

## **Critical analysis of the forensic protocols and ballistic experts at crime scene in Pakistan**

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### **Abstract**

Forensic is an important element of criminal justice system. This paper deals with and goes to be study regarding the proficiency of these tools and the way implementing those in Pakistan with already existing technology are going to be helpful for enhancing criminal justice system. The study of ballistics for legal purpose or to meet ends of justice is termed rhetorical ballistics. The law of proof is that the construction on that the system of dispensation of justice rests. In fact, the aim and object of proof is to guide the Courts to come back to a conclusion concerning a case at hand. But, in sure cases, wherever the queries concerned area unit on the far side the vary of common expertise and data, proof in sort of facts cause issues because the Court might not have ample ability to reach a conclusion supported those facts. Thus, the necessity arises for consultants who have the desired ability and data to tender evidences. In modern times, the reliance on skilled proof has been overwhelming; his paper provides a discussion of the specific crime scene investigation topic, namely ballistics and firearms. The major goal is to explain the significance of this topic in crime investigation as the proposed options of crime-solving techniques. Due attention is paid to the issues like the major units of ballistics, the major types of ballistics evidence, the major factors that are considered by ballistics experts while making an investigation of firearms used by the shooter at the scene of the crime, firearms examination, some facts from the history of firearms, and the overview of firearms. In general, the paper highlights the significant role of ballistics and firearms in crime scene investigation. By sharing ballistics and firearms intelligence across the United States, it is possible to make law enforcement resources more efficient.

The process of firearms identification depends on the use of the general experience and knowledge of firearms identification examiners, without the use of statistical data (Sinha, 2013). The growth of technological innovations requires the interpretation of the obtained data within forensic practices. In fact, ballistics experts working in forensic science labs have an opportunity to provide accurate and comprehensive investigations of firearms-related crimes.

**Keywords:** Forensic, ballistic, protocol, courts, crime, investigation, scenario, challenges.

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### **1. Introduction**

In case a forensic investigation has involved shoot outs then the investigation involves ballistic type of investigation. This is the study of the flight pathway of a bullet or the projectile of a bullet, this is called ballistics. This study is mostly applied in crimes. It involves the analysis of the weapons especially those that have been used in firearms. It involves the analysis of bullets and bullet impacts in the crime in question (Craft 20-23). The bullet trajectory includes the progress of the bullet through the barrel of the gun following discharge or detonation and its pathway both through the air and the aim. Tracing the bullet path reveals from what direction the bullet could have been fired, it is an important stage in forensic science investigation (Craft 27). This can be important in investigating route of actions in the crime or catastrophe.

Ballistics and firearms are known as two of the multiple aspects of crime scene investigation. It is

crucial for any forensic scientist or crime scene investigator to have a good understanding of the significance of presenting ballistics and firearms evidence in a court of law. This knowledge is useful in providing assistance to crime scene investigators to avoid erroneous conclusions in various types of criminal cases. It is not a secret that firearms are extensively used as a “weapon of offense for a variety of purposes ranging from petty crime to gang/militant warfare” (Sinha, 2013, p.1). Besides, firearms can be viewed as an effective device for antisocial activities such as military events, political riots, public demonstrations, strikes, etc. In order to help crime scene investigators in identifying crime scene reconstruction, ballistics experts provide testing of firing the same type of ammunition from firearms of different lengths. This testing allows obtaining valuable information regarding the distances between the victim and the muzzle of the firearm. According to researchers on ballistics techniques, “recovered crime guns can also be test-fired and the resulting bullets and casings from one crime scene can be compared with ballistics evidence at another crime scene to determine whether the crimes were linked to the same gun” (Braga & Pierce, 2004, p. 1). As a rule, the ballistic data is sent to the federal ballistics database known as the NIBIN Networks or the National Integrated Ballistic Information Network. The National Integrates Ballistic Information Network is a national system of ballistic imaging specially developed to assist in firearms examination through the provision of computerized images of bullets and cartridge cases. ATF bears responsibility for the functioning of this system at the national level. Due to the comparison of bullets and cartridges, it is possible to draw conclusions in the crime scene investigation process. If the firearms had been used in any other crime, this information will be provided by NIBIN Network staff. Currently, “crimes are solved by law enforcement following up on intelligence information from ballistic imaging technology”. In other words, the NIBIN Network helps to resolve serious crimes by providing evidence that can be in a court of law. By sharing ballistics intelligence across the United States, it is possible to make law enforcement resources more efficient.

#### **The Significance of Ballistics and Firearms in Crime Scene Investigation**

In criminal trials, due attention is paid to firearms identification evidence that requires thorough examination and analysis of the case in order to draw relevant conclusions. Any type of ballistics and firearms evidence should be carefully examined. The process of firearms identification depends on the use of the general experience and knowledge of firearms identification examiners, without the use of statistical data (Sinha, 2013). The growth of technological innovations requires the interpretation of the obtained data within forensic practices. In fact, ballistics experts working in forensic science labs have an opportunity to provide accurate and comprehensive investigations of firearms-related crimes (Sinha, 2013).

