G77 Determination of Range of Fire in Skeletal Remains

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After attending this presentation, attendees will better understand a technique that can aid in the determination of range of fire in skeletal remains found with firearm injuries.

This presentation will impact the forensic community and/or humanity by providing a relatively quick and easy method for evaluation of firearm injuries in skeletal remains.

The goal of this presentation is to introduce forensic scientists to a technique that can aid in the determination of range of fire in skeletal remains found with firearm injuries.

Introduction: The scenario is not an uncommon one: a person goes off into a secluded area with the purpose of commiting suicide by shooting themself, and is later found in a decomposed or skeletal state. The presence of a weapon would certainly indicate a suicide; however, circumstances are not always as they appear. Remains can also be scattered and separated from the weapon, and weapons can be separated from the remains due to theft. When remains are decomposed or skeletal, the usual clues to range of fire, soot, and stippling are often lost or obscured. The authors present a technique that can aid in the determination of range of fire in the absence of visible soot.

The sodium rhodizonate staining technique is widely employed in crime laboratories to detect lead residue on clothing. The staining pattern obtained can then be compared to the implicated weapon and ammunition utilized to determine the possible range of fire. This technique employs spraying the garment with sodium rhodizonate, then sequentially overspraying with buffer and then hydrochloric acid. A pink color with buffer and then blue-purple color with acid is indicative of the presence of lead. This test has been employed on skin; however the authors demonstrate the technique on human and animal skulls.

Materials and Methods: Amputated heads from six previously slaughtered pigs were purchased for this experiment. Three different weapons and ammunition were utilized: a revolver with a non-jacketed bullet, a 9mm semi-automatic pistol with a copper-jacketed bullet, and a shotgun with 00 buckshot. Hard contact shots were fired with the weapon placed between the eyes on the upper portion of the snout. Distant shots were fired from 3 feet with the handguns and approximately 28 feet with the shotgun. The skin from the head was then removed and tested for traces of lead. The skulls were then boiled in water to aid in the removal of the remainder of the soft tissue. Once the soft tissues were removed, the skulls were re-assembled, if necessary, and tested for lead residue. All skulls were examined for visible lead prior to testing with sodium rhodizonate. Color changes were documented and photographed. A test was determined to be positive for lead if the color changed from pink with the buffer to purpleviolet with the acid.

Results: The distant gunshot wound from the revolver with the unjacketed bullet showed faint positive staining of the bone around the outer surface of the defect, with no staining on the inside of the skull. Evaluation of the skin revealed a ¼ inch x ¼ inch area of positive staining with a few positive spots 6 inches from the wound. The distant gunshot wound from the semi-automatic weapon revealed no visible residue prior to testing. After testing, a small rim of lead partially encircled the skin wound and there were a few positive spots 4, 5, and 6 inches from the wound edges. There were no traces of lead on the skull. The shotgun inflicted multiple buck shot wounds which tested positive for traces of lead on the skin, but not the skull. All contact range wounds had visible residue on the skin prior to testing, and subsequently had brightly positive staining after testing with sodium rhodizonate. The outer surfaces of the skulls also showed positive staining, however the inner surfaces of the skulls also stained positively. Of note, the brains of the pigs were present at the time of the shooting. This finding was reproduced on two human skulls, one of known contact range and the other of presumed contact range.

Conclusion: Sodium rhodizonate may help determine range of fire in skeletal remains. Lead residue was detected inside the skulls with inflicted contact range firearm injuries, whereas it was only on the surface of the entrance wound, and in small amounts, of the distant wounds. More studies are currently underway to further explore these findings.

Sodium Rhodizonate, Skeletal Remains, Range of Fire

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