E37 Analysis of Bullet Entry Hole Diameter by Varying Distance, Caliber, and Grain

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After attending this presentation, attendees will understand how shooting distance, bullet grain, and bullet caliber affects the bullet entry hole diameter in a solid target substrate (drywall). Gunshot Residue (GSR), bullet trajectory analysis, and firearm examination are also established methods used for crime scene reconstruction of shooting incidents. This research is an attempt at providing an alternative method for firearm identification (or exclusion) of a possible class of firearm when the weapon and ammunition are missing from the scene or the recovered weapon is unsuitable for testing.

This presentation will impact the forensic science community by providing a better understanding of the many components involved in a crime scene reconstruction when a shooting took place. It will be evident that conclusions cannot be based solely on one factor, but instead rely on careful scientific method-based analysis of several ballistic variables.

The following handguns were used in this study: Smith & Wesson® M7P9, 9mm caliber; Heckler & Koch® P2000, 0.40 caliber; and Smith & Wesson® M7P45, 0.45 caliber. Bullet entry holes were examined by firing multiple rounds at a drywall target. Three different ammunition calibers were used (9mm, 0.40 and 0.45). Each caliber was either a heavy or light grain type (9mm at 115 and 147 grain, 0.40 caliber at 155 and 180 grain and 0.45 caliber at 185 grain). All ammunition fired was Hornady® hollow point.

Additionally, there were three different firing distances depicting near contact, intermediate, and distant ranges, measured from the gun muzzle to the target at 4inches, 24inches, and 48 inches. Six rounds were fired for each caliber, grain, and distance for a total of 108 expended rounds. Each bullet hole was numbered and the diameter of the entrance holes bullet "wipe" was determined with an L-shaped Lynn Peavey metric ruler. Images of the ammunition before it was fired, as well as of each bullet entry hole, were taken with a Nikon® D3200 camera. The measurements were entered into an Excel® spread sheet and analyzed using the included Analysis of Variance (ANOVA) statistical test to determine significance (p value < 0.05).

Results of this study indicated that a larger bullet caliber does not necessarily produce a significantly larger entry hole diameter when compared to a smaller bullet caliber. Also, the same bullet caliber with different grain does not produce a larger or smaller entrance hole. Findings determined that firing the same caliber and different grain loads at different distances, and firing the same caliber with the same grain loads at different distances, did not affect the size of the bullet entry hole in dry wall.

These conclusions were based on the variables and drywall substrate used in this study and could vary when other types of weapons are fired. This type of scientific model approach to shooting incident reconstruction is needed to enhance expert testimony and admissibility in the courtroom that is not based on myths or anecdotal or erroneous beliefs.

Shooting Distance, Bullet Grain, Bullet Caliber