Thermal diffusivity measurement of enamel and dentin as function of temperature obtained by infrated thermography.

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In this work, it 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 ºC up to 1300 ºC 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.