



Physical Anthropology Section - 2014

H48 Characteristics of Penetrating Screwdriver Trauma to the Cranium

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After attending this presentation, attendees will gain an understanding of screwdriver trauma to the crania and the potential for injury characteristics to be used to ascertain weapon type.

This presentation will impact the forensic science community by presenting results from an initial study of screwdriver trauma to the cranium and reporting on wound characteristics typical of a specific screwdriver type. The findings of this study may allow screwdriver type to be inferred from wound characteristics.

Data from the Federal Bureau of Investigation (FBI) indicates that 13% of 68,720 homicides committed between 2007 and 2011 involved knives or cutting instruments.¹ Matching an injury to an implement by tool mark analysis is an important element of any forensic investigation involving sharp force trauma. Previous works have mainly concentrated on knife and saw marks.^{2,3} Even though homicide cases with screwdrivers are rare, screwdrivers have been reported as weapons used for fatal stabbings.⁴ A screwdriver is easily concealable due to its small size and weight and easily obtainable.

Twenty pigs' (*Sus scrofa domestica*) crania were used. Penetrating trauma was inflicted to each pig's crania using both flared-tipped and parallel-tipped screwdrivers. The screwdriver shafts were 5mm in diameter and the shafts were attached to a drop rod to maintain consistent force for each trauma. The screwdriver was withdrawn after each wound was inflicted. The skull caps were removed and macerated. Tool mark analysis was conducted using a Leica[®] microscope. The following features were analyzed: (1) shape of penetrating wound; (2) length and width of penetrating wound; (3) wound margins (straight or irregular); (4) number and type of radiating fracture (straight or curved) with respective angle; and, (5) number, location, and size of hinges. A Tree model was used to analyze the data. Preliminary results suggest that a distinction between flat-headed flared-tipped and parallel-tipped screwdriver penetrating wounds is possible. Length, margin and width yielded a classification system with 96% accuracy. Using radiating fractures, a distinction was possible using angle, location, and type which provided 80% accuracy in distinguishing flare-tipped from parallel-tipped screwdrivers. Using hinge location and size, a distinction was still achieved; however, only 66% of screwdrivers were correctly classified. Wound shape appears not to be efficient when distinguishing between the two screwdriver types.

In summary, this study suggests that tool mark analysis of screwdriver trauma to the cranium may provide evidence of screwdriver type, specifically, distinguishing between flared-tipped and parallel-tipped screwdrivers.

References:

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2. Shaw K, Chung J, Chung F, Tseng B, Pan C, Yang K, Yang C. A method for studying knife tool marks. *J Forensic Sci* 2011;56(4):967-71.
3. Freas L. Assessment of wear-related features of the kerf wall from saw marks in bone. *J Forensic Sci* 2010;55(6):1561-9.
4. Parmar K, Hainsworth S, Ruttly G. Quantification of forces required for stabbing with screwdrivers and other blunter instruments. *Int J Legal Med* 2012;126(1):43-53.

Screwdriver Trauma, Cranium, Tool Mark