In addition, ballistics and firearms identification plays an important role in completing crime scene investigation. Ballistics is interpreted as the study of projectiles in motion, while firearms identification refers to the identification of firearms through analysis and exploration of the fired bullets and cartridges (Sinham-2013). For a crime scene investigator, it is crucial to have accurate and comprehensive data on firearms identification and ballistics evidence (Sinha, 2013). The NIBIN Network is the key tool in ballistics and firearms exploration is comprised of several computerized networks, including

1. The regional server that provides storage of all images to ensure execution of requests on the fired bullet and cartridge cases.
2. Digital Acquisition System remotes that provide image acquisition and evaluation
3. Rapid Brass Identification that provides on-site digital capture of cartridge cases to be transmitted to IBIS or Integrated Ballistics Identification Systems
4. Match point provides analysis of bullets and cartridges through connection by LAN to DAS remote.

Furthermore, the science of ballistics allows having a good understanding of the shooting skills of a person who fired a shot at the scene of the crime. The following skills of the shooter can be evaluated due to ballistic evidence investigation: eye-hand coordination, motor skills, visualization skills, self-control skills, concentration, self-esteem, and self-confidence.

As a matter of fact, firearms examination differs from ballistics study. This difference is easy to determine, using the definitions of the terms ballistics and firearms examination. In the following section, the background information on ballistics will be presented.

Between 1835 and 1899 events occurred that were ultimately associated with firearms and tool mark identification. The processes included physical typing, simple observation and determination of sizes and shapes of a projectile (Herrick 55). There were also slots for carrying out experiments. During the period between 1930 and 1970, forensic ballistic identification continued to evolve. In USA the scientific crime Detection Laboratory (SCDL) had its operation beginning in Northwest University in the late 1929 till 1930 followed by FBI in 1932. Many other countries also recognized the need to integrate this into their system. In the last part of the century (1970-1999) forensic ballistic has continued to evolve with many forensic firearms experts employed, many of these examiners have continued to conduct research and experiments into the various aspects in this ground and have publicized their results in various leading forensic publications.

The science has benefitted immensely from the various technological advances that have occurred in the last century, which include innovation the firearm tool mark examiner- the binocular comparison microscopes which have been equipped with digital cameras and closed circuit televisions. This allows the direct viewing on an instant documentation using digital photomicrography (Hatcher 67). Side by side viewing of images on the monitor is also very helpful for use instructional work while digital photographs are used in inclusion in the cases filed.

This period has also seen the invention of computers which are inexpensive which has allowed forensic science take full advantage in the development of very significant weapons especially guns in laboratories (Craig 1). In the US Integrated Ballistic Identification System (IBIS) units in the forensic laboratories are linked to a national system to form the National Integrated Ballistics Identification Network (NIBIN).

Due modernity and advancement in computer technology, IBIS systems has allowed the capturing of images that are digital in nature of fired up bullets and cartridges casings. These are then analyzed to give available information to the examiner. The information is formed of hits that can be forwarded for examination. This gives the examiner evidence related to a particular fired bullet in the lab throughout the NIBIN system. In 1998 FBI established a scientific collection; the purpose was to develop a series of consensus guidelines. This was formed to grant validation of the testing method to be exploited during certification study process. Ballistics in Forensic Science and Crime Investigation Systems. As already been described ballistics uses the flight path of a bullet to be able to investigate the details of a crime scene. Forensic scientists carry to investigations by collecting and carrying out analysis using physical evidence. They have specialized in areas such analysis of the DNA or firearm examination, performing tests on weapons or on substances such as glass, fiber, hair, tissue, and body fluids to determine their significance to the investigation. The collected samples must be kept properly and stored well to protect the evidence (Inbau-1). They consider the specific features of firearm that relate to the bullet fired up. Cartridges and cartridge cases are also examined for marks of breech, impressions of firing pin, extractor mark, the rifling pattern and ejector mark. The distance from which a bullet was fired is considered and also the speed at which it was fired. The distance a bullet moves depends on its velocity, a higher velocity has much more impact on the bullet. The gravitational pull and the frictional resistance caused by the air provide slow resistance to the movement of the bullet hence reduced speed. It also able to detects whether a bullet has been fired from a riffle or a handgun, as the stronger fire chambers of a rifle can with stand the increased explosive power of large quantity of powder that is likely to rapture the gun's barrel. In a rifle, powder ignition supplies the thrust to propel the bullet.

