Atomic force microscopy and power spectrum density analysis of dentin tissue irradiated with Er,Cr:YSGG laser

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This study aimed to evaluate the surface microtopographic changes on root dentin caused by Er,Cr:YSGG laser when applied for a clinical protocol in dentistry. For that, eight polished 4 x 4 x 2 mm slabs of bovine root dentin were randomly distributed in 2 experimental groups: G1 – non irradiated dentin; G2 - dentin irradiated using an Er,Cr:YSGG laser (λ = 2.78µm), at repetition rate of 20 Hz, with 750 µm diameter sapphire tip and energy density of 2.8 J/cm^2 (12.5 mJ/pulse). After irradiations, surface topography was analyzed by atomic force microscopy (AFM) using a Si probe in tapping mode. Quantitative and qualitative information concerning the mean average roughness (Ra) and power spectral density (PSD) analysis were obtained of center, intermediary and peripheral areas of laser pulses and compared with data of non irradiated samples. Final mean values data of roughness (Ra), considering the region analyzed (central, intermediary, periphery or non-irradiated ones) were statistically analyzed by one-way analysis of variance (ANOVA) and then by Tukey's test. In the AFM analysis, it was observed that the central region of laser pulses presented higher ablation of intertubular dentin, with about 340-760 nm height, while intermediary, peripheral and non-irradiated regions presented no difference in height of peritubular and intertubular dentin. The Ra values obtained were: center of pulses: 261.26±21.65 nm, intermediary region of pulses: 83.48 ±6.34 nm, periphery of pulses: 45.8±13.47 nm, non-irradiated samples: 35.18±2.9 nm. The PSD analysis of dentin demonstrated that irradiated areas presented higher contribution of all morphological wavelengths in comparison with the non-irradiated samples. In this analysis, the irradiated samples exhibited the formation of morphological wavelengths of 250-170 nm in the periphery region of laser pulses, of 250-100 nm in the center region of laser pulses and of 250-50 nm in the intermediary region of laser pulses. According to these results, we can assume that even when used at low energy density parameter, Er,Cr:YSGG laser is able to promote a significant alteration on the

microtopography of radicular dentin, which is an important aspect to be considered when laser is used for a specific clinical application. Supported by FAPESP (Proc. 1995/5651-0 and 2006/06746-0) and CNPq (Proc. 473723/2007-7 and 143395/2009-2)