Oral Communications Afternoon (16h - 17h45)

PHYSICS IN MEDICINE

[12/05/10 - 16h00 - Room 10]

Optical Diagnosis of Dental Caries By Using Near Infrared Laser Transillumination, Marília Wellichan Mancini, Luciana Almeida-Lopes, Hermes Pretel, *DMC Equipamentos*, Emerson Cristiano Barbano, *Instituto de Física de São Carlos - Universidade de São Paulo*, Luis Carlos Trevelin, Jander Moreira, Denis Henrique Pinheiro Salvadeo, Paulo Eduardo Papotti, Rafael Loosli Dias, *Departamento de Computação-Universidade Federal de São Carlos* ■ In the last decades several optical methods have been proposed in order to allow for enhanced diagnostic of dental caries by using non-ionizing electromagnetic sources. Most of them are based on light induced fluorescence (LIF), allowing for information from both fluorescence images and spectroscopic measurements, optical coherence tomography (OCT) and transillumination (TI). Oppositely to the fluorescence methods, that do not present any direct correlation to the caries demineralization process, the TI method is based on the enhanced scattering properties of demineralized hard tissues in contrast to sound tissue that leads to the observed contrast in the TI dental images. As for TI purposes, the near infrared (NIR) region of the electromagnetic spectrum is the most suitable due to the highest enamel and dentin transparence to light, allowing for better image quality in comparison to that obtained by using visible wavelegths. We have used a 808 nm fiber-coupled diode laser source providing 100 mW maximum output power (Thera Lase - DMC) for transillumination of dental elements and a CCD device camera in order to obtain information on several types of caries lesions including: incipient caries lesions on the occlusal surface, approximal lesions, in-depth examination of morphological details on the enamel surface, namely cracks and early fractures, as well as detailed assessment of the restoration-enamel boundaries whose deffects can lead to secondary caries. Hidden caries in dentin and secondary caries were observed as well. Image processing has been used to treat and analyze NIR images in order to obtain information on the shape and evolution level of dental lesions from the laser based transillumination images. In addition to be a non-invasive and non-ionizing, NIR laser TI (NIR LTI) method has proven to have potential to provide both qualitative and quantitative information as an improved diagnostic tool of dental caries in comparison to the current clinically available methods.

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[12/05/10 - 16h15 - Room 10]

AFM evaluation of morphologic and topographical alterations in Escherichia coli after PDT, Walter Miyakawa, *Divisão de Fotônica - Instituto de Estudos Avançados, São José dos Campos, SP*, Silvia Cristina Nunez, Martha Simões Ribeiro, Aguinaldo Silva Garcez, *Centro de Lasers e Aplicações - Instituto de Pesquisas Energéticas e Nucleares, São Paulo, SP* ■ In antimicrobial PDT (photodynamic therapy), bacterial cells inactivation is strongly dependent on the interaction of the photosensitizer with the cell envelope. The aim of this work was to evaluate, by atomic force microscopy (AFM), the alterations caused by red laser irradiation on a Gram negative microorganism (Escherichia coli) using the methylene blue as a photosensitizer. Cells culture were grown until a stationary phase to reach a concentration of approximately 108 cells/mL allowing the production of extracellular slime in a biofilm-like structure. The cells including the extracellular matrix were spread on a clean glass coverslip, and their structures observed using a Shimadzu SPM 9500J3 AFM operating in non contact dynamic mode. Subsequently, a water solution of methylene blue at 60 μM was applied over the same cells. After waiting a pre-irradiation time of three minutes, the cells were illuminated with a diode laser (λ=660 nm, output power 40 mW, fluence 180 J/cm^2, beam diameter 0,04 cm^2) for three minutes. AFM images of the treated cells were then obtained. A second set of experiments was performed with fewer cells per area, without extracellular slime, and other laser conditions (10 min of irradiation at 600J/cm^2). The results showed alterations on cellular scaffold markedly dependent on the number of cells, fluence, and the presence of extracellular slime. The slime is targeted by the photosensitizer, and after irradiation a destruction of the matrix was observed. When fewer cells were evaluated with higher fluence, the destruction was much more evident. The AFM images suggested rupture of the cellular membrane and cellular fragments were observed. These preliminary findings indicate that the combination of a sensitizer and a specific wavelength can lead to the loss of the bacterial surface integrity, and depending on the studied parameters dramatic changes of the cell shape can be detected by AFM. Therefore, AFM seems to be a powerful tool to investigate parameters associated with photodestruction of microorganisms.

[12/05/10 - 16h30 - Room 10]

THERMAL DIFFUSIVITY MEASUREMENT OF ENAMEL AND DENTIN AS FUNCTION OF TEMPERATURE OBTAINED BY INFRARED THERMOGRAPHY., PEREIRA TM, ZAMATARO CB, ZEZELL DM, *Centro de Lasers e Aplicações IPEN - CNEN/SP* ■ The goal of present study was developed a software that calculates automatically, the thermal diffusivity value as function of temperature in materials. The infrared thermography technique was used for data acquisition of temperature distribution as function of time. These data were used to adjust a temperature function obtained from the homogeneous heat equation with specific boundary conditions. For that, an infrared camera (detecting from 8 μm to 9 μm) was calibrated to detect temperature ranging from 185 ^{o}C up to 1300 ^{o}C at an acquisition rate of 300 Hz. It was used, 10 samples of dental enamel and 10 samples of dentin, with 4 mm x 4 mm x 2 mm, which were obtained from bovine lower incisor teeth. These samples were irradiated with an Er:Cr:YSGG pulsed laser (λ = 2,78 μm). The resulting temperature was recorded 2 s prior, 10 s

during irradiation and continuing for 2 more seconds after it. After each irradiation, all obtained thermal images were processed in the software, creating a file with the data of thermal diffusivity as a function of temperature. Another file with the thermal diffusivity values was also calculated after each laser pulse. The mean result of thermal diffusivity obtained for dental enamel was 0,0084 ± 0,001 cm^2/s for the temperature interval of 220-550 ^oC. The mean value for thermal diffusivity obtained for dentin was 0,0015 ± 0,0004 cm^2/s in temperatures up to 360 ^oC; however, this value increases for higher temperatures. According to these results, it was possible to conclude that the use of infrared thermography, associated with the software developed in this work, is an efficient method to determine the thermal diffusivity values as a function of temperature in different materials.