Evaluation of thermal stability of human dental tissue using Fourier Transform Infrared Spectroscopy

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Determination of the chemical changes that temperature can induce in enamel and dentine was carried out, in order to. Correlate the tissue thermal stability with the temperatures that laser irradiation produce on tissues during dental treatment. To this end, tissue powder (5mg) heated until 1200 °C, with a 50 °C-step, was employed. A mixture of the tissue with potassium bromide (100mg) produced the pellets used for transmission measurements in an FTIR spectrometer. Three samples were obtained for each evaluated temperature and analyzed tissue, resulting in a total of 150 samples. Spectra were acquired by FTIR (Nicolet, 380, USA). With 2cm^{-1} resolution, 32 scans 4000-400 cm^{-1} spectral range. The absorption bands were assigned according to the literature, and the area and full width ah half maximum (FWHM) was calculated for every band by means of a program developed in MATLAB. Areas calculated by the program developed in MATLAB agreed with the values obtained manually using the Origin program, thus confirming that the former can be employed in the calculation of a large quantity of samples and bands. In the organic matrix, the C-H presents a decrease of approximately 10% from the initial value at 400 °C, the same temperature where collagen is totally eliminated in dentine. The mineral matrix is more resistant: the carbonate shows an increase at 400 °C and presents about 10% maximum value when the tissues are heated until 1000 °C. The area of the phosphate bands increase around 700 °C, falling to 15% of the initial value at 1200 °C. The water is practically eliminated next to 800 °C. The mineral matrix of the tissues is more resistant to temperature variations compare with the organic matrix. The latter is virtually eliminated by 500 °C.