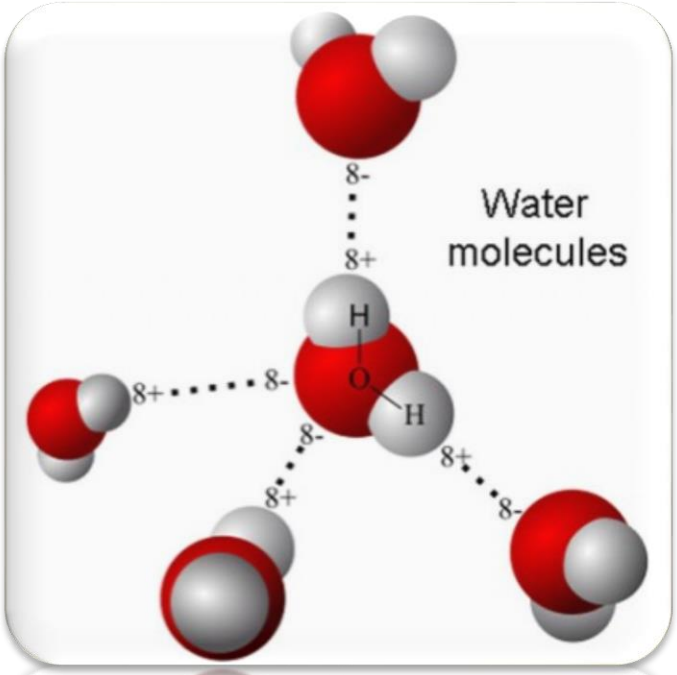
6. Welch AJ, Van Gemert MJC. *Optical-Thermal Response of Laser-Irradiated Tissue*. New York, NY: Plenum Pub Corp; 1995:865-902.

WHY IT HAPPENS ?

AS THE ENERGY OF THE ER:YAG PHOTONS IS ABSORBED BY THE CHROMOPHORE (MOLECULAR WATER), IT IS CONVERTED TO VIBRATIONAL AND ROTATIONAL ENERGY WITHIN THE TARGET MOLECULES, WHICH IS THE MOLECULAR BASIS FOR HEAT.



Hydrogen bonds between water molecules.

IT IS THIS TRANSFER OF ENERGY (TO WATER) THAT WILL CAUSE EXPANSION AND PRESSURE IN A CONFINED ENVIRONMENT (THE TOOTH), LEADING TO THE EXPLOSIVE "THERMAL-MECHANICAL ABLATION" OF TOOTH STRUCTURE.[7]

7. Lussi A, Megert B, Longbottom C, et al. Clinical performance of a laser fluorescence device for detection of occlusal caries lesions. *Eur J Oral Sci.* 2001;109(1):14-19.

TOPIC 2

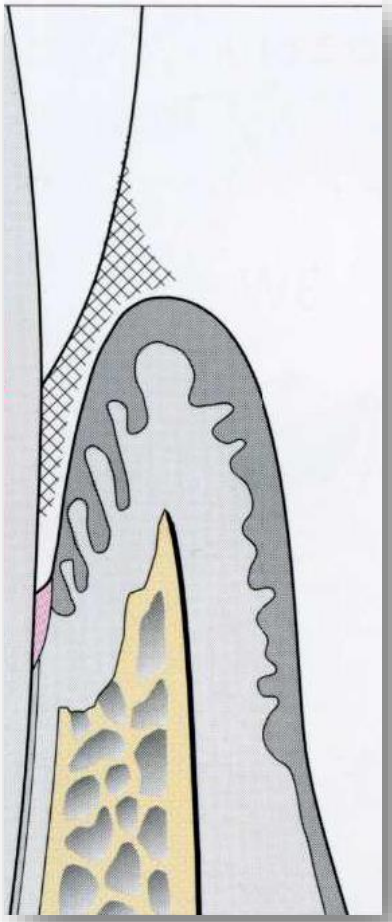
TRADITIONAL NON-SURGICAL POCKET TREATMENT

POCKET DEBRIDEMENT

The periodontium is a connective tissue organ that is protected by epithelium

Chronic periodontitis is defined as inflammation of the gingiva extending into the adjacent attachment apparatus.