Other principles in consideration in ballistics include the yaw, which causes a bullet to tumble while in motion. More damage is caused when a bullet tumble compared to that which moves in a tight spiral. Bullet composition is also considered as one that contains copper as a jacket to the inner core while some bullets are do not have these jackets, but they have a tip made of lead or one that is hollow or blunt. Such bullets deform and break apart on impact and in that they produce more damage to the target compared to a single piece of metal.

Forensic and medical examiner are able to access the characteristic of the damage of a tissue in a victim and have a clue and an understanding of the nature of the kind of bullet used. Tissue damage by a bullet result into different forms of injury; a bullet can crush a tissue or bone, as seen in bullets that move at slow speed. Fragmented bones cause further damage as the bones shards to become missiles. Secondly bullets causes' damage by citation. This is a damage caused when there is a forward tissue or air movement. This effect of tissue and air movement by the bullet results into a broadened wound. This produces further structural damage.

The air on the sides of a very fast moving bullet becomes compressed; this is due to several hundreds of atmospheric pressure that can generate a shock wave that causes extreme damages on the tissues of the body. This causes organs that are fluid filled like bladder, heart and bowel to burst due to this high pressure. One of the most crucial tools in forensic ballistics is the use of comparison microscope, here the marked tools are compared side by side and similar components are analyzed and afterwards eliminations are done. Once the firearms have been recovered, they are surrendered to the fire arm Tool marks Unit, a division of FBI laboratory that is devoted in identification of these gargets. They use gunfire which is a computerized, shot shell and bullet analysis and electronic firearm on a single computer platform. Success is achieved when a system user matches between a specimen added into the data base and a previously filed specimen. It is very important to have a good understanding of the nature of weapons used by criminals through the proper analysis of the wound and also about weapon and manner of use of weapon. In fact, the field of ballistics is focused on using innovative technologies. For example, ballistics imaging technology is considered to be an effective "potent tool for moving the law enforcement response to violent gun criminals forward by linking multiple crime scenes to one firearm" (Braga & Pierce, 2004, p. 1). A recent study shows that ballistics imaging technology has a positive impact on the productivity of police departments. Researchers used negative binomial regression models in order to provide analysis of times series data on ballistics matches.

They found that “ballistics imaging technology was associated with a more than six fold increase in the monthly number of ballistics matches made by the Boston Police Department’s Ballistics Unit”.

Ballistics imaging technology helps law enforcement agencies to achieve success in crime scene investigations that would not have been possible using traditional ballistics methods. All in all, ballistics is divided into several units, including internal, external, terminal, and transitional ballistics.

- Internal ballistics can be defined as “a study of the properties and performance of the projectile while still moving through the barrel of the firearm” (Prior, 2004, p. 181).
- External ballistics stands for the study of the projectile movement, performance and attributes after exiting the muzzle of the barrel” (Prior, 2004, p. 181).
- The term terminal ballistics is defined as the study of the effect of the projectile on hard surface contact (splat and ricochet), hard and soft surface penetration, and soft tissue wounds” (Prior, 2004, p. 181).
- Transitional ballistics refers to the study of the transition from the motion of the projectile through the barrel of the firearm to its flight through space or the air.

As a matter of fact, ballistics is considered to be the science of mechanics of the projectile’s behavior, including the nature of its flight and possible effects, starting from the time of firing a shot to the time of its effects on the target.

## **2. The major types of ballistics evidence located at the scene of the crime**

There are several types of ballistics evidence that can be presented at the crime scene:

1. The bullet or projectile
2. The fired cartridge case
3. FDR or Firearms Discharge Residue evidence
4. Bullet wipe found around wounds
5. The pistol
6. Ammunition in the magazine.

The major factors that are considered by ballistics experts while making an investigation of firearms used by shooters at the scene of the crime

The major factors that should be taken into consideration by ballistics experts while conducting an investigation of firearms used by the shooter at the scene of crime include:

1. Evaluation of the gravitation effect
2. Evaluation of the muzzle velocity
3. Evaluation of the angle of elevation of the barrel
4. Evaluation of the sectional density of the barrel
5. Evaluation of the bullet shape (Heard, 2011)

### **Firearms examination:**

The major goal of firearms examination is to examine, analyze and compare the marks left by the firearms on the fired bullets and cartridge cases. It is required to use a microscope in order to carry out a comparison of these marks, making efforts in identifying the relationship of the elements to a special type of firearm. Firearms and Tool mark identification is a science aimed at identifying certain defects in firearms.

The key tasks performed by firearms examiner include a number of activities aimed at achieving the established goals:

1. To restore obliterated serial numbers on firearms
2. To detect and characterize PGSR or primer gunshot residue
3. To determine the distance through detecting GSR
4. To ensure tool mark examination (Wecht & Rago, 2005).

