TECHNICAL NOTE

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Matching Bullets to Bone Impact Signatures

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ABSTRACT: When bone is penetrated or perforated by a bullet, the bullet's impacting surface is often uniquely modeled by the fractured bone. Reconstructing bone with simple superimposition of the bullet's contour lines allows matching of a particular bullet to its specific bone defect.

KEYWORDS: pathology and biology, postmortem examinations, ballistics

At autopsy, every effort should be made to associate a bullet with its wound track. This is especially necessary when more than one weapon is used or when bullets found during the recovery of skeletal remains are dissociated by decomposition. In addition, bullets recovered at autopsy or surgery can be confused by mislabeling or other inadvertent means. Therefore, the authors of this paper explored the possibility of matching bullets to bone impact sites. Recognizing that unique mirror-image modeling of deformable bullets occurs at the impacting surface led us to find a rapid technique for matching reconstructed bony defects with the impacting surfaces of the bullet.

Methods and Results

The bullet impact site was reconstructed by excising the surrounding bone and realigning the bony fragments. This and the bullet's impacting surface were photographed at the same magnification in the normal plane (90° to the axis of impact) using an operating microscope (6 to 40 power). We used a black-and-white 35-mm format, but any film, including instant developing types, could yield equally reliable results.

Technically, we obtained better results by "smoking" the bullet surface with a thin coat of carbonaceous soot to eliminate metallic highlights and accentuate the contour.

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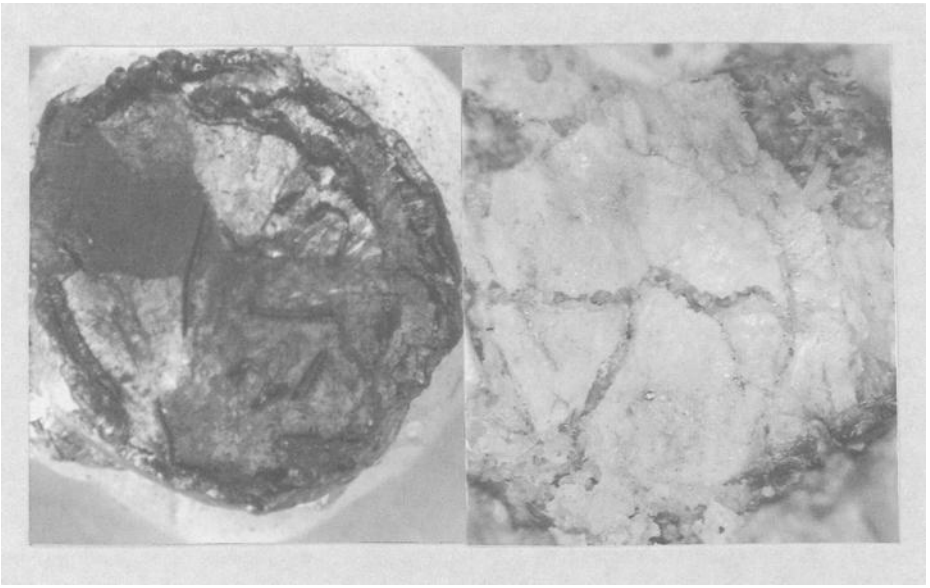

FIG. 1—(Left) *Reversed print of the impacting surface of a bullet;* (right) *skull fracture at the bullet impact site. The similarities are evident with unaided observation.*

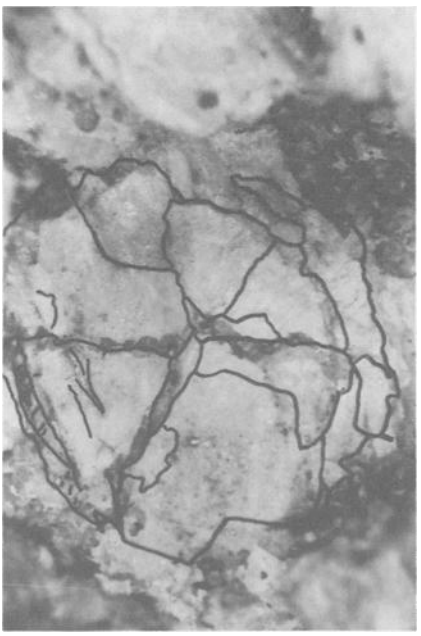

FIG. 2—*Acetate contour overlay of a bullet superimposed upon a fracture. The similarities are more striking and are sufficiently unique to confirm a match.*

However, smoking was found to be slightly detrimental when using copper-washed or jacketed bullets because the bullet can then no longer be color-matched with the copper and lead marks on the bone. Therefore, photographs were taken before and after the smoking process.

Matching is done by comparing photographic enlargements. A clear acetate overlay of the bullet's contour lines is prepared and flipped to overlay the mirror-image contour onto the photo of the bone impact site. Similarities between the reversed print of the bullet and the fracture are demonstrated in Fig. 1; the superimposed overlay confirms the match (Fig. 2). Matches can also be made by videosuperimposition or manipulating computer-digitized photographs, but both processes are more labor-intensive.

Discussion

Stahl et al. [*1*], Dixon [*2,3*], and Smith and Harruff [*4*] have endeavored to match projectiles to wounds by using evidence impressed on or retained in bullets passing through intermediate targets. Our experience indicates that only a minority of bullets show these effects. While fragments of clothing can be carried into the wound depths [*5*], thereby linking a projectile to a specific surface defect, the literature of forensic science is devoid of specific references matching bullet to wound through tissue effects. Fackler et al. [*6*] correlated bullet deformation with the range of fire but could not specifically match bullet to wound through tissue effects only. Unique munitions may leave class characteristics [*7–11*] but, again, cannot be used to confirm that one projectile and no other produced the wound in question.

Conclusion

We believe our technique allows rapid, specific matching of bullet to bone in cases where bone has been struck and the fragments have been recovered, reassembled, and compared with a bullet that has not been unduly deformed by subsequent impacts.

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