Journal of Forensic Science & Criminology
Volume 9 | Issue 2
ISSN: 2348-9804

Research Article Open Access

Can Bullet Characteristics Link a Bullet to a Manufacturer?

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Citation: Brown A (2021) Can Bullet Characteristics Link a Bullet to a Manufacturer? J Forensic Sci Criminol 9(2): 203

Received Date: April 18, 2021 **Accepted Date:** May 22, 2021 **Published Date:** May 24, 2021

Abstract

This paper was written to understand if there is a way to identify a bullet manufacturer based solely on the shape and characteristics of the bullet. Traditional methods of bullet identification are to use a bullet comparison microscope and look for toolmarks and rifling to link it to one particular gun. Cartridge case identification is a lot easier to link to the manufacturer being that there is already some identifying information of the breech face. These include but not limited to the bullet size (9mm), the gun manufacturer (SW-Smith and Wesson), and the trigger pin impression. This research is being done to find an alternative method of bullet identification in the event there are no cartridges left at a crime scene nor does the bullet have sufficient tool marks or rifling to link to a specific gun.

Keywords: Ballistics; Bullet Identification

History

The initial inquiry into bullet identification came about after legal professionals wanted to do away with the assumptions used in determining correlations between bullets and guns. Court cases involving questions of what gun fired the fatal round have been documented as far back as 1835 [1]. One example was in a Minnesota case where one of 2 suspect revolvers was used in a killing. A gunsmith was able to determine that one gun had true rifling and the other falsely rifled at the muzzle. From this, he gathered that the bullet most likely came from the revolver with true rifling.

In 1925, the Bureau of Forensic Ballistics was formed in New York City by Major Calvin H. Goddard Charles E. Waite, Philip O. Gravelle, and John H. Fisher [1]. Since most law enforcement agencies did not have their own Ballistics unit, they would call in the Bureau to investigate those matters. John H Fisher is also credited with being the first to modify and use a comparison microscope to analyze fired bullets and cartridge cases.

The Federal Bureau of Investigation (FBI) opened its own ballistic laboratory in 1932 [1]. Today, it is the biggest ballistics lab in the nation.

Over the next 45 years, several books were written explaining the science behind and techniques of bullet identification. It also continued to be a tool for convicting suspects in several court cases. Some high-profile examples being President John F. Kennedy, Lee Harvey Oswald, and Dr. Martin Luther King Jr.

Despite these advances, there is still skepticism in using bullet identification evidence in some courts [2]. Today, bullet identification is partially based in assumptions [3]. This causes problems when applying the Daubert Standard to this type of evidence [3]. Unlike DNA analysis, there isn't a method that yields a clear, definite, yes or no answer [3]. There are many Ballistics Examiners world-wide working to solve this problem.

Methods

Several scholarly articles were read through multiple search engines and used to provide a basis of information for creating this alternative method.

Results

Present methods of bullet identification involve comparing toolmarks on a bullet and a cartridge case [4]. Multiple types of comparison microscopes are used to identify these matches. Pattern matching is when the striations of two bullets, two cartridges, or one bullet and one cartridge are compared to see if they are a match [5]. Once the round is identified, the individual gun the round came from can be traced [5]. The gun that was used in the crime will then be examined and linked to the crimes' culprit. This method is not 100% accurate [7]. It depends on the examiner's level of experience and inference on what is considered a match. This method is widely considered to be the most effective by ballistics professionals.

Rifling is the spiral shape of indentions that form raised and lower areas (lands and grooves) inside the barrel. Toolmarks are markings caused by components of the gun hitting the bullet and casing during the usual process of firing a round or by striations the round obtains as it travels through the barrel. Striations are unique to one specific gun. Several instruments in a gun can create toolmarks. Trigger pin impressions are found on the breech face of the cartridge case. It forms when the trigger is pulled causing the pin to make contact with the breech face leaving an indentation. The ejection mark is formed when the ejector hits the cartridge and launches it out of the gun. Extractor marks are found around the rim of the cartridge. Anvil marks are found around the rim of rim fire cartridges (rounds that are ignited when the trigger pin hits the rim of the case) or the center of center fire cartridges (rounds that are ignited when the trigger pin hits the center of the case). Striations come from the imperfections that happen in the manufacturing of gun parts [8]. The most useful striations come from the manufacturing of the barrel of the gun; where it gets all of its identifying features. When the round is ignited, the heat causes the metal to expand, allowing it to take on the rifling of the barrel along with any other stray marks that are inside it [8]. Magazine marks occur when the round as it is loaded into the chamber from the magazine [2]. The combination of these 2 types of toolmarks are compared in a bullet comparison microscope to see if they align [9].

Bullets can be made out of many different materials. The traditional metal for the core of a bullet is lead with cases made out of zinc and copper [10]. More modern bullets are made with bronze, aluminum, tin, steel, rubber, etc [11]. Primer is an explosive chemical compound that is used to ignite the combustible powder inside the case [12,13]. The compound is impact sensitive and compacted in a brass or copper alloy cup [14,15]. The modern version of gun powders also known as black powder is made up of sulfur (S), charcoal (C), and potassium nitrate (saltpeter, KNO3) [16]. The charcoal and sulfur are the fuels of the bullet and the saltpeter is the bullet's oxidizer [17]. There are no specific details about bullet, primer, or powder components that could be linked to individual companies [18]. Information about the chemical components of manufacturers' ammunition was unaccessible.

Conclusion

Present methods of bullet identification involve comparing toolmarks on a bullet to the marks on a cartridge case. Pattern matching is when the striations of two bullets, two cartridges, or one bullet and one cartridge of compared to see if they are a match. This method is widely considered to be the most effective by ballistics professionals [19]. Rifling is the spiral shape of indentions that form raised and lower areas (lands and grooves) inside the barrel. Toolmarks are markings caused by components of the gun hitting the bullet and casing during the usual process of firing a round or by striations the round obtains as it travels through the barrel. Striations are unique to one specific gun. Several instruments in a gun can create toolmarks [20]. Based on the research done, there is not sufficient information publicly available to answer questions about bullet manufacturers' chemical formulas. After exhausting all research avenues, information on companies' specific metal percentages in bullets, primer components, chemical ratios, nor powder materials were found.

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