Besides, firearms function testing is based on the application of the proper strategies and knowledge of firearms operation. There are two major categories of firearms:

- Handguns that are specially developed to fire a shot using one hand (e.g. pistols and revolvers)
- Long arms that are specially developed to fire a shot from the shoulder (rifles and shotguns) (Wecht & Rago, 2005).

It is known that modern firearms are developed to operate in a similar way. The following steps describe the operation of firearms:

1. the trigger is pulled
2. the firing pin is promptly forced against the primed area of the chambered cartridge by means of a hammer
3. an internal spark is caused by the rapid compression of the primer
4. it is directed toward the cartridge to ensure ignition of the powder
5. the powder begins to burn
6. burning of the powder leads to the build-up of gasses
7. the cartridge case begins to expand against the walls of the chamber
8. the bullet is forced to move down the barrel
9. The cartridge case is forced in the reversed direction against the cartridge stop ( Wecht & Rago, 2005).

In general, a firearm examination involves is based on the following features: “the make, model, caliber, general rifling characteristics, barrel length, and trigger pull of submitted firearms” (Wecht & Rago, 2005, p. 344). It is required to perform a field test aimed at determining the function of firearms during actual firing. In addition, it is necessary to comply with the established rules while loading the firearms with live ammunition. A water tank is used to ensure that the bullet’s damage is minimal. In some cases, a box with cotton filler is used as an alternative. After conducting a test, a firearms examiner collects bullets and cartridge cases in order to examine them using a microscope. A comparison microscope is an important device used in firearms examination (Wecht & Rago, 2005). The major function of this device is to provide a side-by-side comparison of the fired bullets and cartridge cases. The device is specially designed to allow the firearms examiner to explore two objects simultaneously. According to experts, “the dividing line between the two images can be moved back and forth to aid in a direct comparison of two different objects or can be eliminated for viewing one object at a time” (Wecht & Rago, 2005, p. 344). If a firearms examiner identifies that the firearms evidence and test tool marks are the same, he or she will assume that the firearm is the one tool excluding others that generate the evidence tool mark.

Interestingly, firearms identification differs from ballistics identification, although both procedures play a crucial role in forensic science practices, namely in tool mark identification. There are three main challenges associated with firearms examination:

1. wrong identification of a tool as the source of a tool marks that it failed to generate
2. the key features of tool marks consist of non-unique marks
3. confusion in terms of subclass characteristics shared by more than one tool

The key features of the marks produced by some level of change over a long period of time (Wecht & Rago, 2005).

Besides, in the 1570s, the snaphaunce was invented to be used as an early form of the flintlock. The mechanism of this device was developed in a way that allowed the flint to be linked to the spring-loaded arm. Sparks were produced through the flint’s striking against the metal plate to achieve ignition of the powder. This type of firearm was used in Germany. The snaphaunce served as a cheap mechanism and was recognized as an effective device till the 18-th century ( Heard, 2011).

Later on, the flintlock was invented to present a new type of ignition system that allowed producing the flash from the ignition of the powder that moved through the touch hole. As a result, the main charge was ignited and the flintlock was discharged. This type of firearm was cheap and easy to use. It was not dependent on weather conditions.

According to experts, “unlike the complicated and expensive wheel lock, this was a weapon which could be issued in large numbers to foot soldiers and cavalry alike” (Heard, 2011, p. 5). This device was very popular in the 17-th century.

Finally, the rim-fire system was invented in France. The inventor was a French gunsmith Flobert. He

designed a device that was effective for high-pressure weapons with a small-caliber. The rim-fire cartridge had a hollow flanged rim, which was crushed by the firing pin and caused the explosion of the priming compound. The propellant which was located inside the cartridge case was ignited. According to experts, the key drawback of this device was “the propensity of the cartridge to discharge if dropped onto its pin” (Heard, 2011, p.6).

Further, the centerfire system was developed placing emphasis on the center fire ammunition which required the only primer cup to be soft enough in order to be crushed by means of the firing pin. The device was invented in 1860. The major principles of the centerfire system are used in modern types of firearms (Heard, 2011, p. 6).

Hence, later on, there were innovations like rifling, the revolver, self-loading pistols, and other types of firearms. Since then, firearms innovations were related to changes in frame, such as the use of lightweight aluminum, plastics, and other materials, as well as the invention of “smaller calibers and higher velocity bullets”, the invention of magnum handgun ammunition, and the advancement of gas-operated locking systems (Heard, 2011, p. 10).

