## G36 When the Hammer Falls: Patterned Injury Comparison in a Blunt Force Homicide

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After attending this presentation, attendees will have a new tool to consider when assessing patterned injury in bone.

This presentation will impact the forensic science community by demonstrating a novel use for a well-established technique and increasing collaboration among forensic odontologists, forensic anthropologists, and forensic pathologists.

During the course of an autopsy on a female homicide victim, the pathologist observed deep incised injuries on a small triangular portion of frontal bone. She removed the segment and requested an analysis from the forensic anthropologist. The specimen was macerated in order to preserve the marks. After the maceration process, additional superficial etched patterns became visible on the bone. Law enforcement was contacted by the forensic anthropologist who requested that they include a jewelry hammer in their suspect searches, based on research reviewing different types of hammer heads. One possibility that might explain the distinctive pattern was the interchangeable heads used in making custom jewelry. During the course of a search, the detective located a worn and obviously used hammer/hatchet combination (Q1) with very similar markings on the hitting surface, and attempts were made to determine whether it should be included as a possible suspect weapon in the homicide. Ultimately, the weapon could not be ruled out as the cause of the marks on the bone.

The cranial vault of the decedent in this case was badly fractured, and the segment containing the marks was separate from the rest of the vault. The original bone markings observed by the pathologist were relatively deep semicircular score marks in the external table of the left frontal bone. The additional markings observed after the bone was cleaned appeared to be superficial, roughly parallel V-shapes. The V pattern appeared in small (~1 mm-~2mm) Vs and also as larger overlapping K parallel shapes (~4mm-~6mm) arrayed in a shallow arc. The superior portion of the arc contained inverted Vs ranging in size from ~0.1mm-~1.0mm. There were three larger incised defects: one curvilinear (~1.8cm) and two that were roughly parallel and measured ~0.8cm and ~1.2cm, respectively.

The suspect hammer in the case was badly worn, with a misshapen metal head and dilapidated handle. The hitting surface contained multiple overlapping marks that resembled both Vs and Ks. They covered the head of the hammer and were depressed in some instances and elevated in others. There was one portion of the head that contained an arced area of elevated metal with multiple overlapping Vs and Ks and two or three roughly ovoid depressed pits. This area became the focus of the investigation comparing the two etched surfaces.

Multiple techniques were used in attempts to transfer the pattern observed on the skull and the pattern observed on the hammer onto similar surfaces in order to make a comparison. The hammer was overlaid with thin tracing paper and a charcoal pencil was passed softly across the surface. This same technique was used on the bone segment containing the pattern. This process was very successful; however, it produced "negatives" of the pattern rather than the actual pattern. The hammer was punched into clay, a corkboard, and Styrofoam® in an attempt to determine which portion of the head "marked." These techniques were less successful than the tracing paper method.

The forensic odontologist determined that a cast could be made of the head of the hammer, and this would allow determination of which portion of the head might have created the marks on the bone. Dental polymer impression material was used to cover the head of the hammer, and a dental stone model was made from the resulting impression. Comparisons of the marks made by the suspect hammer and the marks on the bone were conducted using a dissecting microscope with magnifying lenses. The suspect hammer could not be ruled out as the cause of the marks on the cranial vault.

In order to determine whether other hammers could have similar markings on the hitting surfaces, four other used hammers (K3, K4, K5, and K6) were obtained and tested. In addition, a new ball-peen hammer (K1) and a new (unused) hammer/hatchet combination (K2) similar to the suspect hammer were tested. All of the tested known hammers could be ruled out, as they did not have similar characteristics to the marks on the bone.

This case is a good example of successful multidisciplinary cooperation and creative thinking. By involving several types of experts in the case, evidence could be examined in a novel manner. The defendant in this case ultimately pleaded guilty.

**Pattern Comparison, Dental Casting, Evidence Preservation**