E47 Entrance and Exit Hole Characteristics: Bullet Types, Substrates, and Firing Distance

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Learning Overview: The goals of this study focused on the ammunition, the target substrate, comparing the shape of the entrance and exit holes, and the diameter of the entrance bullet hole from two firing distances.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by investigating the correlation between class characteristics of bullets and the diameter of entry and exit bullet holes in different substrates. This presentation will also help the forensic science community by providing guidance for further firearms research.

This study was designed to compare the shape and diameter of bullet entrance holes fired from two different distances. The comparison concentrated on ammunition and target substrate. A Smith and Wesson® SD9VE 9mm Luger® firearm was used in this study. Three types of bullets used were: Ruger® (ARX), Federal® (FMJ), and 2nd Amendment® (HP). Target materials were bicycle inner tubes, aluminum, and glass bottles. Three test fires were performed for each bullet type into each substrate at distances of five and ten feet. A total of 51 test fires were performed. The firing and firearm data were analyzed using the Analysis of Variance (ANOVA) and Student *t*-tests. Significance was determined when the $p < 0.05$.

The results showed that there was a significant difference in the size of the entrance hole when comparing a hollow point bullet fired into the three different substrates. There was a significant difference when using the different types of ammunition and comparing the bullet hole sizes in the various substrates. There was no significant differences when comparing the size of the bullet entrance and exit holes when these were obtained at the two different firing distances. Ruger® (ARX) bullet holes were more irregularly shaped than the circular-shaped bullet holes from the Federal® (FMJ) and 2nd Amendment® (HP). The shape of the 2nd Amendment® (HP) bullet holes in the rubber and aluminum were circular and symmetrical, while the bullet holes in glass were relatively rounded but irregularly shaped. In some of the target substrate, there were visual differences noted between the various bullet types used, but this was not investigated in the present study. In conclusion, with the increase in criminal use of firearms violence, it is especially important to obtain probative evidence and expert testimony from firearm examiners. It is recommended that using shorter muzzle-to-target distance be investigated in addition to the visual impact on the targets.

Entry and Exit, Bullet Holes, ARX, FMJ, HP