

ANALYTICAL STUDY OF FORENSIC BALLISTICS IN THE CRIMINAL INVESTIGATION IN INDIA

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Abstract

Forensic ballistics is a crucial aspect of criminal investigation, as it deals with the examination of bullets and firearms to determine the link between a crime and the weapon used. The use of forensic ballistics can provide crucial evidence in criminal cases, linking suspects to specific crimes and providing investigators with valuable information about the crime scene and the events that took place. Forensic evidence must be handled and stored in a way that preserves its integrity. This means that it must be kept in a secure location and protected from damage or contamination. Proper documentation and labeling must be used to ensure the chain of custody is maintained, and the integrity of the evidence is preserved. Forensic ballistics has a long history and developmental background, starting in the late 1800s when the first systematic study of bullets and firearms was conducted. Since then, the field has continued to evolve and improve, with new technologies and techniques being developed to aid in the examination of evidence. This paper aims to explore Forensic Ballistics and show how it may be applied in criminal investigative procedures.

Keywords: Forensic Ballistics, Criminal Investigation, Forensic Science.

Introduction

Weapons have played an important role in civilization throughout human history, and they continue to do so now. Anyone that has ever watched a movie or stood next to the screen knows that people have a fascination with firearms. Westerns have long been a popular way to remember the battle between criminals and government officials that took place in the 19th century. In war films, the usage of handguns and automatic weapons is common, whereas in urban crime shows, these weapons are used in a variety of ways. Police officers are armed with handguns, while hunters are armed with long rifles. Military personnel are equipped with even more advanced weaponry. It's impossible to deny that we live in a world where guns are ubiquitous.

In today's violent and assault crimes, lethal assault weapons are by far the most commonly utilized weapons, and they are employed in an overwhelming majority of violent and assault crimes. Firearm investigation is a branch of forensic science dedicated to the study of firearms and the crimes they cause. In forensic investigations involving weapons, it is

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frequently used in conjunction with the field of ballistics, which studies the path taken by projectiles in flight. When a bullet is fired, it travels a predetermined path before striking its intended target. A variety of artefacts, such as firearms, cartridge cases, bullets, and live ammunition, as well as trace materials and any other items destroyed by a projectile, may be collected for study amid investigations wherein the use of weapons is suspected.

Real-world crime scenes require the use of forensic science to establish a link between a firearm and a criminal. This paper intend to enhance awareness of Forensic Ballistics and describe its application in criminal investigative procedures.

Forensic Ballistics

Latin "*ballista*" is the root of the word "Ballistics," which refers to a moving body or object. It is a branch of forensic science that studies how bullets travel through the air. The term "projectile" refers to a body that is propelled through the air, typically by a rifle. The study of projectiles necessitates the study of arms.¹ Forensic ballistics is one of the branches that studies firearms, as well as explosive charges and ammunition, in order to figure out how a crime scene sought after it happened. Because reconstruction can lead to a lot of evidence that can be used in court to help the prosecution, it has become an important part of the criminal investigation process. No two missiles fired from the same or different guns will have the same trace marks on their faces.²

As a result, each rifled firearm leaves its own distinctive markings, similar to a fingerprint, on both the bullet shot and the cartridges case from which it was fired. When a bullet or cartridge is mentioned, it is feasible to connect it to the weaponry that is under discussion. According to a firearm examiner, if an evidence gunshot appears to have the same class features and individual characteristics as rounds fired from a "suspect firearm," then it is possible that the shot was fired from that suspect weapon. These facts can be shown through comparison microscopes and photomicrography, which can be the more valued and a reliable way to show them, Ballistic experts collaborate with judges, police officers and legal professional, and who hire them to testify as independent experts in court. They played a significant "complementary" role in making sure that everyone is treated fairly in recent times.

1 Rashika Gupta, "Ballistics: The Probative value of Evidence", Cri LJ 1992.

2 MC Sarkar, et al., Sarkar's LAW OF EVIDENCE, p. 877.

Fortunately, with the help and knowledge of ballistics, it has become feasible to accurately determine not just which cartridge was shot with which rifle was used, but also a number of other crucial parameters, though with various degrees of likelihood. For example, the investigation will look at the time the firearm was fired, the range of fire, and other comparable concerns. Ballistics experts, along with chemical analyzers, can uncover a multitude of information about a crime, including the role played by a certain firearm, the type of ammunition used, and other details about the crime scene. Thus, whether firearms are found at the scene of a crime or on the person accused of committing the crime, the services of a ballistics expert are necessary.³

It is possible that firearms will be left on the scene of an incident. The area where the pistol was discovered is thoroughly searched for foot-footwear prints, transport tracks, and other evidence of human presence. Handprint may also be identified on some sections of the firearm, including the trigger guard, slide casing, and other components. When a firearm is visually inspected, the report includes a description of all of the firearm's structural features, damage, and contamination. The ballistics expert determines the model, caliber, kind, trademarks and serial number of the firearm. Aside from that, the bore walls are examined for indications of powder gas smell, which helps identify when the shot was discharged. On determines if the projectile was in flight by evaluating all objects in the line of fire, including dents and damages in the floors, ceilings, and walls. A ballistic specialist examines a bullet to evaluate its shape, design, number of bore lands, size, and color. A ballistics expert counts the pellets and assesses their size, shape, and maximal and minimal dimensions. All of these procedures are used by ballistics experts to help recreate a firearm crime.

