A97 A New Quantitative Method for Analyzing Burned Human Remains

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Learning Overview: After attending this presentation, attendees will better understand the variation in thermal alterations on human remains and variables that can contribute to these heat-related changes.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by highlighting the need for a more quantifiable approach to analyzing burned human remains that can aid investigators in building a legal case.

Fatal fires produce a range of physical alterations to the body, from blistering of soft tissue to the calcination of bones.[1,2] These physical alterations leave patterns that can be studied and analyzed to interpret perimortem events. Many anthropological-based classification systems progress quickly through the burn process, capturing only the advanced stages of heat-related damage and therefore are not widely used today. Previous models are primarily descriptive, with little to no attempt at quantifying the amount of thermal damage on a human body.[3-5] There is a need to develop a quantitative method that encompasses all thermal alterations and can be more broadly applied to a range of fire environments.

This study involves observational experiments of the burning of 90 donated human cadavers. Data were collected as part of the Fatal Fire Death Investigation Course by the San Luis Obispo Fire Investigation Strike Team, Inc. Cadavers were placed in vehicles, structures, confined spaces, and outdoor fire contexts. All physical alterations to both soft and skeletal tissues were documented with digital photography. Temperature data were collected through the use of thermal couples and thermal imaging devices placed on multiple locations and depths directly on the human remains. The new model was developed based on observations of thermal changes noted during these experiments. This model assesses burned remains by applying a Total Body Score (TBS) based on the affected body region (i.e., skull, upper and lower limbs, thorax, and hands/feet). Once the visual analysis was completed, all scores for each region were added together to form a TBS and compared across all fire environments to identify any patterns.

This study found notable differences in TBS between fire environments. Outdoor and confined-space fires exhibited the highest degrees of fragmentation and calcination across all bodily regions, which is consistent with some of the highest scores observed (TBS scores between 28–33). There were notable differences between compartment and trunk fire individuals. Compartment individuals exhibited widespread charring and calcination to the skull, hands, and feet, and limited soft tissue loss on all other bodily regions, which resulted in significantly lower scores (TBS scores between 19–26). Trunk individuals exhibited widespread calcination and fragmentation to the hands, feet, limbs, and skull (TBS score between 27–33), which is consistent with some of the highest scores recorded. Structure fire individuals exhibited limited bone exposure and soft tissue loss across all bodily regions, which resulted in some of the lowest scores observed (TBS scores between 8–20). The results of this study demonstrate TBS varied based on time, temperature, and ventilation patterns within each fire environment, illustrating a relationship between these variables. This study demonstrates the applicability of this model to a variety of fire conditions. More importantly, it demonstrates there is a pattern between fire environment and bodily conditions, making it possible to model heat-related damage. As data collection progresses, these TBS will be taken to form a more robust model for estimating exposure time to *in situ* conditions.

Reference(s):

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Burned Human Remains, Classification System, Forensic Anthropology

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