A14 The Effects of Household Bleach on Bone in the Processing of Forensic Remains

Bobbie J. Leeper, MS, University of Pittsburgh, Dept of Anthropology, 3302 Wesley W Posvar Hall, Pittsburgh, PA 15260; Michael I. Siegel, PhD, University of Pittsburgh, Dept of Anthropology, 3132 Wesely W Posvar Hall, Pittsburgh, PA 15260; Margaret A. Judd, PhD, University of Pittsburgh, Anthropology Dept, 3302 Wesley W Posvar Hall, Pittsburgh, PA 15260; Sarah E. Henderson, PhD, University of Pittsburgh, Dept of Oral Biology, 566 Salk Hall, Pittsburgh, PA 15260; and Alejandro J. Almarza, PhD, University of Pittsburgh, Dept of Med-Oral Biology, 566 Salk Hall, Pittsburgh, PA 15260*

After attending this presentation, attendees will understand the effects of household bleach on the gross appearance of bone and trauma marks and its effect on the stiffness of bone.

This presentation will impact the forensic science community by describing the effects of a commonly used defleshing method on bone as well as by presenting a method by which to compare the biomechanical properties of bone prior to and following the defleshing process.

Individuals processing human remains from forensic cases are confronted with the unique challenge of choosing a defleshing method that is non-destructive to bone in order to preserve identifying features and fine marks of trauma, while remaining within the time constraints of a legal setting. Sodium hypochlorite (NaOCl), an oxidizing agent, in the form of household bleach such as Clorox®, is used in some laboratories to speed the process of defleshing and as an additional disinfectant. Household bleach is popular among many researchers due to its easy availability and low cost. Some have claimed that while other chemicals are harmful to bone tissue, household bleach is safe enough for human forensic cases, even those exhibiting signs of peri-mortem trauma.[1] Nawrocki intimates, due to health safety issues, that biohazardous remains must be simmered in water with bleach before entering the main osteology laboratory to be handled for analysis.[2] Despite these claims, others assert that bleach is too harsh to be used on bone.[3]

The goal of this study is to describe and compare two commonly practiced methods of defleshing human remains — plain water boiling and boiling with Clorox® bleach — in order to assess the effects of bleach on bone tissue. Three concentrations of Clorox® (low, medium, and high) were compared to the method of boiling in plain water. White-tailed deer (*Odocoileus virginianus*) distal hind-limb segments exhibiting knife-cut marks and saw marks (n=20) were used to test the effects of each defleshing method on the bone tissue and the appearance of sharp-force trauma on the bone, in addition to using them to test the effectiveness of soft tissue removal. The effectiveness of the method was assessed by comparing the quality of the end result and the time-to-completion for each method. The effects of the methods on the bone were assessed by noting the gross appearance of the bone and trauma marks prior to and following each processing method. Additionally, bone core samples were taken before and after processing to be used in a biomechanical test of the structural integrity of the bone tissue. An Instron® 5564 with a 2kN capacity was used to conduct unconfined compression tests to test the stiffness of the bone tissue of these bone core samples.

Each of the four defleshing groups took 6-8 hours to complete (M=6.55 hours, SD=0.605), with no statistically significant difference among the methods in time-to-completion. Moreover, comparison of the strain at 1790N, the first peak on the stress/strain graph, and the tangent modulus of the pre- and post-processing bone core samples revealed no statistically significant difference among the groups in the stiffness of the bone. However, cortical bone exfoliation was noted in two of the five high-concentration bleach samples.

In conclusion, the addition of bleach to heated tap water does not affect the time-to-completion or the stiffness of the bone, but, in high concentrations, can damage bone tissue macroscopically. Bleach is also known to lower the quality of DNA retrieval.[4] Therefore, unless it is found that bleach can sterilize biohazards that boiling alone cannot, it should be avoided in forensic cases as it has the potential to damage bones if not used properly.

References:

1. Stephens BG. A simple method for preparing human skeletal material for forensic examination. *J Forensic Sci* 1979; 24:660-662.
2. Nawrocki SP. The University of Indianapolis Archaeology and Forensics Laboratory. In: Warren MW, Walsh-Haney HA, Freas LE, eds. The Forensic Anthropology Laboratory. New York: CRC Press, 2008.
3. Fenton TW, Birkby WH, Cornelison J. A fast and safe non-bleaching method for forensic skeletal preparation. *J Forensic Sci* 2003; 48(1):1-3
4. Lee EJ, Luedtke JG, Allison JL, Arber CE, Merriwether DA, Steadman DW. The effects of different maceration techniques on nuclear DNA amplification using human bone. *J Forensic Sci* 2010; 55(4):1032-8

Defleshing, Bleach, Bone