### **Overview of Firearms**

In the USA, the Federal Firearms Act of 1938 is aimed at imposing a federal license requirement on manufacturers, importers, and individuals involved in firearms selling business. A firearm can be defined as a weapon of any type from which a bullet is discharged. There are several classifications of controlled firearms or weapons, including

- Firearms include a wide range of guns (e.g. bolt action and straight pull rifles)
- Shotguns include smoothbore guns with a barrel of 24 inches in length with a maximum of 2 inches in diameter. As a rule, shotguns have no magazine and non-detachable magazines with two cartridges.
- Prohibited weapons include any type of firearms not mentioned above, e.g. rockets, military ammunition and weapons, and machine guns.
- Air weapons include spring, pre-charged pneumatic, or carbon dioxide weapons. As a rule, this type of firearm is based on the utilization of high-pressure air, which is pressurized by means of a piston in order to push the projectile or bullet down and out of the barrel.

### **Categories of firearms**

In addition, the above-mentioned categories of firearms are divided into several groups:

#### ***Semi-Automatic***

This type of firearm will load itself from the magazine with dozens of bullets. The key advantage of this weapon is fast reloading and the increased rate of fire.

#### ***Revolver***

This type of firearm is known as a pistol with ammunition in a rotating drum of 5 and 7 shots. Due to the rotation of the cylinder after each shot, the next shot is consistent with the short barrel. This weapon has slow reloading and a reduced rate of fire.

#### ***Rifle***

This type of firearm has a long-rifled barrel specially designed to ensure long-range usage in military actions and during hunting. Rifles are presented in the forms of a single shot, self-loading, manual action, bolt action, or automatic. Most rifles are self-loading. One form of the rifle is the shorter barreled assault rifle specially developed for usage in the military.

#### ***Sub-Machine Gun***

This type of firearm is known as a fast-loading weapon with a high rate of fire. The major forms of sub-machine guns include single shots and automatic. It is used in the military to provide continuous fire.

#### ***Machine Gun***

This type of firearm has a very high rate of fire. Besides, it is fast reloading and has great power to be used in the military.

#### ***Shotgun***

This type of firearm is known as a smooth bored, powerful weapon. It has short-range and low accuracy.

It can be used with different types of ammunition, such as solid slugs and pellets. There are different forms of a shotgun, including single and double-barreled.

Both a firearms examiner and a ballistics expert are focused on the use of laboratory tests to assess crime in firearms-related environments and explain the causes of the use of firearms by criminals. Interpretation of the key findings allows for making evaluations of the circumstances of the criminal act and provides a reliable interpretation of the case in the court of law. Any incident that involves the use of firearms is assessed as common practice for law enforcement personnel and crime scene investigators. The knowledge of the different types of firearms is essential for them. According to experts, the proper interpretation and accurate presentation of firearms evidence in a court of law is the key goal of the study of firearms and ballistics evidence (Heard, 2011; Sinha, 2013).

Anyway, the use of new forensic technologies, including firearms and ballistics technologies, can help to address the challenges of those wrongly accused. It is possible to identify the failures of the criminal justice system if the faulty forensic evidence, including firearms and ballistics evidence, is properly analyzed and interpreted. The adoption of new techniques in the area of firearms and ballistic evidence examination will revolutionize the ways used to provide crime scene investigations. Currently, due attention is paid to the issues like the degree of certainty and reliability in crime scene investigation (Braga & Pierce, 2004; Heard, 2011; Prior, 2004; Sinha, 2013).

Furthermore, due to recent and important developments in the science of ballistics and firearms examination, experts effectively use the knowledge of physics, fluid mechanics, practical gun engineering, propellant quality assurance, control, and diagnostic measurement of ballistic evidence in order to achieve success in crime scene reconstruction. These practices help to identify the manner of death of victims from firearms injuries (Braga & Pierce, 2004; Claridge, 2016). According to researchers, “every firearm has individual characteristics, akin to the uniqueness of human fingerprints, that is transferred in the form of microscopic scratches and dents to the projectiles and cartridge casings from it”.

### **Protocols / Guidelines for Evidence Collection, Preservation and Transportation**

#### ***Audio-Visual Analysis***

- All items should be packaged in containers of suitable size.
- All items should be packaged in containers that will prevent contamination or deleterious change.
- Ensure that all evidence collected is properly documented, labeled, marked, photographed and inventoried before it is packaged.
- Remember that evidence may also contain latent, trace, or biological evidence so take appropriate steps to preserve it.
- Package all digital evidence in anti-static packaging to prevent it from static electricity. Only paper bags and envelopes, cardboard boxes and antistatic containers should be used for packaging of digital evidence.
- The video evidence should be collected in its original format as it is recorded on the recording device (DVR, VCR, etc.).
- Make sure that the Pin/Pattern/password of the digital device (DVR, Mobile Phone etc.) is being provided by the evidence submitting person / Agency.
- Evidence should be packaged in a manner to avoid getting bent, scratched or otherwise deformed. Plastic material should not be used for packaging.
- Collect all power supplies, cables and adapters for all electronic devices seized.
- Shock resistance packaging material should be used to avoid physical damage to any components of the device(s).
- Label all containers used to package digital evidence clearly and properly.
- The packaging areas should be void of ultraviolet (UV) light (present in some types of fluorescent tubes). UV may hasten the degradation process.
- The packaging environment should have a mild temperature and humidity. An extreme environment can lead to spoliation of potential evidence, for example mold growth.
- All items are packaged in containers that can be sealed.
- The seals must display the initials of the personnel creating the seal.
- The seals must display the date when the seal is created.
- The seals must be made from a material that is tamper evident. The removal of the seal must cause some visible damage to the container that can indicate that the seal has been removed or tampered with.
- The evidence packaging is labeled with at least the Submitting Agency case number and item number, date and initials of the person who packaged.
- It is advisable that forensic evidence tape shall be used.

