A27 Modeling Thermal Alterations on Burned Human Remains

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

This presentation will impact the forensic science community by highlighting the limitations of current models and the need to create a new model that can be more broadly applicable to the forensic community.

Since its original publication in 1996, forensic anthropologists have used the Crow-Glassman Scale (CGS) to characterize heat-related damage to human remains.[1] The CGS was developed from a mass casualty fire in Waco, TX, where the remains exhibited advanced stages of heat-related damage. As a result, this scale progresses from blistering to fragmentation in only five stages, thus, limiting its utility. The CGS does not include descriptions of times or temperatures, nor does it quantify surface area or percentage of body affected. This scale is also not typically used by medical examiners, who instead use calculations of total burned surface area and the rule of nines to describe the extent of burn injuries. As such, there are inconsistencies in the reported descriptions of burned bodies from medical examiners from those provided by forensic anthropologists.[2-5] This research seeks to develop a method more applicable to and consistent with remains encountered in fires, thus bridging the work between the various forensic sciences.

This study involves observational experiments of the burning of 40 donated human cadavers between 2014 and 2016. 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 vehicle fires, structure fires, outdoor contexts, and in confined spaces. All physical alterations to both soft and skeletal tissues were documented with digital photography and thermocouples. The visual assessment of the burned bodies was guided by the existing CGS and supplemented with additional time and temperature data. Skin splits, subcutaneous fat exposure, muscle exposure, and presence or absence of soft tissue color banding were among the soft tissue variables recorded for each individual. Skeletal color banding, charring, calcination, fracturing, and fragmentation were among the skeletal changes recorded.

The amount of thermal damage to remains is correlated with maximum temperatures and exposure times in each fire environment. Individuals placed in the front seat of vehicles exhibited limited soft tissue loss and bone exposure, consistent with exposure to high temperatures (CGS score of 3). Individuals placed in trunks exhibited calcination and fragmentation, consistent with prolonged exposure to high temperatures (CGS score of 5). The individuals in outdoor fires exhibited calcination, fragmentation, and heat-related fracturing, consistent with prolonged exposure to high temperatures (CGS score of 5). Remains in structure fires exhibited partial soft tissue loss and soft tissue color banding, which is consistent with exposure to intermediate temperatures (CGS score of 2). Remains from confined space fires exhibited charring, muscle exposure, and limited presence of soft tissue, consistent with intermediate temperatures (CGS score of 3).

The results of this study demonstrate notable and patterned differences in physical alterations, making it possible to model heat-related damage. The presence of soft tissue, muscle exposure, and skin splits on some remains illustrates the need for refining the CGS to include these variables. As data collection progresses, a more robust model to describe heat-related damage in addition to temperature data will be created that can be more broadly applicable to remains encountered in fatal fires.

Reference(s):

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