The disease is characterized by loss of clinical attachment due to destruction of the periodontal ligament and loss of the adjacent supporting bone.



J Periodontol. 2000 May;71(5 Suppl):i-ii, 847-83. **Parameters of Care. American Academy of Periodontology.**

1. Hand instruments treated group after 24h versus 72h
T-test for Dependent Samples
Marked differences are significant at p < .05000

RESULTS

Tab.1

	Mean	Std.Dv.	N	Diff.	Std.Dv.	t	df	p
Myelo/Cont/24.	108.1333	10.48037						
Myelo/Cont/72	140.9333	13.55658	15	-32.800	16.60120	-7.6521	14	0.000002
CD68Cont/24	29.6000	4.22239						
CD68/Cont/72	123.8667	17.27453	15	-94.267	19.93728	-18.3121	14	0.000000
CD34Cont/24	13.5333	2.35635						
CD34/Cont/72	24.4667	5.96258	15	-10.933	6.63827	-6.3789	14	0.000017
Vimen/Cont/24	76.9333	10.76016						
Vimen/Cont/72	253.9333	62.71417	15	-177.000	64.80520	-10.5781	14	0.000000

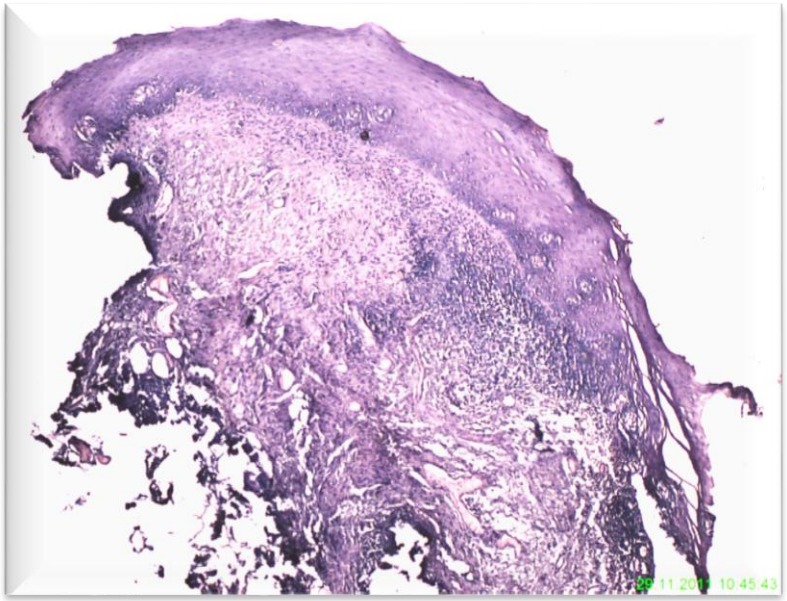


Fig. 1 (Magnification x40) Inner periodontal pocket area treated with curette.

THERE significant differences on all parameters between 24h and 72h in tested SAMPLES

After **hand curettage** the underlying connective tissue was disorganized with pronounced surface irregularities.

CONCLUSION

WE BELIEVE THAT RELATIVELY LOW POSTOPERATIVE CELLULAR INFLAMMATORY RESPONSE SEEN IN LASER TREATED GINGIVAL TISSUE COMPARED TO HAND INSTRUMENTATION CAN BE ATTRIBUTED TO THE VERY NARROW ZONE OF THERMAL DISRUPTION AND TO THE MINIMAL INVASIVE INSTRUMENTATION OF POCKET WITHOUT LEADING TO MAJOR TRAUMA OF THE SOFT TISSUES.

IN THE STUDY WE FOUND HIGHER CD34 EXPRESSION FOR LASER TREATED GROUP, WE HYPOTHESIZED THAT THESE FINDINGS CAN BE ADDRESSED TO LASERS TRANSFER OF ENERGY TO SURROUNDING TISSUES IN THE FORM OF HEAT ABLE TO INDUCE A HEAT SHOCK RESPONSE WHICH MIGHT HAVE AN IMPACT ON ENDOTHELIAL CELL MIGRATION AS ESSENTIAL TO ANGIOGENESIS AND REPAIR.