In addition to the studies and methodologies described above, the ballistic expert must make decisions on a number of other issues, including the following:

- a) A firearm can be identified by looking at the shape of the thing and determining if it is a firearm. This question could arise while analyzing a homemade weapon that has been constructed in reduced form to replicate a known type. When it comes to determining whether or not a device can truly ignite gunpowder, fire a projectile, or create striking power, the mechanism and individual components of that device must be investigated thoroughly.

3 B.R.Sharma (ed.), FORENSIC SCIENCE IN CRIMINAL INVESTIGATION AND TRIALS, 6th ed, 2020.

- b) Whether or not a projectile can be fired from a specific sort of weapon—this question is critical in determining whether or not the weapon can be used as a criminal instrument.
- c) Whether or not the weapon in question was utilized in the commission of the offence.

In view of the foregoing description, a ballistic expert performs the following two fundamental functions:

First and foremost, the scientific function entails the gathering, testing, and assessing of evidence in order to form an opinion about that evidence.

Secondly the forensic function, which entails expressing that opinion to the Court in order to assist it in reaching a logical conclusion.

Historical Background and Developments

Prior to the advent of mass manufacture of weapons, gunsmiths created barrels and bullet moulds by hand. Consequently, the individuality of each rifle was unavoidable. As a result, the rounds fired always left characteristic marks that were unique to a given rifle, regardless of the weapon. While this method has been used for decades, it was the first method to identify the pistol that fired a bullet in the first place. Foul play can be detected by using the fingerprints left on firearms and other evidence found at a crime scene. Forensic fingerprinting can help identify suspects and specific weaponry used in a crime.

In 1835, a forensic firearm examination was performed for the first time in the world. That's when Henry Goddard used ballistic fingerprinting to establish if a victim's bullet belonged to the real criminal. He saw an imperfection on the bullet's surface that wasn't produced by the barrel or an impact. It appeared to be a manufacturing flaw that occurred throughout the manufacturing process. He reasoned that collecting the bullet mould would be a simple way to confirm the shooter's identity. The mould in the suspect's residence matched the markings on the bullet he found while looking for the gunman. In spite of the fact that the gunman later confessed to his crimes, this was crucial evidence in convicting him of the crime.⁴

Regina v. Richardson,⁵ Another early usage of rifle identification may be seen in a case from 1860. One of the most important pieces of evidence and testimony was a piece of newspaper

4 GOING BALLISTIC: THE FORGOTTEN ORIGINS OF FORENSIC WEAPON IDENTIFICATION, University of California, Berkeley, <https://cls.berkeley.edu/sites/default/files/paper-blum.pdf>, (last Visted on 1st May, 2022).

5 *Regina v. Richardson*, 65 U.S. 188 (1860).

wadding. Bullets and gunpowder used to be held together by wadding until cartridges were invented. On the crime scene, wadding matched wadding found in the victim's wound which was made up of London Times Newspaper. The suspect's wadding was composed of the same substance as the wadding previously gathered. In the end, it proved his identity as the gunman and helped convict him.

As the volume of guns and ammunition produced rose, the rifling technique became even more consistent and standardized. Therefore, while forensic experts could match the rifle's barrel marks on a recovered bullet to those on the rifle's barrel with a forensic expert's assistance, identifying the bullet to a specific firearm manufactured by one manufacturer with only visual examination became more complicated. After all, "necessity is the mother of invention!" as the adage goes. So a magnifying lens could see gunfire up close. Per the New York Times, Oliver Wendell Holmes, a future Supreme Court justice, used a magnifying lens to inspect a test shot fired into cotton wool to compare striations on a victim's bullet retrieved during an autopsy.

With the passage of time, magnifying glasses become an essential part of weapon examinations. Despite the availability of microscopes, comparing two rounds at the same time proved difficult. An error in ballistic fingerprinting led to Charles F. Stielow's conviction in 1915. He was found guilty and sentenced to death for killing his employer and his maid with a 0.22 millimetre handgun. Investigator Charles E. Waite reexamined the evidence with Dr. Max Poser, a microscopist, and decided that the bullets found at the crime scene could not have been shot from Stielow's weapon. Stielow was acquitted and released.⁶

Major Calvin Goddard, chemist Philip Gravelle and Physicist John Fisher joined Waite in New York City to form the Bureau of Forensic Ballistics (BFB). Philip Gravelle designed the comparison microscope (two microscopes linked by an optical bridge) to tackle simultaneous comparison difficulties. The first notable use of this microscope was in the 1929 Saint Valentine's Day Massacre investigation.

