G13 Mass Loss Reaction of Root Canal Materials Exposed to Thermal Radiations: Forensic Interest in Fire Disaster Modeling

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The goal of this presentation is to provide an understanding of how root canal materials could help investigators in fire disaster modeling that involve victims.

This presentation will impact the forensic science community in fire disaster modeling by submitting the outcomes found following an experimental study conducted in association with the Section of Engineering Fire in the Central Laboratory of Police of Paris (LCPP), France. The benefit of this study lies in the continuity of a previous study on dental tissues used in fire modeling. These findings could be used in fire disasters that involve victims.

In the oral cavity, dental roots are protected by alveolar bone. The endodontic material is the most preserved dental material when bodies are severely burned, such as during fire disasters or airplane crashes involving extreme thermal radiations. This study followed a previous study based on dental tissues. This work was conducted in association with the Section of Engineering Fire in the LCPP using specific tools, such as the Calorimetric Cone (CC) and the Thermo Gravimetric Analyzer (TGA).

The main goal of this study was to analyze the degradation of the gutta-percha with and without cement zinc-eugenol oxide when teeth are exposed to different thermal radiations, both macroscopic (using CC) and microscopic (using TGA), when analyzed to define the mass loss changes and thermogram of these root canal materials. This work is intended to provide further organic tools to assist LCPP investigators in fire scenario modeling involving victims.

Material and Methods: Twenty-seven teeth were divided into three groups of nine teeth each and placed into three plates to reproduce the physiological environment of human teeth surrounded by alveolar bone. For each of the plates of nine teeth, three were filled only with gutta-percha, three others with gutta-percha in combination with cement zinc-eugenol oxide, and the last three were filled only with cement zinc-eugenol oxide.

Two preliminary studies using TGA were conducted on root canal material to determine the repeatability and reproducibility of the settings from 25°C to 800°C with a heating rate of 10°C/min. Then, the three plates of nine teeth were placed under the CC with three different thermal radiations: 20 kW/m2, 35 kW/m2, and 50kW/m2. Another TGA microscopic analysis was performed on these burned samples.

Results: The results of this study demonstrate that, when burned, the gutta-percha leaves an important quantity of residues compared with other polymers. Moreover, the gutta-percha and the cement zinc-eugenol oxide revealed a mass-loss reaction between 540°C-765°C, which is the mean fire temperature in Paris.

Following the previous study on human teeth, these findings are still promising in the fire investigation field and further investigations could also be conducted on alveolar bone. During a fire disaster investigation, the LCPP use inorganic burned materials found at a fire scene to modelize the fire scenario. One milligram of dental tissues and root canal material could also be used and considered as a comparison point for the LCPP in a fire scene involving victim(s).

Fire Disaster Modeling, Forensic Odontology, Endodontic Material