### **Transportation**

When transporting audio/video evidence:

- Keep the evidence away from magnetic fields such as those produced by radio transmitters, speaker magnets, and magnetic mount emergency lights. Other potential hazards are seat heaters and any device or material that can produce static electricity.
- Avoid keeping the evidence in a vehicle for prolonged periods of time. Heat, cold, and humidity can damage or destroy the evidence.
- Ensure that computers or electronic devices are packaged and secured during transportation to prevent damage from shock and vibration.
- Document the transportation of the evidence and maintain the Chain of Custody on all evidence transported.

### **Storage**

When storing audio/video evidence:

- Ensure that the digital evidence is inventoried.
- Ensure that the digital evidence is stored in a secure, climate-controlled environment or a location that is not subject to extreme temperature or humidity.
- Ensure that the evidence is not exposed to magnetic fields, moisture, dust, vibration, or any other elements that may damage or destroy it.
- All items should be packaged in suitable sized containers that will prevent contamination or deleterious change.
- Ensure that all digital evidence collected is properly documented, labeled, marked, photographed and inventoried before it is packaged.
- Remember that digital evidence may also contain latent, trace, or biological evidence and take the appropriate steps to preserve it.
- Package all digital evidence in anti-static packing to prevent it from static electricity. Only paper bags and envelopes, cardboard boxes and antistatic containers should be used for packaging of digital evidence.
- Evidence should be packed in a manner to avoid from being bent, scratched or otherwise deformed. Plastic material should not be used for packing.
- Collect all power supplies, cables and adapters for all electronic devices seized.
- Shock resistance packing should be used to avoid physical damage to any component of the device(s).
- Label all containers used to pack digital evidence clearly and properly.
- Main system units and/or notebooks need to be secured in an appropriate container to avoid tampering or spoliation of the potential digital evidence that could reside in it.
- The packing areas should be void of ultraviolet (UV) light (present in some types of fluorescent tubes). UV may hasten the degradation process.
- The packing environment should have a mold temperature and humidity. An extreme environment can lead to spoliation of potential evidence, example mold growth.
- The collected digital device(s) should be stored in a secure environment or location that is not subject to extreme temperature or humidity. It should not be exposed to magnetic fields, dust, vibration, moisture or any other environmental elements that may damage it.
- Leave Mobile Devices/ Smart Phones in the power state (On or off) in which they are found. If possible, place the phone in flight or airplane mode.
- Mobile Devices/ smart phones should be isolated from the Network using Network Isolation Techniques i.e. Faraday Isolation bags, Radio Frequency shielding material, anti-static packing and aluminum foils.
- All items are packed in containers that can be sealed.
- The seals must display the initials of the Submitting Agency Personnel, creating the seal.
- The seals must display the date when the seal is created.
- The seals must be made from a material that is tamper evident. The removal of the seal must cause some visible damage to the container that can indicate that the seal has been removed or tampered with.
- The evidence packing is labeled with at least the Submitting Agency case number and item number.
- The First Responder should maintain the Chain of Custody throughout the transporting process to prevent possible tampering or spoliation, and maintain the integrity and authenticity of evidence.

### **Firearms and Tool Marks**

In order to minimize safety risks and contamination of evidence the following measures should be followed while packing the evidence:

- Every evidence exhibit must be packaged separately.
- Every firearm must be packaged in unloaded condition with safety on.
- There must not be live rounds in the chamber of the firearm, magazine or in the parcel.



- Every cartridge case and bullet must be packaged separately.
- Evidence submitted for Gun Shot Residue (GSR) analysis must be packaged in hard box instead of cloth bag or paper envelope. Layers of the clothes containing GSR must not touch with the other layers. Clothes must be wrapped by placing a white paper sheet between the layers of clothes before packing it in a hard box.
- For serial number restoration of firearms, area containing obliteration should be marked clearly if there is more than one location of obliteration.
- For trajectory analysis, vehicles must not be washed or cleaned at all prior to examination. Suspected bullet holes must be covered with white paper.
- Seals must be intact and as per mentioned in the docket.
- If firearm is recovered from water or any other liquid, then submit the firearm with the same sample of water or liquid from which it has been recovered.