Relevance of Forensic Ballistics

In India, forensic evidence is being introduced into courtrooms in a fragmented state of completeness. A pitiful state has been achieved by India's vetting of scientific evidence in

⁶ James T. Spencer, AN INTRODUCTION TO FORENSIC SCIENCE: THE SCIENCE OF CRIMINALISTICS, Syracuse University (2007).

recent years. It is commonly understood in both the legal and forensic worlds that evidence is meaningless unless it can adequately explain probabilistic estimates to the trial.

But in India, specialists just report whether or not samples are same. In fact, it is impossible to discern between the person and others who may have comparable features.

This means that the proof must be able to rule out any other possible suspects. An important aspect of forensic evidence in legal contexts is its ability to show or refute a specific fact. The specimen has probative value in establishing a relationship between the suspect and the crime if it matches DNA collected from the suspect. If, on the other hand, it does not match, the suspect will be excluded from the investigation.

When it comes to analysing scientific evidence in criminal trials, the Indian Evidence Act, 1872, is quiet on the criteria that should be followed by the trial judges. This is a significant problem in India because the Indian Evidence Act, 1872, is vague on what standards should be applied. If a person possesses some specialised knowledge in a certain field such as science or art, that individual may be designated as an expert and his or her testimony is considered pertinent fact under Section 45 of the Indian Evidence Act, 1872. In a similar vein, Section 51 affirms the relevance of the principles on which an expert's opinion is founded. The trial judge is not guided by any other rules for considering the trustworthiness and admissibility of expert testimony other from this. The prospect of expert evidence being accepted at face value by judges in India is a major source of concern for evidence scholars. This is owing to the judges' lack of comprehension of the premises on which a particular expert evidence is based. Insofar as the uniformity of admissibility requirements that are to be followed by judges in criminal trials involving scientific evidence is concerned, there is a legislative vacuum. This latitude has resulted in a greater exercise of judicial discretion on the part of trial judges in India when it comes to admitting expert reports. In most jurisdictions, particularly in the United States, it is nearly universally acknowledged that judges must examine scientific evidence in order to exclude junk science from consideration.

Scientific evidence, often known as forensic evidence, is evidence that has been obtained using scientific or technological means. When it is brought before a court of law, the first question that is asked is whether or not it is admissible in court. When it comes to determining the trustworthiness of scientific evidence, the trial courts have been confronted with a significant issue. During a trial, establishing the scientific validity of evidence in the case has always been a bone of contention for judges and attorneys. The fact that they have

no scientific training places them in a precarious position when judging whether the scientific answers are dependable enough to be used at trial. The reliability of scientific evidence is the major factor that contributes to its attractiveness.

When determining admissibility, the courts looked more at the expert's competence than they did at the scientific theory or technique that was employed to arrive at a certain conclusion, according to the court's ruling.

It is more difficult to determine whether forensic expert evidence should be admitted in a criminal trial when judges and lawyers do not have the necessary expertise in the relevant scientific area. The Indian Evidence Act demands judicial verification of expert evidence in criminal trials. However, trial judges lack certain minimal competence to rule out expert evidence based on scientific evidence validity. The landmark Daubert judgement by the US Supreme Court is a 'reliability validity' paradigm of evidence.

To distinguish Daubert from Frye, the most important feature of Daubert is that it requires the trial court to conduct an independent evaluation of the evidence in order to determine whether it is admissible. The Daubert ruling established a clear standard for the admissibility of scientific evidence in legal proceedings. The Supreme Court of the United States interpreted the text of the Federal Rules of Evidence for the first time in order to allow scientific expert witness to be admitted into evidence.

Relevance and dependability are the two conditions for admissibility under Daubert that must be met. When a scientific evidence is admitted into evidence, the trial courts must give appropriate weight to these critical aspects of the case. The reliability of evidence presented in a trial involving a scientific discipline must be considered when determining the relevance of the evidence. Most plainly, it is unsettling that trial practice does not appear to have been transformed as a result of procedures that were accepted before to the implementation of reliability criteria and are still being accepted now

The probative value of any evidence, for that matter, is determined by the combination of legal reliability and logical relevance. Science and expert testimony have a high probative value, which means they can aid the Court in making a decision in cases when technical assistance is required. It is of no assistance to the Court in its interpretation.

