H109 Recognizing Patterned Fire and Heat Damage to Bone

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The goal of this presentation is to investigate patterned thermal destruction of bone, particularly when applied to medicolegal analyses of victims of fire. A focused, systematic approach to burn bone analysis is proposed through the observation of definitive bone-altering characteristics indicating whether the consumption of human tissues in fire is normal or abnormal.

This presentation will impact the forensic community by elucidating thermal destruction patterns through the analysis of specific burning process signatures observed on bone while considering extrinsic properties of the fire constant.

Burned bone research is well represented in the anthropological liter- ature yet there is little technical consensus in the procedural analysis of specific types of residual skeletal trauma. This disparity appears rooted in the varied approaches in burned bone analyses and suggests that the forensic anthropology community requires additional research and samples to achieve reliable pattern recognition. It is the intention of this presentation to identify certain heavily researched burn variables and suggest that they may be recog- nized as constants in an all-encompassing fire. Designation of these variables as constant influences of heat and fire on a decedent may allow burning process signatures to become decipherable.

By considering temperature, atmosphere, and duration as constants, thermal bone destruction becomes recognizable and patterned. These signa- tures include shielding soft tissues and body position, color change as the bone is subjected to heat-induced chemical changes, and finally heat shrinkage fractures in bone (Symes et al. 2008). If these features are docu- mented on cases of burned remains, researchers are no longer restricted by the "constants of fire." With this theoretical basis established, researchers can understand normal burn patterns as a whole and how each bone is consumed in a fire. For the purposes of this presentation, bone fractures, as a fire process signature, are demonstrated.

While at least seven burned bone fracture types have been defined in the literature, this research has found one fracture pattern particularly diagnostic. The curved transverse fracture, sometimes labeled a "thumbnail fracture," has been recognized and debated for decades in the literature by anthropol- ogists. The research will demonstrate that curved transverse fractures not only indicate fleshed body consumption, but these also specify the direction of destruction on that element. By understanding the direction of bone destruction on major elements, the pattern of destruction of the individual can be documented and evaluated for normalcy.

Curved transverse fractures are a reflection of a pattern that is well documented in victims consumed by fire – the pugilistic posture. The pugilistic posture is initiated by contraction of muscle fibers due to heat destruction as flexors generally override the extensors. This posture is retained until structures are destroyed and no muscle fibers cross joints to influence limb position. Curved transverse fractures on long bones are simply a reflection of this muscle destruction and contraction.

Heat altered muscle shrinkage action is discontinuous in nature. While the tension on muscle fibers is constant, their movements are not. The discontinuous nature is facilitated by increasing tension on the muscles and subsequent destruction of muscle and bone around the heavily burned attachment sites. As stretched muscle bundles eventually break free of attachments, muscle tension is temporarily relieved until heat once again produces more shrinkage. While at rest, muscle bundles create a line that will demarcate the next curved transverse fracture. As major muscles intermit- tently shrink up the shafts of bone, the residual curved transverse fractures inadvertently document direction of bone destruction specifically at that point on that element.

In presenting this research, the authors simplify the complex and over- whelming destructive results associated with remains recovered from fire scenes. By illustrating a single burning process signature, curved transverse fractures, this presentation focuses on just one of three major variables that assist in the recognition of typical fire destruction of a fleshed body. As these data become increasingly recognizable, the process of thermal bone destruction is found to be patterned, predictable, and eventually useful in recognizing atypical behavior associated with victims of fire.

Reference:

[1] Symes SA, A Piper, CW Rainwater, EN Chapman, and DR Gipson. Patterned Thermal Destruction Of Human Remains in a Forensic Setting. In: Analysis of Burned Human Remains. CW Schmidt and SA Symes, eds. In Press. New York: Elsevier, 2008.

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