If any evidence related to a particular case is previously in PFSA custody, clearly mention the link of previous evidence while submitting new evidence.

**NOTE:** Paper bags are not considered to be good packing materials for sharp or broken objects. Sharp objects can easily puncture the bag and cause injury.

- Good quality known prints are important and necessary. Smudged or blurred prints, overlays, too much ink, prints outside the blocks or off-centered, etc., will reduce the chances for an identification to be affected.
- If suspects are known, please obtain a set of fingerprint and palm print cards and submit them with the evidence.
- Take elimination fingerprints of the victims, family members, caretakers, etc.
- Original questioned document must be submitted for Fingerprint Examination.
- Docket / Cover letter addressed to the Director General, PFSA, Lahore clearly indicating required analysis and details of questioned and reference thumb impressions shall be required.
- Case Fee is required in Civil Cases hence, Bank Draft/ Pay Order from any bank in favor of DG, PFSA, Lahore must be submitted along with case (photocopy of bank draft is not acceptable).
- No case fee is required for Criminal Cases from Punjab province but a copy of FIR must be submitted.
- No case fee will be charged from departments under Punjab Govt.

### ***Forensic Pathology***

Mini Autopsy means examination of all viscera (heart, lungs, liver, spleen, kidneys, gastrointestinal tract and brain etc.), along with tissues of special interest (e.g. neck tissues in cases of strangulation, tissues around the bullet tract with tissues from exit and entry wound in gunshot cases, etc.). Mini autopsies constitute a QC and QA procedure for autopsies conducted in 800 autopsy centers of Punjab and elsewhere, where Forensic Histopathology services are not available. Approx. 1/3rd of all Medico legal autopsies are referred for Histopathological examination of the tissues, to reach the final diagnosis as to cause and manner of death, injuries inflicted during life or after death; and to ascertain the role of various contributory factors in the process of death. More than 2500 such cases are referred per year. Major problems encountered in such tissues sent from outside, are briefly mentioned here:

#### ***Poor Fixation***

- The tissues are fixed in formalin solution, which is formaldehyde gas dissolved in water. With time, its concentration declines gradually, especially if the lid of container is not tightly closed.
- If the tissues are sent in formalin which is below 10%, the tissues get autolyzed. Therefore, good quality, freshly prepared formalin should be used to fix the tissues.
- Fixative has to be added even in Exhumation cases
- Every specimen including soft tissues, bones, teeth and fetus etc. should be fixed
- If cytological examination of fluids, secretions and blood is required, then add few drops of 10% Formalin in the specimen
- Brief medical history of the deceased should be clearly mentioned in the forwarding letter.

#### ***Packing of histopathology (tissue) samples***

- Completely immerse the tissues into 10% formalin solution in a plastic jar having screwed lid.
- Quantity of formalin solution should be 3 – 4 times the tissue size.
- Tightly close the lid.
- Place evidence tape around the lid.
- Sign the evidence tape at regular intervals so that half part of the signature is on the evidence tape and

the other half of the signature is on the container.

- Place stamps on the evidence tape in a similar manner. If evidence tape is not available, stamped red wax seals may be used as an alternative.
- Place the sealed container/jar in a plastic bag and tie the knot.

#### ***Labeling of samples***

Mention following information on the label on sample jars:

- Name of the deceased
- PMR/Case number
- Sample details
- Date and Time of sampling
- Collectors name, designation and signature

#### ***Transportation of samples***

- Place the sealed jar/s in an appropriately sized card board box and secure the containers in the box.
- Mention upper side on the box.
- Apply evidence tape at all opening slots of the card board box.
- Sign and stamp the evidence tape as mentioned above.
- Attach chain of custody form with the box.
- The sample jars may be transported individually as well. However, make sure that during transportation, they are kept in upright position, so that formalin is not drained out. Otherwise, tissues would get dry and autolyzed.
- Put postmortem report, all relevant documents such as Report of Death (Report e Marg), FIR/ Application Report, MLC, Road Certificate, Concise Case Details (Mukhtasar Halat e Muqadma), and in cases of Exhumation Legible copy of Magistrate or Court Order Relative/Family request along with sample of evidence tape and/or sample of signatures and stamp in an envelope.
- Seal the envelope with evidence tape signature and stamp as described above. If evidence tape is not available, stamped red wax seal may be used alternatively, as described above.
- Send the histopathology samples and documents to PFSA.