Contrary to popular belief, the Court is not precluded from making reasonable guesses when there is no expert assistance available.

To establish a witness's credibility, the trial judges must consider the reasons stated for his judgments, as well as the evidence and information provided to support his conclusions.

However, courts generally accept an expert's view if it is corroborated. It is important to note that the Indian Evidence Act does not clearly specify that corroboration is a sine qua non criterion for this rule. There has been a significant formal movement in admission standards. As of yet, neither the courts nor the prosecutors have addressed the potential that previous convictions were based on inaccurate evidence, nor the need to assess past practise that this knowledge entails. In lieu of empirical reliability, courts might rely on forensic or legal dependability, which allows them to use a precedent-based method in which judgments or decisions are based on prior precedent.

A ballistic expert who has conducted the necessary tests and testified that by firing a number of test cartridges from a given firearm and comparing them under a microscope with the evidence cartridge, it can be definitively determined whether the evidence cartridges were fired from the concerned firearm or not, such evidence may be relied upon. However, where it is not certain that the weapon confiscated from the accused was used to fire such bullets, the ballistic expert's assessment based on the recovery of mutilated pellets collected from the bodies of the deceased and the bodies of the injured loses its significance. In most cases, the failure to get a ballistic report when an injury is inflicted by a gunshot does not cast doubt on the prosecution's version of events. The facts of each case determine whether or not the inspection of a ballistic report is required to advance the prosecution's account of the events in question. Whether or not an accused individual used a firearm, it cannot be proven that the prosecution must always use the testimony of a ballistic expert to prove the accusation, regardless of the quality of the direct evidence presented. When there is no direct proof or when it is unclear if the injuries were inflicted by a specific weapon, a ballistic expert is called in to assess the situation.

In the case of *Mohinder Singh v. State of Punjab*,⁷ "where the death is due to injuries or wounds by a lethal weapon, it has always been considered to be the duty of the prosecution to prove by expert evidence that it was likely or at least possible for the injuries to have been caused with a weapon with which and the manner in which they are alleged to be caused. It is elementary that where the prosecution has a definite or positive case, it must prove the whole of that case. In the present case, it is doubtful whether the injuries which are attributed to the

⁷ *Mohinder Singh v. State of Punjab*, AIR 1953 SC 415.

appellant were caused by a gun or by a rifle It is only by the evidence of a duly qualified expert that it could have been ascertained whether the injuries attributed to the appellant were caused by a gun or by a rifle and such alone could settle the controversy as to whether they could possibly have been caused by a firearm being used at such a close range as is suggested in the evidence.” The decision was discussed by the Supreme Court in a recent case where the learned Judges said: “These observations do not purport to lay down an inflexible rule that in every case where an accused person is charged with murder caused by a lethal weapon, the prosecution case can succeed in proving the charge only if an expert is examined. It is possible to imagine cases where the direct evidence is of such an unimpeachable character and the nature of the injuries disclosed by post mortem notes is so clearly consistent with the direct evidence that the examination of a ballistic expert may not be regarded as essential. Where the direct evidence is not satisfactory or disinterested or where the injuries are alleged to have been caused with a gun and its prima facie appears to have been inflicted by a rifle, undoubtedly the apparent inconsistency can be cured by the oral evidence of a ballistic expert. In what case the examination of ballistic expert is essential for the proof of the prosecution case must naturally depend upon the circumstances of each case.”

Types of Forensic Ballistics

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Internal ballistics, external ballistics, and terminal ballistics are the three main areas of study in the subject of ballistics. There is a lot of overlap between the three categories, and establishing a successful load necessitates a basic understanding of each.⁸

Internal Ballistics

Internal ballistics is concerned with everything that occurs between the chamber and the barrel's end. Powder, bullets, brass, and primers are all important elements that determine the cartridge's performance and can have an impact on other areas. The attributes of the firearm are also included in this section. Internal ballistic factors like as chamber size, rifling, twist rates, suppressors, and barrel harmonics can all be included in the internal ballistic area of study and have a direct influence on the bullet's exterior ballistics.

It is very common for forensic experts to do internal ballistics tests.

- Investigating the mechanisms of firearms to determine the cause of accidental firing.

⁸ Robert A. Rinker, UNDERSTANDING FIREARM BALLISTICS (6th Ed.), Mulberry House Publ. Com., 2005.

- Examining fired bullets and cartridge cases under a microscope to see if they were fired by one of a certain firearms.

External Ballistics

The study of a projectile in flight is known as external ballistics. It's possible that this is a bullet, a sabot, or a missile. Gravity and drag are the two major factors that affect all of these missiles. Internal ballistics imparts the projectile's speed and spin, but whatever is imparted to the projectile after it leaves the barrel has an impact on the trajectory, which is the major output of External Ballistics.

