Case #132

NAME Educational Activities Committee

Case provided by:

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1. A 20-year-old man sustains a penetrating gunshot wound to the head with the entrance wound on the right side of the lower lip. The wound consists of a 0.5 cm round defect with a dark red abrasion margin at 12 to 3 o'clock and a skin split at the 7 o'clock position of the wound. Three dark, punctate curvilinear areas of gray-black residue originate from the 7, 10, and 11 o'clock positions of the wound. Scattered gunpowder stippling, up to 5 cm peripheral to the wound center, is appreciated.

   What is the cause of the illustrated residue pattern on this entrance wound?

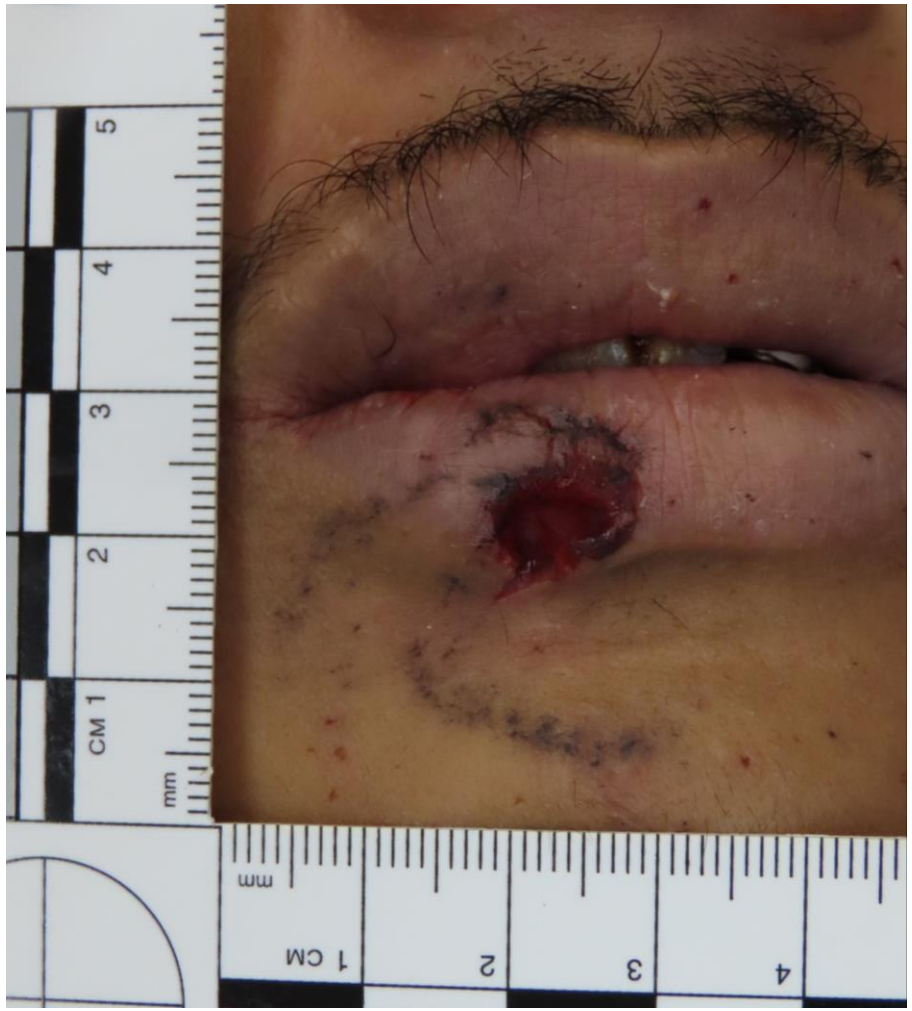
- ◯ Escape of gunshot residues from a revolver cylinder gap
- ◯ Circular motion of the firearm or target at discharge
- ◯ Lead vapor escape through electroplated bullet surface fractures
- ◯ Expansion dynamics of a jacketed hollow-point projectile

Answer...

C. Vaporous lead stream escaped via the fracture sites of an electroplated bullet (CORRECT ANSWER, 45.81 % of responses)

“Comet-tailing,” also known as the “vortex effect,” is a distinctive spiral-shaped pattern observed around certain gunshot entrance wounds. This phenomenon arises when a plated bullet, typically one with a thin electroplated metal coating over a lead core, fractures upon discharge. The fracturing allows vaporous lead to escape through the cracks of the spinning projectile, depositing a dark, spiral residue around the central bullet defect. This pattern is most commonly associated with intermediate-range gunshots, approximately one to three feet from the target.

