H48 Anthropological Saw Mark Analysis on Bone: What is the Potential of Dismemberment Interpretation?

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After attending this presentation, attendees will gain a better understanding of the utility of saw mark analysis on bone, and the five features that can be used to correctly identify the class of tool used in dismemberment.

This presentation will impact the forensic community and/or humanity by enhancing the utility of saw mark analysis, and purposes a standard methodology for the recognition of saw mark features and characteristics in bone.

Tool mark analysis is a highly specialized area of forensic science with new techniques for the refinement of weapon analysis and comparison. Despite recent advancements, saw mark analyses have received little research attention and currently have few standards for analysis. Regardless of the lack of standardization and *Daubert* criteria, forensic practitioners, including anthropologists and pathologists, continue to conduct saw and knife mark analysis and testify on the results. The high number of these "unusual" cases and the investigative and judiciary benefit of the testimony, coupled with the lack of a standard methodology, demonstrate a growing need in the forensic community.

Even though a majority of this research was done over a decade ago by the first author (Symes 1992), forensic anthropological tool mark analysis appears stagnant, while at the same time, criminalists seldom work with saw marks in human bone. Even more alarming is the continued lack of communication between criminalists and anthropologists, despite the fact that each is attempting tool mark analyses with similar goals in mind.

The authors propose a tool mark recognition system that approaches analysis of cut marks from five recognizable class features. Within these class features, there are multiple characteristics, ranging from simple to complex. This presentation will illustrate the utility of how even the simplest characteristics of a saw mark can contribute to systematically narrowing the potential class of tool used in a criminal act. By examining saw mark trauma for each of these recognizable class features, it is possible to detect many of these characteristics without extensive training and sophisticated equipment. The recognizable class features presented by this research include:

1. Saw Cut Direction—After documentation and retrieval of all contextual evidence, bones can be examined for saw kerfs, useful in determining orientation and direction of cut. This information is dependent upon an understanding of osteology and saw cut action. Direction of saw progress is indicated by false starts and entrance cuts progressing to break away spurs and notches. Direction of power stroke is essentially parallel to wall striations with exit chipping occurring in the power direction.

2. Saw Power—Since mechanically powered saws cut with more force and speed, their blades are manufactured to withstand more pressures (unless the blade is supported in a frame like a band saw, or the blade has little movement like a cast/autopsy saw). The simple fact that power saws generally have wider blades means that a simple measurement of minimum kerf width quickly seriates the saw class potentially used. If you add the features of energy expression and polish, differences between hands versus mechanical saws are recognizable.

3. Saw Design (Shape)—Saws are generally classified into rip versus crosscut. This simply indicates whether a saw has filed teeth or not. Because filed teeth essentially taper more to a point than non-filed teeth, filed teeth form a 'W' shaped kerf floor as opposed to non-filed teeth that form a flat, squared-off floor. Curved versus straight blades also fit into this category.

4. Saw Tooth Size—Erratic sawing behavior can leave solid evidence behind. If a saw is stopped in mid-stroke and removed, measurable features may exist. Close examination with low powered magnification may indicate tooth imprints on kerf floors, pull out striae may indicate the saw tooth frequency, or simply the introduction of succeeding teeth to a cutting stroke may create a wavy striation that indicates distance between teeth. Each of these features provides the potential for a measurement between teeth that can result in Teeth per Inch (TPI) assessments.

5. Saw Tooth Set—Saws designed to cut hard materials usually have tooth set. Set is simply lateral bending to the teeth so that the combination of bent teeth creates kerfs wider than the actual blade cutting the bone. Tooth set is usually in the form of alternating, but can be a wavy or raker set. Tooth set influences blade drift. Where raker set doesn't appear to let the blade drift, alternating set does put the blade in motion with the introduction of every tooth, and this motion is predictable and measurable. Wavy set is like alternating, but on a larger scale.

This research attempts to confront existing misconceptions, communication gaps, relieve anthropologist

'microscope anxiety,' and ignore individual characteristics mindset (as opposed to class characteristics), while giving a hierarchy of recognizable characteristics among cut mark features, many of which can be scored without expensive equipment or SEM confusion. Finally, it is important to realize that every aspect of the proposed research will communicate the potential of highly ignored types of evidence found in every case of dismemberment and mutilation—tool marks in bone.

Saw Marks, Bone, Class Characteristics