B38 Determining the Angle of Impact From the Analysis of Bullets Following Perforation of Glass

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After attending this presentation, attendees will better understand how applying different methodologies in analyzing a bullet can assist investigators in determining the position of a suspect in the reconstruction of a shooting incident, specifically in situations where that bullet has perforated a glass target.

This presentation will impact the forensic science community by providing a quantitative measure in analyzing and interpreting bullet evidence for future use in the courtroom.

When two objects come into contact with one another, there is a potential for the transfer of material between those objects. The goal of this research was to develop statistical models to aid investigators in the reconstruction of a shooting incident. Specifically, the determination of the direction of fire from the bullet's angle of impact was addressed by assessing the deformation of the bullet and the transfer of glass onto the bullet.

Transfer of material to bullets is an underexploited area of trace evidence. Current research has mainly been observational, and no attempt has been made to provide a quantitative measure to the results.

Four aspects of bullet deformation after perforation of a glass target were studied during this research: (1) the shape of the bullet holes; (2) the side view of bullet deformation; (3) the frontal view of bullet deformation; and, (4) the distribution of glass onto the bullets. A Ruger SR9 9mm pistol was used to fire 100 cartridges at individual glass targets at angles of 45º, 50º, 60º, 75º, and 90º using Winchester® 115 grain, 9mm, Luger® full metal jacket factory ammunition and reloaded lead round nose ammunition consisting of 115 grain Missouri Bullet Company bullets, 4.1 grains of Hodgdon® Titegroup powder, and Sellier & Bellot® 4,4 small pistol boxer primers.

The following methodologies were employed for image capture and analysis: (1) focus stacking using Zerene Stacker to generate high-quality images of the frontal view of the bullet; (2) analysis of the bullet holes in the glass targets using HemoSpat; and, (3) analysis of bullet deformation and distribution of glass onto bullets using ImageJ. Regression modeling and principal component analysis were performed on the data. The research found that examining bullet holes in glass is not a viable method for determining angle of impact. It also found that the side view deformation of full metal jacket bullets can be used to distinguish between some impact angles, for example, 90º and 65º, but cannot be used for lead round nose bullets. Furthermore, the front view deformation and distribution of glass on full metal jacket bullets can be used to distinguish between some impact angles, for example, 75º and 50º, but cannot be used for lead round nose bullets.

Bullets, Angle of Impact, Shooting Reconstruction