External ballistics forensic examinations are divided into two categories:

- Calculating and reconstructing bullet trajectory.
- Determining a bullet's maximum range

Terminal Ballistics

The behaviour of the missile (projectile) after it impacts the target is referred to as terminal ballistics. The study of missile penetration in various types of targets, such as solids and liquids, is known as terminal ballistics. It's the study of animal tissues' injuring capacities. It entails research on bullet-resistant fabrics like jackets and vests. Bullets are used to pierce glass panes in windows, exhibits, and buildings as part of the research. Soil, brick, or wood might be the target. Terminal Ballistics is sometimes referred to as Wound Ballistics when the target is a human body.

Forensic analyses of terminal ballistics are divided into three categories:

- Calculating the firing point's distance from the target and finding out if a bullet caused a certain wound.
- Establishing the caliber and type of projectile responsible for the damage or injury produced by a bullet.
- Assessing targets or wounds in biological tissue for bullet exit and entry points.

Application of Forensic Ballistics in Criminal Investigation

When it comes to committing some of the most heinous crimes, guns or bullets are sometimes the most visible proof. Evidence such as shell casing fragmentation, even blood spatter patterns and bullet cavities are among the most sought-after by crime scene investigators. Re-creating a crime scene or conducting an investigation into a criminal incidence may require the use of several forensic ballistics procedures.⁹

- **Gun Powder Residue Patterns:** When a gun is discharged, the bullet seems to be the sole item that leaves the barrel. In reality, shooting ejects gunpowder remnants, which leave a distinctive pattern on an item near the barrel. The pattern's appearance changes depending on the distance between the weapon and the target. Such patterns can be linked by forensic ballistic experts to the approximate distance from where the handgun was fired.
- **Trajectory, Bullet Cavities, And Ricochet:** An investigator's ability to reconstruct the flight path of a gunshot can be extremely helpful in reenacting a crime. The trajectory of a bullet aids forensic ballistic experts in detecting the direction from which a projectile is thrown in the field of investigation. If gunshot wounds are discovered on floors, walls, or ceilings or in other places/objects at the crime scene, investigators can use two ways to estimate the trajectory of the bullet. Prior to this, shooters' positions, heights, and other attributes were determined by inserting sticks and strings into bullet holes to calculate the projectile's flight path. When using the newer technique, the trajectory of the bullet is determined by means of a laser.
- **Striations on A Fired Bullet:** The 'rifling' method used in the manufacture of each firearm's barrel is what distinguishes it. The interior of the barrel develops a sequence of grooves and spirals as a result of this process. For a bullet to travel accurately and safely, these grooves are required. Because of this, when a bullet is fired, it leaves spiral groove patterns and enters the rifle chamber. Due to the same reason fingerprints are unique, no two pistol barrel grooves are alike.
- **Extractor Pin, Ejector Impressions, and Firing Pin:** In order to fire a gun, the firing pin must first hit the cartridge core, igniting the primer. The primer ignites the gunpowder when it contacts the firing pin. The firing pin also leaves an indentation in the

⁹ Edward E. Hueske, PRACTICAL ANALYSIS AND RECONSTRUCTION OF SHOOTING INCIDENTS, CRC Press, 2005.

cartridge case's centre ring. This imprint, which is unique to each gun's firing pin, may be used to link cartridges to certain rifles.

- **Tissue Damage:** Forensic examiners are experts in extracting a wealth of information from the victim's wounds. Whether or whether not the bullet fragment is recovered, the wound itself can provide information on the bullet type, the sequence of strikes, the distance from which the bullet was fired, the velocity, and other characteristics. This method can be used to determine the direction, velocity, and distance of a shot in thick bones such as the skull.
- **Fingerprints:** Of course, a shooter would physically handle the bullets when loading them into a cylinder. This causes perspiration to be deposited on the handgun's surface. When a bullet is fired, the intense heat evaporates the sweat, leaving salts on the gun's surface. Using fingerprint powder enhances contrast. After retrieving the fingerprints, they can be compared to a database.
- **Firearm Examination:** Although a variety of evidence like gunshot residues GSR, wounds, wasted ammo, cartridge casings and other material can be used to demonstrate this, firearm inspection is also significant in determining its relation to the crime.

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Forensic Ballistic Expert

Experts are defined in a variety of ways. Powell's, a social scientist, interpretation is the most widely accepted. According to him, "an expert is a person who has spent a significant amount of time and effort studying a certain field of study and has a high degree of expertise in the subject matter at hand."

In the Indian Evidence Act of 1872, Section 45 deals with "opinions of third persons when relevant," as follows: "When the Court has to form an opinion upon a point of foreign law, art, or science, or as to identity of finger impressions or handwriting, the opinions on that point of persons specially skilled in such foreign law, art or science, or in questions as to identify of fingerprint or handwriting", they are referred to as experts.

