

Recently we became interested in a totally new wave length that could be used for dental purposes (2780 nm).

The used laser type is an Er Cr:YSGG Hydrokinetic Laser (Millennium Waterlase by Biolase, San Clemente/California, U.S.A.) with a fiberoptic transmission system. The patented Waterlase technology with an aiming pulsed laser creates the energized water molecules and initiates the cutting of the selected material regarding to the applied power and water-air-mixture.

Disposable color-coded tips are based on the different indications. The cutting focal point is 1mm from the tip.

Our clinical results show that working especially on hard tissues can be done faster than ever before with any available type of laser – and in a clinically relevant time. The ability to remove hard tissue precisely and rapidly without smear layer, heat production and vibration makes it an highly valued instrument. Besides it also can be applied in soft tissue indications. The laser cuts effectively and coagulates with low power.

The need for anesthesia is eliminated in most cases. The new hydrokinetic laser is a useful tool in the wide range of instruments in dentistry. The high patient acceptance instead of using a drill in many cases of cavity preparation make this laser forget the drill in many treatment cases and helps to make our dental service attractive and convenient for our patients.

28

Role of Water Irrigation during Erbium Laser Ablation of Hard Dental Tissue: Evaluation of the Effects of Atomized Water Spray vs Water Surface Film

*R.J.Freiberg, D.Boutossov, C.Cozean
EnO Vision, Lake Forest, USA*

Background and Objective: A number of investigators have shown the ability of erbium lasers, enhanced by a thin film of water, to ablate dental tissue due primarily to the laser initiated subsurface expansion of the interstitial water in enamel. It has recently been suggested that laser atomized water droplets (“hydrokinetic effect”) further enhances ablation of the tooth.

Study Design: Four methods of investigation were used to evaluate the hydrokinetic effect including: 1) theoretical, 2) ablation of known optical materials without interstitial water, 3) ablation of teeth with and without atomized water particles, and 4) comparison of 2 Erbium lasers with and without the hydrokinetic effect. **Results:** Theoretical analysis casts doubt upon the effectiveness of water atomized particles to enhance cutting. No ablation occurred in optical materials without interstitial water. The volumetric ablation rates of the enamel measured with two dental laser systems exhibited similar dependence upon the pulse energy of the laser. The surface characteristics of the ablated craters were also similar.

Conclusions: The proposed hydrokinetic effect does not contribute in any significant degree in the ablation of dental enamel.

29

Absorption Band Characterization by FTIR Spectroscopy of Dentin Tissue Irradiated by Erbium Laser at Sub-Ablative Energy Densities

*D.M.Zezell, L.Bachmann, R.Dibold, R.Hibst
Instituto de Pesquisas Energéticas e Nucleares; Institut für Laser Technologie in Medizin und Meßtechnik*

The purpose of this work was to characterize, using Fourier Transform Infrared Spectroscopy (FTIR), the alteration in dentin following irradiation with erbium laser at energy densities below the ablation threshold. Samples were prepared from bovine incisor teeth, and ground using a diamond disc as thinly as possible (80-40 µm) in order to provide a good infrared signal. The irradiation was carried out with an erbium laser

($\lambda = 2.94 \mu\text{m}$) and energy densities ranging from $0.365\text{J}/\text{cm}^2$ to $1.940\text{J}/\text{mm}^2$. An FTIR spectrometer with a spectral range of 4000 cm^{-1} to 400 cm^{-1} ($2.5 \mu\text{m}$ to $25 \mu\text{m}$) was used. An alteration in the spectral range was observed at 1201 cm^{-1} , where the band changed to a shoulder at the highest energy densities. Another alteration, assigned to a water band, was the sharpening of the band centered at 3300 cm^{-1} . This sharpening corresponds to the loss of adsorbed water in the dentin surface when irradiated with energy densities below the ablation threshold. The loss of the water in the dentin tissue is a reversible process since the majority of the water is not part of the structure. A diminution in the band centered at 1201 cm^{-1} was tentatively assigned to organic material present in the tissue.

30

Effect of Erbium Cr:YSGG Laser on Human dentin Collagen. A preliminary study

E.T.Farmakis, E.Kontakiotis, N.Kouvelas

Dept of Endodontology of University of Athens, Greece.-

EURODENTICA S.A.

The aim of this study was to determine any changes to the organic substrate of human dentin under the use of Hydrokinetic Effect of Biolase Technology Millennium Laser of Erbium Cr : YSGG.

The changes occurring were determined by using 5% ninhydrine, a substance that produces chromatic changes to the substrate, upon the presence of available carbohydrate and amino-groups .

Fifteen standardized human dentin discs (each 2 mm thick) were prepared, divided in halves and organized in 3 equal groups.

In group A, one half was exposed to 3,5watt Laser and the remaining served as control.

In group B, one half was exposed to 6watt Laser and the remaining served as control.

In group C, both halves were etched, one half was exposed to 3,5watt Laser and the remaining served as control.

All discs were immersed for 3h in 5% ninhydrine solution and then examined under light microscope ($\times 10$ and $\times 20$ magnification)

Results showed that control areas from groups A+B showed similar color changes (a blue-reddish color) whereas the lased subjects showed circular areas with no color changes surrounded by deep blue rings.

The etched control subjects showed white areas disturbed by light-blue lines.

From this preliminary study it is suggested that there is a severe change of human dentin collagen under the use of Hydrokinetic Effect of Biolase Technology Millennium Laser and lesser changes occur after the use of etchant.

31

The Ablation Threshold of Er:YAG and Er:YSGG Laser Radiation in Dental Enamel

C.Apel, J.Meister, R.S.Ioana, N.Gutknecht

Department of Conservative Dentistry, Periodontology and Preventive Dentistry, University of Aachen, Germany; Institute of Lasermedicine, Heinrich Heine University, Düsseldorf, Germany

The scientific investigation of fundamental problems plays a decisive role in understanding the mode of action and the consequences of the use of lasers on biological material. One of these fundamental aspects is the investigation of the ablation threshold of various laser wavelengths in dental enamel. Knowledge of the relationships and influencing factors in the laser ablation of hard tooth tissue constitutes the basis for use in patients and the introduction of new indications.

The present paper examines the ablation threshold of an Er:YAG laser ($\lambda = 2940 \text{ nm}$) and an Er:YSGG laser ($\lambda = 2790 \text{ nm}$) in human dental enamel. To this end, 130 enamel samples were taken from wisdom teeth and treated with increasing energy densities of 2 to $40 \text{ J}/\text{cm}^2$. The sample material was mounted on a auto-