The analysis of the perforation of the bullet 11 mm. on the metal sheet

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Abstract. The bullet hole traces from both entrance and exit at the crime scene are important data which can be used in the investigation. Most of the analytical investigation will be mostly considerably on the physical appearance e.g. tear, traces of gunshot, the size of the entrance and exit bullet holes. The purpose of this research was to study the pattern and the difference of marks on the metal target caused by the collision of gunshots using 4 types labeled as A is Full Metal Jacketed (FMJ) 135 gr. of Thai Arms., B is Jacketed Hollow Point (JHP) 230 gr., C is Full Metal Jacketed (FMJ) 230 gr. and D is Lead Semi Wad Cutter (LSWC) 200 gr. all of Bullet Master, shot from a Colt Gold Cup 11 mm caliber at 7 different distances as 0.00, 0.15, 0.50, 1.00, 1.50, 2.00 and 2.50 meters to records a diameter of bullet hole. In this experiment, the shot at the close range could be seen most clearly physically. On the metal target, ring of the black gunshot residue around the collapse entrance of bullet holes and a tear at the exit of the bullet was appeared. The physical properties of bullet hole on the metal sheet of each bullet type are different that can basically inform about type of bullet (p < 0.05), at the 95% confidence level but the size of bullet hole can’t use for identity shooting distance.

1. Introduction
In 2016, an analysis article by the University of Washington mentioned that the mortality rate from firearms in Thailand more than the United States was 4.45 people per 100,000 individuals in the population. Also, in South East Asia Thailand is the second most rated country for firearm death rate being almost 5 times that of Malaysia. Furthermore, the amount of deaths from firearms in Thailand was as high as Iraq; of which is one of the most perilous countries in the world. In Thailand, the majority of cases were correlated to criminal cases; that had hidden illegal property of firearms. Thus, it’s one of the causes for the expanding amount of crimes spread throughout society.

Furthermore, evidence determined the utilization of firearms in the following incidents: firearms, bullet heads, casings, weapons, residue and bullet holes are important types of evidence [1-2]. Thus, the bullet heads could be utilized to observe the barrel spirals weapons and the categories of firearm barrels...
of the offender. More, Bullet casings could be utilized to investigate the firing pin; in order to determine what category of firearm was utilized for the motivation. Additionally, the characteristic of bullet holes would vary depending on the category of guns, bullet, the weight of the bullets, speed and the characteristics of the firearm barrels [3-4]. By the characteristic of bullet impressions that occurred at the scene, it’s treated as another crucial witness component; of which could be associated to the offender's gun(s)[5-6]. This allows the development of a database that may be used for general and forensic analysis of bullet damage.

This work aims to study the 11 mm bullet damage; of which was fired at metal target at a variety of distances. From ballistic testing, the examination of empirical outcomes and the utilization of forensic database were able to determine the size and type of ammunition as well as the firearms used. Therefore, this had assisted with investigations of accurate results in the future.

2. Materials and method

2.1. Materials
This research used an automatic firearm, Colt Gold Cup 11 mm. caliber; having 5 inch barrel length. There are about 4 types of bullets listed as follows: A is Full Metal Jacketed (FMJ) 135 gr. of Thai Arms., B is Jacketed Hollow Point (JHP) 230 gr., C is Full Metal Jacketed (FMJ) 230 gr., D is Lead Semi Wad Cutter (LSWC) 200 gr. all of Bullet Master. Shooting targets are made of metal plaque 30cm × 30cm × 1 mm. There was a table about 10cm × 10 cm and was closed with plastic to protect impurity. The distances of shooting at 7 ranges as 0.0, 0.15, 0.50, 1.00, 1.50, 2.00 and 2.50 meters were investigated. There were a Mitutoyo brand Vernier caliper and Nikon brand digital camera D7000 with lens size 18–105 mm for collection data.

2.2. Research method
The researcher seized the metal plate with a clamping stand; in order to avoid the motion. Furthermore, measuring tape was utilized to measure the firing position as determined, ie 0.0, 0.15, 0.50, 1.00, 1.50, 2.00 and 2.50 meters. Then, the researcher fired with 11 mm guns, 4 types of bullets that range from 0.00 to 2.50 meters, with one sample of the shooting was repeated three times (n = 3)

2.3. Data collection approaches and preliminary outcomes examination
The researcher documented photographs with a digital camera and measured the diameter of the entrance bullet hole, the access hole and depth of the bullet holes by using the Vernier caliper. Afterwards, we reported in the design of numbers, mm. This was done through determining the mean, standard deviation, utilization of the completed statistical program to contrast variations of the average of each change, the traces were affected by firing on the metal sheet. Afterward, the examination of variances of the bullet types per the diameter and depth of the bullet holes were evaluated. In addition, this encompassed analyzing the divergences between the shooting distance per diameter of bullet holes.