The Indian Evidence Act, 1872, Sec.45 authorizes the production of an expert to assist the judge in forming an opinion on questions of foreign law, science, art, or handwriting identity. An expert is a person who has dedicated time and study to a particular field of knowledge and is thus uniquely qualified to provide an opinion. The Indian Evidence Act defines an 1872

expert as a “specially skilled person”. They are experts who run a business or profession that demands them to know a lot about the subject. There are no legal requirements for how much experience or qualification a person must have to be considered an expert.

A combination of things could make a witness an expert, like:

1. Expertise, which could include academic achievements, professional training, experience in the trade, means at their command, and how they used those means to come to a conclusion.
2. Using simple language, photos, charts, sketches, and other evidence to back up his claims so that a person who doesn't know what he's talking about can understand it.
3. Relevancy doesn't mean just assuming that the facts are true, but drawing conclusions either from his own experience or from the work of people who have been proven to be credible.

Section 293 CrPC. relates to certain Government Scientific experts and lay down: -

“Reports of certain Government scientific experts. —

1. *Any document purporting to be a report under the hand of a Government scientific expert to whom this section applies, upon any matter or thing duly submitted to him for examination or analysis and report in the course of any proceeding under this Code, may be used as evidence in any inquiry, trial or other proceeding under this Code.*
2. *The Court may, if it thinks fit, summon and examine any such expert as to the subject-matter of his report.*
3. *Where any such expert is summoned by a Court and he is unable to attend personally, he may, unless the Court has expressly directed him to appear personally, depute any responsible officer working with him to attend the Court, if such officer is conversant with the facts of the case and can satisfactorily depose in Court on his behalf.*
4. *This section applies to the following Government scientific experts, namely:-*
 - a. *Any Chemical Examiner or Assistant Chemical Examiner to Government;*
 - b. *The Chief Controller of Explosives;*
 - c. *The Director of the Finger Print Bureau;*
 - d. *The Director, Haffkeine Institute, Bombay;*
 - e. *The Director, Deputy Director or Assistant Director of a Central Forensic Science Laboratory or a State Forensic Science Laboratory*

f. the Serologist to the Government.

g. any other Government scientific expert specified, by notification, by the Central Government for this purpose.”

The experts mentioned above don't have to be called to give oral evidence as a matter of course by the party. Section 293 of the CrPC 1973 says that this isn't the case, though. The court will have a lot of power in this case, and it will be able to call and question the witness only if it thinks it's necessary for the good of the case. It's possible to use the report of these experts in any kind of hearing. If the report is about something that was sent to them for examination or analysis and report in the course of a case under the CPC, it can be used as evidence in that case.

If one of the experts named at (a) to (f) is called to a court hearing, but he can't make it in person, he can send a responsible officer who works with him to the court. If the officer is knowledgeable about the case and can speak well in court on his behalf, he can do this.

Importance of Forensic Ballistics

Firearms are used frequently in crimes. In fact they figure prominently in most of the heinous crimes like murders, dacoities, robberies, assassinations and mob violence and also in police encounters and firings. The firearm evidence, therefore, is important in criminal investigations and trials.

The firearm evidence pertaining to their identification through fired ammunition is well-established. It is now on the same footing as the fingerprint evidence. The individuality of the marks imprinted by a gun on a fired cartridge or on a bullet is universally recognized. The assertions of the expert that no two firearms even of the same make, model, batch and made one after the other leave identical marks on fired ammunition are accepted like the assertions of the fingerprint experts that no two fingerprints from two different fingers even from the same person are alike. Accused persons have been convicted and convictions have been maintained solely on the basis of the firearm evidence.

It is, however, necessary that the link between the evidence and the culprit is properly established. The firearm recovered from the culprit, which fired the fatal bullet or the cartridge case recovered from the scene, should be proved to be in the possession of the accused at the time when the crime was committed.

The firearm evidence further helps to:

1. Decide whether the given incidence is a case of murder, accident, killing in self-defence or suicide.
2. Determine the sequence of events.
3. Verify versions.
4. Establish the number of shots, their directions and ranges and the number of firearms used in the incident.
5. Distinguish between real and fake incidence.

