A18 The Mummy in the Microwave: The Efficacy of the Microwave Method for the Maceration of Desiccated Tissue

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After attending this presentation, attendees will better understand decomposition as an important variable when selecting a maceration method and specifically, how the efficacy of the microwave technique is interrupted by desiccated tissue.

This presentation will impact the forensic science community by presenting observations made in a controlled laboratory environment on a subject for which little published data exists. Further, desiccation is considered on a molecular level and introduced as a new variable for consideration when selecting a method for tissue removal.

The maceration of human remains in the forensic anthropology laboratory has received variable attention in the literature. For logical reasons, an early emphasis was placed on the preservation of bone composition and gross morphology. More recently, the focus has shifted to the effect of various maceration techniques on nuclear DNA preservation and the preservation of microstructures associated with traumatic lesions.[1-3] Among the suite of methods tested in these studies is the microwave technique, in which skeletal elements are placed in a microwave-safe dish, loosely covered with a lid or plastic wrap, and microwaved on high for one-minute intervals until all soft tissue "easily slip[s] from the bones."[1] The use of both *Sus scrofa* and human bone and associated soft tissue is reported in the literature with consistent positive results. Absent from these studies is a discussion regarding decomposition as a variable and the potential for its many stages to differentially affect the efficacy of a maceration method. Because it has been lauded for its ease of use, and tested positively in the preservation of both DNA and the micro-morphology of osseous lesions, the microwave method was selected for use in a recent analysis conducted by the Metropolitan State University of Denver Human Identification Laboratory (MSUD-HIL). This presentation reports the results of the use of the microwave method in a case in which overlying soft and connective tissue structures were present in various stages of desiccation.

The skeletal elements associated with the left shoulder girdle, arm, and hand of an adult male were recovered from a high-altitude outdoor site north of Denver, CO. Desiccated dermal and connective tissue was present and mummification was observed in the hands, characterized by the preservation of all dermal layers and integumentary accessories (nails, eponychium, and hair). Prior to processing these remains, the technique was performed on eight *Sus scrofa* ribs; the results of preliminary processing were consistent with published data. The human remains were then processed in the MSUD-HIL. Bones were sequentially placed in a glass dish containing 2mm of water and covered with plastic wrap, then heated using a microwave (2.2 cu. ft., 1,250W) set on high for one-minute intervals. The process was numerically scored following Steadman et al. to quantify odor, soft tissue texture, ease of tissue removal, and bone quality.[1] The resultant bone quality scores were consistent with published results, but odor, tissue texture, and ease of tissue removal (and subsequent processing time) varied greatly from published scores. Additionally, scores between skeletal elements varied greatly, with the clavicle demonstrating the greatest ease of tissue removal and the scapula and carpals presenting the most difficulty.

The results suggest the structural changes associated with dehydrated cartilage and connective tissue has a substantial effect on the maceration of human remains and should be considered prior to engaging in tissue removal. Zhu and Fang report that the nanostructure of dehydrated cartilage is characterized by inhomogeneous fibril D-periodic spacing (decreased tissue organization), increased fibril diameter (greater bulk and density), and an increase in surface rugosity (with attendant changes in surface area expected).[4] These structural changes proved to be reversible during laboratory rehydration, making it is reasonable to suggest that the added process of rehydration affects maceration time as the distance from the denaturation threshold is increased. The increased processing time may have bearing on extant concerns surrounding DNA recovery and analysis and the preservation of trauma morphology, indicating that desiccated tissue should be regarded as a significant variable in the maceration process. Therefore, further testing is recommended to address tissue removal throughout the continuum of decomposition. While these observations do not outweigh the empirically tested benefits of the microwave method, they do suggest that more careful consideration is warranted.

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Reference(s):

1. Steadman D.W., DiAntonio L.L., Wilson J.J., Sheridan K.E., Tammariello S.P. The effects of chemical and heat maceration techniques on the recovery of nuclear and mitochondrial DNA from bone. *J Forensic Sci* 2006;51(1):11-17.
2. Lee E.J., Luedtke J.G., Allison J.L., Arber C.E., Merriwether D.A., Steadman D.W. The effects of different maceration techniques on nuclear DNA amplification using human bone. *J Forensic Sci* 2010;55(4):1032-1038.
3. King C., Birch W. Assessment of maceration techniques used to remove soft tissue from bone in cut mark analysis. *J Forensic Sci* 2015;60(1):124-135.
4. Zhu P., Fang M. Nano-morphology of cartilage in hydrated and dehydrated conditions revealed by atomic force microscopy. *J Phys Chem Biophys* 2012;2(1):106-108.

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