G42 Teeth and Fire: Forensic Analysis of Teeth and Dental Material Exposed to Fire

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After attending this presentation, attendees will better understand the macroscopic changes undergone by burned teeth as well as some of the techniques that can be applied in their analysis.

This presentation will impact the forensic science community by illustrating the usefulness of integrating the observations obtained from the analysis of burned dental remains from different contexts, such as forensic cases, commercial cremations, and experimental studies.

Burned skeletal remains are associated with different scenarios of forensic interest, including traffic accidents, explosions, domestic fires, plane crashes, or natural disasters. Fire also is used to destroy forensic evidence in criminal cases, and commercial cremations can raise forensic questions related to identification or commingling issues. Different techniques are useful in the analysis of burned remains, including macroscopic, X-ray, and molecular DNA analyses. Macroscopic analysis focuses on parameters such as color changes, fire-related fracturing, detection of dental treatments and prostheses, and anatomical traits useful for identification. Radiographic analysis detects antemortem dental treatments, fire-related changes in the physical properties of dental materials, and non-visible dental fractures. The integration of these analyses can help to detect and select suitable or more promising samples for DNA analysis.

First, the results of 40 commercial cremations from the Memora Funeral Home (Salt, Girona, Spain), which were examined and documented using standardized protocols before and after cremation, are presented. The retort conditions (temperature and time of exposure) were essentially the same for all individuals included in the study. Commercial cremation is one of the more destructive treatments of human remains. This process involves burning the body until all organic materials are destroyed by heat, followed by pulverization of the burnt remains before returning the ashes to the family. In spite of the destruction of some dental structures during the burning process, this presentation illustrates how analysis of cremains before pulverization can still provide relevant information for comparison with dental records, including dental prostheses and typical heat-induced dental alterations.

Second, the results of a laboratory study directed at evaluating the macroscopic changes induced on teeth by heat exposure under controlled time and temperature conditions, and their effect on the effectiveness of DNA extraction and Short Tandem Repeat (STR) profiling are presented. Burned teeth followed the same macroscopic pattern previously described for bones, reaching a chalky white condition in 5 minutes at 400ºC; however, fractures were observed from 10 minutes at 300ºC, with differences between crowns and roots. DNA extraction was not possible from groups treated at 400ºC for 10 and 15 minutes; 500ºC for 15 minutes; 600ºC for 5 minutes; and 700ºC for 5, 10, and 15 minutes. For STR profiling, full amplification was possible after cremation, although it was very low after 1-5 minutes at 300ºC.

Last, an identification case example is presented in which DNA analysis could not distinguish between two brothers who died in the same car accident, but identification of each was possible through odontology.

Burned Human Remains, Burned Teeth, Forensic Odontology

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