Importance of Ballistic Report

Fired rounds of ammunition had been taken to the Patna-based Forensic Science Laboratory for analysis. The facts and his findings plainly suggest that the cartridges discovered near the corpses of the deceased persons would have been unable to be fired from the country-made pistols confiscated near the dead bodies, and that those pistols were faulty in their construction. Additionally, the study found that the aforementioned firearms had never been fired. Blackening of the margins of wounds on the bodies of the deceased victims indicates that a firearm has been used within approximately 18 inches of the bodies' location on the ground.¹⁰

The Apex Court discussed the application of ballistic expert report in the case of *Kalua vs State of U. P.*,¹¹ where it was seen that A person was shot and killed with a handgun produced in the nation. A cartridge casing was discovered near the deceased's cot, and the accused presented a country-made handgun. The ballistics expert's opinion was sought on whether the cartridge recovered at the crime site had been shot from a country-made handgun or not. The cartridge discovered from the crime site was discharged from the seized country manufactured handgun and no other firearm, according to a ballistics expert. The court "highlighted the importance of Ballistics expert opinion. It would be insufficient to convict the appellants of the crime without help of the circumstantial evidence based on the testimony of the eyewitnesses and IO."

¹⁰ *Brijlala Prasad Sinha v. State of Bihar*, 1998 AIR 368.

¹¹ *Kalua v. State of U.P.*, 1958 AIR 180.

Admissibility of Expert Evidence

The law of evidence serves as the foundation upon which the entire system of dispensing justice is built and operates. In fact, the purpose of evidence is to help the courts reach a decision in a particular case. While facts can be used to support a judgement in some cases, they can also present problems when the Court lacks the appropriate expertise to do so. As a result, there is a demand for experts who, via their experience and education, possess the necessary ability and expertise to submit evidence based on facts.

When it comes to complex and subtle issues requiring scientific knowledge and technical capabilities, expert evidence is the twenty-first century's desideratum, one that is gradually becoming interwoven with the judicial system. However, the extent to which scientific testimony is admissible in the traditional adjudication mechanism is a key concern, and the present study explores the extent and scope of admission of expert evidence, as well as court appreciation in the field of ballistics in particular. Where a demand for cross-examination of ballistic experts is filed, the report is acceptable without the ballistic expert being examined.¹²

Case Analysis

A medical officer is not a ballistic expert

In a case of causing death by firearm injuries, the defence raised a plea that there was variance between the eye-witness account and medical evidence. It was urged by the defence that the weapons attributed to the accused persons by eyewitnesses cannot cause such injuries as stated by the doctor. The Medical Officer is not a ballistic specialist, the Supreme Court ruled. He was not expected to say if the injury was caused solely by a gunshot. In that sense, his opinion is irrelevant. It is well established that medical evidence is merely opinion and not conclusive. The medical officer was not a ballistic specialist. He was not expected to say whether a gunshot alone might have caused harm. In that sense, his opinion is irrelevant.¹³

Ballistic expert opinion rejected for giving opinion on the injury based on photographs

The Supreme Court has observed that the evidence of a ballistic expert as to what weapons and how many weapons were used was not accepted, as the expert himself had not seen the

¹² *Mal Singh v. State of Rajasthan, 1987.*

¹³ *Mahmood v. State of Uttar Pradesh, AIR 2008 SC 515.*

injuries and had given his opinion after seeing the injury in the photograph and that apart the expert was not in a position to give categorical opinion.

Circumstantial Evidence Adequate to Prove Guilt

In a case, where a husband is alleged to have caused the death of his wife by causing gunshot injury, there was complete lack of medical evidence. The revolver seized from the room where murder was committed was neither sent to finger-print expert nor to ballistic expert. Even blood found on the revolver had not been sent for chemical examination. However, it was held by the Supreme Court that the non-examination of fingerprint and ballistic expert would not negate the circumstantial evidence which have proved the guilt of the accused beyond all reasonable doubt.¹⁴

Regardless of the quality of direct evidence, the prosecution cannot be required to lead the evidence of a Ballistic Expert in every case where a firearm is allegedly used by the accused. The examination of a Ballistic Expert may not be considered necessary where the direct evidence is unimpeachable, and the nature of damage revealed by post-mortem notes is compatible with the direct evidence. It was apparent that the bullet discharged from the accused's pistol had injured the victim's spinal cord, causing paralysis of both lower limbs and death., it was held by the Supreme Court that absence of Ballistic Expert's evidence is not fatal to the prosecution case.¹⁵

Infamous case in the region of Connaught Place Delhi; wife of accused was brutally killed and chopped taken to burning tandoor in hotel. Medical pathology prima facie stated in report that cause of death was hemorrhage Whereas the statement given by the accused mentioned that 2 rounds were fired from his licensed weapon. This Failure caused, lead to another autopsy where the X-ray examination was performed aligned the facts stated by the accused.¹⁶

Further, in the case of *Vineet Kumar Chauhan vs State of U. P.*,¹⁷ it was seen Bullet wounds claimed the lives of the injured. A bullet was extracted from the spinal cord during post-mortem examination, but it was not sent for forensic investigation; instead, deformed bullets from the murder scene were sent for expert opinion. The twisted bullets from the purported

14 *Raj Kumar Prasad Tamarkar v. State of Bihar*, (2007) 10 SCC 433.

