G3 Selection of Analytical Techniques for Teeth According to Conservation and Conditions After Being Exposed at Different Temperatures

Nancy Vargas Becerril, PhD, National Autonomous University of Mexico, Av Universidad 3000, Coyoacán, Copilco Universidad, Mexico City 04510, MEXICO; Marco A. Alvarez-Perez, PhD, National Autonomous University of Mexico, Av Universidad 3000, Coyoacán, Copilco Universidad, Mexico City 04510, MEXICO; Lorena Valencia Caballero, PhD, Licenciatura en Ciencia Forense, Circuito de la Investigación Científica s/n, Av. Universidad 3000, Facultad de Medicina, Ciudad Universitaria, Distrito Federal 04510, MEXICO; and Ivet Gil, PhD, Unam Facultad De Medicina, Cto. De La Investigacion S.N. Cd. Universitaria, Licenciatura En Ciencia Forense, Mexico City 04510, MEXICO*

After attending this presentation, attendees will be aware of other analytical techniques to obtain information from burned teeth.

This presentation will impact the forensic science community by presenting other analytical techniques in each case, depending on the conditions and damage inflicted by the temperature, on mineralized tissues.

Forensic science is interested in the study of tissues heated at high temperatures. Several studies have reported high temperature effects, including color change, modification of mechanical properties, crystallization, porosity, and crystal size.[1] Techniques such as Fourier Transform Infrared Spectroscopy (FTIR), X-Ray Diffraction (XRD), Mass Spectrometry (MS), and Thermogravimetric Analysis (TGA) can be used to characterize physicochemical properties in mineralized tissues exposed to high temperatures; however, the mineralized tissues become brittle, which makes analysis difficult. The best strategy for analysis of mineralized teeth exposed to high temperature is still unknown.[2]

The goal of this work was to determine suitable techniques for the analysis of burned tooth samples depending on the tooth conditions and damage. Human dental organs were analyzed after exposure to temperatures ranging between 100°C and 1,200°C (intervals of 100°C) for three hours. TGA and MS analyses identified lost mass at each temperature due to chemical reactions resulting from tissue decomposition. Dentin undergoes major mass loss at temperatures ranging between 100°C and 600°C, whereas enamel undergoes major mass loss at higher temperatures. Microstructural analyses using optical microscopy and Scanning Electron Microscopy (SEM) detected physical damage on the dental organ surfaces, color changes, and high temperature-induced embrittlement. FTIR analysis identified characteristic bands of the enamel and dentin phases at each tested temperature. The dentin bands were present from 100°C to 600°C, but were absent at temperatures higher than 600°C, whereas the enamel bands are more prominent at temperatures higher than 600°C. This indicates the elimination of the organic phase and a modification of the inorganic phase through crystallization.

These results suggest that it is possible to analyze structural changes such as the loss of organic matter in teeth exposed to high temperatures under controlled conditions; however, this technique has limited application under real-world conditions due to variations in soft tissues, environmental conditions, and time.

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Reference(s):

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2. Thompson T.J.U., Gauthier M., Islam M. The application of a new method of Fourier Transform Infrared Spectroscopy to the analysis of burned bone. *Journal of Archaeological Science* 36 (2009) 910−914

Teeth, Temperature, Identification

*Presenting Author