3. Results and discussion

3.1. Characteristics of bullet hole traces from a 11 mm firearm
The estimation of firing range was first made based on the direct and visual examination of the target. From the experiment, it was determined that when firing with 4 types of bullets, namely Bullet A (THAI ARMS FMJ 135 gr.), B (Bullet Master JHP 230 gr.), C (Bullet Master FMJ 230 gr.) and D (Bullet Master LSWC 200 gr.); it was demonstrated that the substantial aspects were apparently clear. The shot at the close range on the metal sheets could be seen most clearly physically, ring of the black gunshot residue was established around the collapse entrance of bullet holes and a tear at the exit of the bullet was appeared. However, At the firing range of 0.50 meters wasn’t found black residue stains on metal sheets as displayed in figures 1 and 2.
Figure 1. The bullet hole at the metal target at the firing range of 0.0 meters

Figure 2. The bullet hole at the metal target at the firing range of 0.50 meters

3.2. Comparative study of bullet hole traces at different firing ranges

The outcomes of the examination of the entrance hole of the bullet that appeared on the metal sheet from an average of a diameter of the entrance bullet hole 4 types were at 7 distances; of which displayed that bullets A and B had a diameter of the entrance hole much more than the bullets C and D were statistically significance at a level of 0.05 in all shooting phases; of which is presented in figure 3. The bullets A and B had a diameter of the entrance holes, it was between the ranges of 13.10-13.60 mm and 13.60-15.00 mm, respectively. The bullets C and D had an average of the entrance hole diameter of 11.60 and 12.00 mm, respectively. When considering the diameter of the entrance hole per firing range, it was found that the diameter of the entrance bullet holes can’t use for identity firing range.

Figure 3. Comparison of average diameter of the entrance bullet holes 4 types at 7 distances

The exit hole examination outcomes from determining the mean diameter of the bullet exit hole found that the bullet C would have the minimum diameter of the bullet exit hole of between the ranges of 11.41-11.85 mm at all firing ranges. Bullet D was the closest with bullet C being 12 mm. Bullets A and B would have the diameter of the exit hole at 13.74 mm at the firing range between 0.0-0.15 meters. At the firing range at 0.5-2.0 meters, the bullet B had the maximum hole diameter, between the ranges.
of 14.40-15.00 mm. When contrasting the category of the bullet, it is determined that the bullet A had a
diameter akin to that of the bullet B. However, there was a diameter amount of the exit hole more than
bullets C and D at significant the level of 0.05 as shown in figure 4 (a). The bullets A and B could be
divided from the physical characteristics of the exit hole. The bullet B had a tear rather than the hole of
bullet A.

As for the measurement of the depth of the bullet holes, it was determined that at a distance of 0.0
m, the D bullet hole had the topmost depth (21.11 mm) in figure 4 (b). At a distance of 0.15-2.50 meters,
the bullets A, B and D had a similar depth of 14.10-17.00 mm. The C hole had the lowest depth about
9.00 mm at every shooting distance. When contrasting the bullet hole 4 types of depth values, it was
established that ammunition categories A and B had substantially greater hole depth compared to C, at
significant the level of 0.05. The firing range did not affect the depth of each bullet hole category.

![Figure 4. Comparison of average diameter of (a) the exit bullet holes and (b) the depth of the bullet holes at 7 distances](image)

4. Conclusion
Information gained from this study can be used to investigate the 11 mm bullet hole traces on the metal
sheet. Based on the investigation of the bullet hole traces on the metal plate was determined that the
smooth hole edge, quite round. The physical properties of each bullet type are different that can basically
inform about type of bullet (p < 0.05), at the 95% confidence level but the average a diameter of bullet
hole can’t use for identity shooting distance. Data from the analysis of the effect of destruction was
created by this gun. As a result, it would be a framework for backing evidence. Finally, evidence for
weight and soundness was determined to be integral.

Acknowledgements
The authors are grateful to the Faculty of Liberal Arts and Science, Kasetsart University and Department
of Physics, Faculty of Science, Silpakorn University

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