15 *Vineet Kumar Chauhan v. State of U.P.*, AIR 2008 SC 780.

16 *Sushil Sharma v. State (Delhi Administration)*, 2018 SCC Online.

17 *Vineet Kumar Chauhan v. State of U.P.*, AIR 2008 SC 780.

murder scene did not match the sample rounds shot from the pistol in issue, according to an expert. The court observed that “It cannot be laid down as a general proposition that in every case where a firearm is allegedly used by an accused person, the prosecution must lead the evidence of a Ballistic Expert to prove the charge, irrespective of the quality of the direct evidence available on record. It needs little emphasis that where direct evidence is of such an unimpeachable character, and the nature of injuries, disclosed by post-mortem notes is consistent with the direct evidence, the examination of Ballistic Expert may not be regarded as essential. However, where direct evidence is not available or that there is some doubt as to whether the injuries could or could not have been caused by a particular weapon, examination of an expert would be desirable to cure an apparent inconsistency or for the purpose of corroboration of oral evidence”.

Expert opinion must be supported by reasons

The Court is not compelled to accept the scientists’ or experts’ views if they are unacceptable. Experts’ opinions are not binding on the court. The Judge must make the final decision. In order for the court, who is not an expert, to develop its own view on those materials, the expert must present them to the court. Opinions must be backed up by reasoning, not just a blank finding. Experts testify but do not decide. Pre-requisites for expert evidence:¹⁸

Before expert testimony is admitted, it has to be established that,

The subject is such that expert opinion is necessary,

What are the qualifications essential to justify the status of an expert?

The witness in question is really qualified to be an expert.

Expert Evidence is a weak type of evidence

It was held that expert testimony is a poor sort of evidence and that courts do not often consider it to be ‘conclusive’ proof. Other evidence must back up the expert’s claim. Expert testimony is always suspect and should be treated with caution because of the limitations and imperfections in human memory and knowledge, which is why it should never be taken as definitive proof.¹⁹

¹⁸ *Law Society of India v. Fertilizers and Chemicals*, AIR 1974 Ker 308.

¹⁹ *S.Gopal Reddy v. State of Andhra Pradesh*, 1996 4 SCC 596.

Expert Evidence is Opinion Evidence

The Court observed that the stress was laid that the “ballistic expert had deposed with reference to the two empty cartridges found at the spot that the shots could have been fired from the 20 bore DBBL gun seized in the case and the expert was not definite about it. Keeping in view that the evidence was not direct evidence but an opinion evidence of the expert and on appreciation of his evidence as a whole in the background of the other facts and circumstances there could not be any shadow of doubt that the DBBL gun was used in firing the shots.”²⁰

Non-Submission of Sample

In the case *Amarsingh v. Balwinder Singh & others*,²¹ it was seen that the weapon and empty containers had not been forwarded to a forensic science laboratory for comparison. On behalf of the defence, it was contended that omission was a key fault in the prosecution case that might be used to undermine the prosecution version. The court held that “It would have been certainly better if the investigating agency had sent the firearms and the empties to the Forensic Science Laboratory for comparison. However, the report of the ballistic expert would in any case be in the nature of an expert opinion and the same is not conclusive. The failure of the investigating officer in sending the firearms and the empties for comparison cannot completely throw out the prosecution case when the same is fully established from the testimony of eyewitnesses whose presence on the spot cannot be doubted as they all received gunshot injuries in the incident.”

Similar observation were made by court in *Sheoshanker Singh v. state of Jharkhsnd & anothers*.²²

Conclusion

It is possible that the role and importance of ballistics in the administration of criminal justice will be overpowering in the modern societal setting. To comprehend the sophistication and complexities of modern weapons and ammunition, specialized knowledge and skills in decoding sophistication and complexities are necessary.; when it comes to effective interpretations of culpability and criminal liability, expert knowledge and skills in blending

20 *Shamim Rehmani v. State of U.P.*, 1975 SCC (Cri) 667.

21 *Amarsingh v. Balwinder Singh & others*, (2003) 2 SCC 518.

22 *Sheoshanker Singh v. state of Jharkhsnd & anothers*, (2011) INSC 132.

such knowledge in legal paradigm are required on the other. In fact, the latter is critical in terms of bringing the guilty to justice and the innocent to liberation from prison. What is vital, however, is the right acknowledgement and acceptance of expert evidence as a significant tool in the administration of justice in the appropriate circumstances. Using regular witnesses to excavate the scope and depth of illegalities may sound good and be true in some circumstances, but in today's world of transnational criminal activities, terrorism and organized crime, it may be severely insufficient. Achieving this may only be achievable with the use of distinct and specialized knowledge of intricate issues, which only an expert may be qualified and skilled to testify about in this case. As a result, there is greater reliance on experts.

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