In addition to the spiral residue pattern, comet-tailing may also be accompanied by an eccentric abrasion collar, particularly when the bullet enters the skin at an angle. This abrasion collar, thicker on one side, can provide information about the bullet's trajectory and angle of entry. Notably, the number of visible spiral lines often correlates with the number of fractures in the bullet’s plating. While the presence of comet-tailing can indicate the use of plated ammunition and suggest a specific range of fire, further research is necessary to determine the precise distance parameters and the influence of various firearm and ammunition characteristics on this effect.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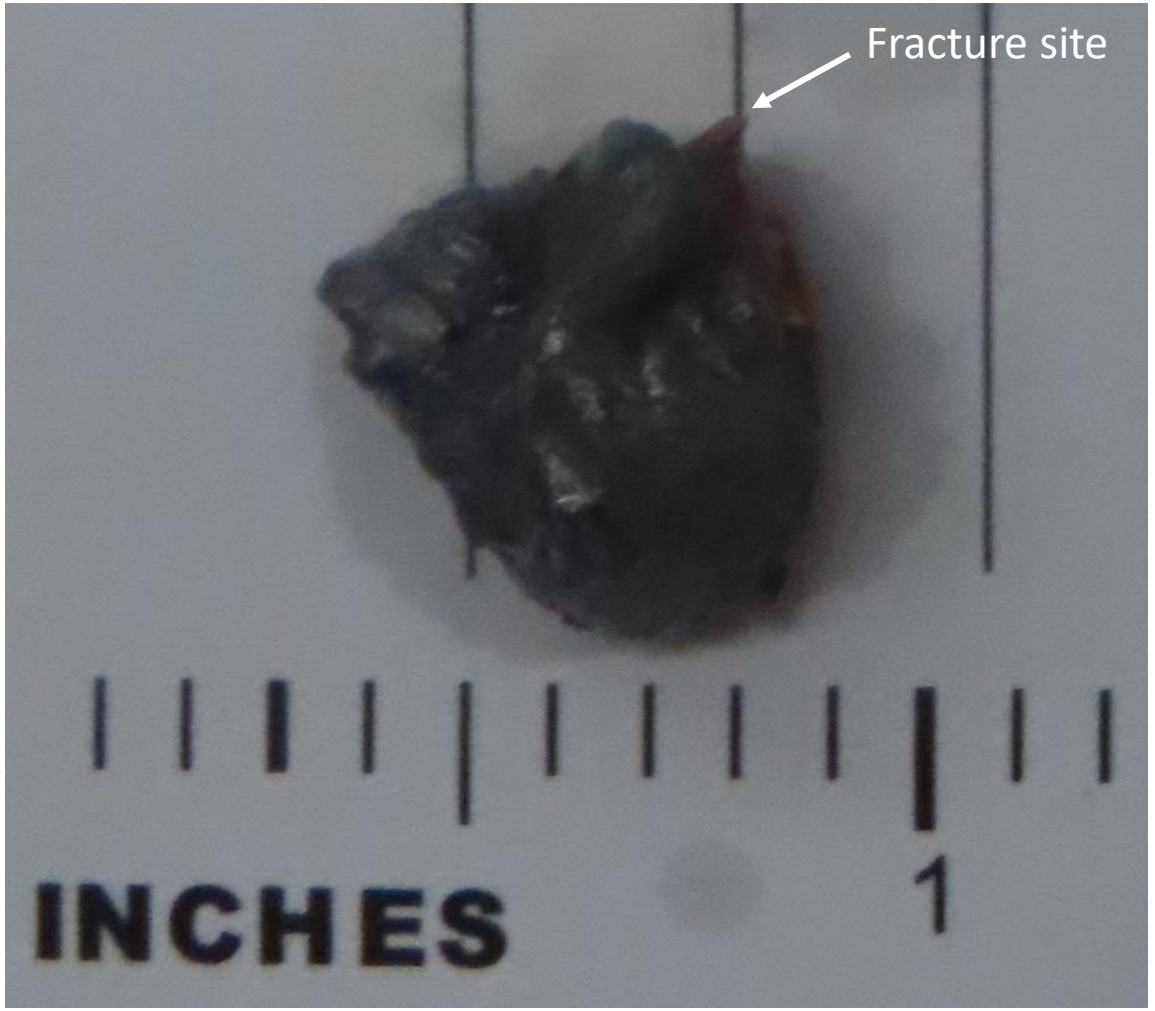
Fracture site
INCHES
1

Additional example of “Comet-tailing” on clothing

Other responses…

A. Escape of gunshot residues from a revolver cylinder gap (34.03% of responses)

Although gunshot residue can escape from cylinder gaps in revolvers and create usual patterns of soot (and even stippling) deposition, the spiral pattern seen in our photos are more consistent with comet-tailing.

B. Circular motion of the firearm or target at discharge (7.85% of responses)

It is suggested that a malfunction in a firearm, such as a defect in the barrel, can produce comet-tailing pattern; However, the motion of the shooter or the target is not contributory.

D. Expansion dynamics of a jacketed hollow-point projectile (12.30% of responses)

The jacketed hollow point bullets (JHPs) do not tend to fragment or fracture in the same way as electroplated bullets when fired. The vaporous lead leakage that creates comet-tailing is less likely to occur, as JHPs do not have the same microfracturing behavior observed in electroplated bullets.

REFERENCES

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2. Joseph A Prahlow, Susan B Allen, Travis Spinder, Robert A Poole. Pseudo-gunpowder stippling caused by fragmentation of a plated bullet. Am J Forensic Med Pathol. 2003 Sep;24(3):243-7. doi: 10.1097/01.paf.0000083361.31429.60.

3. Barrera, V., Fliss, B., Panzer, S. et al. Gunshot residue on dark materials: a comparison between infrared photography and the use of an alternative light source. Int J Legal Med 133, 1115–1120 (2019). https://doi.org/10.1007/s00414-018-1965-7