Influence of Er,Cr:YSGG and Nd:YAG laser on enamel and dentin composition when irradiated at preventive purposes

Patricia Aparecida da Ana, Felipe Guimarães Albero,Denise Maria Zezell
Centro de Lasers e Aplicações, IPEN - CNEN/ SP

Luciano Bachmann
Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, FFCLRP-USP

The present study evaluated the dental enamel and dentin after Nd:YAG laser irradiation, compared with Er,Cr:YSGG lased and non-treated surfaces, using Fourier Transformed Infrared (FTIR) spectroscopy.
Thirty 5 x 5 x 2 mm slabs of sound enamel and dentin were obtained from fifteen freshly extracted bovine teeth. After planning and polishing, samples were ramdomly divided into six groups with five samples each: G1) unlased enamel; G2) unlased dentin; G3) enamel irradiated with Er,Cr:YSGG laser (λ= 2.78 μm) at 5.6 J/cm^2 and 25 mJ/pulse; G4) dentin irradiated with Er,Cr:YSGG laser at 2.8 J/cm^2 and 12.5 mJ/pulse; G5) enamel irradiated with Nd:YAG laser (λ= 1.064 μm) at 84.9 J/cm^2 and 60 mJ/pulse, and G6) dentin irradiated with Nd:YAG laser at 84.9 J/cm^2 and 60 mJ/pulse. The specimen surfaces were subjected to analysis by Atenuation Total Reflexion- Fourier transform infrared spectroscopy (ATR-FTIR - OMNIC, ThermoNicolet, USA), under the following conditions: 4000-650 cm^{-1} range, 4 cm^{-1} resolution and 120 scans. For analysis of enamel, it was considered the region between 883 cm^{-1} to 1070 cm^{-1} for phosphates and 1300 cm^{-1} to 1600 cm^{-1} for carbonates and organic contents; for dentin analysis, it was considered the region between 883 cm^{-1} to 1070 cm^{-1} for phosphates; 1200 cm^{-1} to 1400 cm^{-1} for amide III; 1400 cm^{-1} to 1600 $cm^{-1}$for amides I and II and 1600 cm^{-1} to 1700 cm^{-1} for water and amide I. The ratios of the bands area were analyzed and the relative changes in organic and inorganic components after laser irradiation were compared using the ratio content/phosphates. After that all data were subjected to statistical analysis at 5% significance level.
The FTIR profiles of enamel irradiated with Er,Cr:YSGG laser were similar to those from control samples, showing a slight decrease on carbonate components. After Nd:YAG irradiation, it was observed a significant decrease of organic content of enamel. In contrast, both Er,Cr:YSGG and Nd:YAG lasers promoted a significant decrease on the contents of amides I, II and II and on carbonate of dentin, evidencing that those laser treatments caused a decrease of the organic contents of dentin.
In conclusion, high intensity laser irradiation promoted changes mainly on organic and carbonate contents of both enamel and dentin, with can be correlated wich the mechanism of the resistance improvement of these tissues to demineralization. FAPESP/CEPID 05/51689-2 and Procad/Capes 0349054.