#### ***Questioned Documents***

- Package the questioned document evidence in paper envelope of appropriate size and do not fold the questioned documents.
- Write the necessary information on the envelope before packaging the questioned document evidence in it. Do not write anything on the envelope after the evidence has been packaged.
- If the questioned document evidence is requested for indented writing/latent fingerprints test, then package the evidence carefully in such a way that it is not rubbed with other packaged documents.
- Envelopes used for packaging the evidence should protect the evidence from wear and tear and contamination.
- Make sure that all the necessary documents required for the case are attached with and properly documented.
- Case documents should be protected from severe environmental conditions such as moisture and fire.
- If the questioned evidence consists of charred or water-soaked documents, then pack them in a suitable hardboard box/container packed with cotton cushion so as to protect them from further destruction.
- Dispatch /submit the evidence in properly sealed form.
- Docket / cover letter should be addressed to the Director General, Punjab Forensic Science Agency, Lahore with clear mention of required examination. The questioned, routine/ admitted and dictated exemplars should be clearly marked and mentioned in the docket/cover letter.
- The case fee (If applicable) should be submitted only through Bank

Draft/Pay Order in favor of the Director General, Punjab Forensic Science Agency, Lahore.

- In case of extra ordinary large number of questioned exhibits, only probative evidence items, as determined in consultation with the investigation officer, shall be examined.

#### ***Trace Chemistry***

Due to the wide variety of evidence brought to the Trace Chemistry Department there is no single way to collect and pack the evidence. Each scene should be carefully examined for the presence and identification of trace evidence. The probative evidence should be collected in such a manner that it is not contaminated or lost. No harm to the integrity of the evidence should take place.

***Explosive evidence (Pre-blast/Post blast)***

*General Considerations*

- 2 - 5 gram of sample from the suspected explosive material/ bomb device should be received.
- In case of detonating cords like prima cord and safety fuse, only 3-6 inches of the sample cut from the prima cord must be submitted.
- Intact detonators, hand grenades, suicide jackets, mines must not enter to the lab premises and are strictly prohibited to receive.
- Only the 2 - 5 gram chemical/suspected explosive material recovered from the explosive devices [Intact detonators (0.1-0.5 gram), hand grenades, suicide jackets, mines] and sealed in a labeled parcel should be submitted for analysis.
- No trace evidence case must be sent to PFSA through courier service, all the case evidence item must be submitted by the authorized person nominated by the submitting agency along with the clear information related to the evidence samples being submitted to PFSA.
- Debris collected from the blast seat/blast scene like soil, metal parts, suspected bomb device parts like deformed metal pieces, plastic pieces, ball bearings, jagged fabric, broken time devices etc. in SEPERATE sealed and labeled parcels clearly mentioning the location from where the evidence was collected.
- Intact soil sample mentioning as “control” taken out from the uncontaminated nearby place at blast scene, in separate sealed and labeled parcel must be submitted.

*Essential properties of Container Used for Packaging*

- Unused
- Airtight (For all Fire Debris and most Explosives or Chemical Items)
- Clean–no hydrocarbon or other chemical residue
- Inert–will not break down when heated or in contact with solvents
- Will not promote a static electrical charge ( For Explosives)

*Seals*

- A clean seal is essential.
- Containers must be completely sealed to prevent any passage of vapors or contaminants into or out of the container. Be certain, can lids are tight all the way around. For plastic bags, they must be heat sealed completely with no flaws in the seam if they are being used for fire debris samples.
- Tamper evident tape (tamper proof tape) must be placed across the container lid/seam in such a manner that the item cannot be partially or completely opened without tearing the tape.
- Seals and Tape must be dated with case number and exhibit number and initialed/signed by the investigator of record. The date of the seal should also be included.

*Gunshot Primer Residue Sample Required:*

- Pure carbon adhesive stubs dabbed from both hands of the shooter preferably one stubs from each hand including back and palms in a sealed and labeled parcel.
- No cotton swabs or hand washes from the hands of the shooter are accepted.
- At least 2 Adhesive carbon stubs dabbed from (1: right hand & Palm, 2: left hand back & palm)
- GSR sampling must be done within 4- 6 hours of shooting. After that, GSR sample may not be present for detection and identification.
- HAND WASH is not suitable for GUNSHOT PRIMER RESIDUE analysis.

*Evidence Collection Instructions*

<b>Packaging Type</b>	<b>Case Type</b>
Plastic bags or Ziplocs	A non-biological material such as powder/ explosive
Metal cans/ nylon bags	Arson evidence ( burnt victim’s clothing )
Glass vials	Explosive/suspected powder/ignitable liquids/ acids/bases
Paper folds	Hairs, fibers, minute glass particles, paint chips
Cardboard boxes	(Physical Match cases) knives, large pieces of glass, plastic andvehicle paint from the victim’s clothing.
Pure carbon adhesive stub	Primer gunshot residue collection

Toxicology

### **3. Research Methodology**

The present research paper is conclusive, descriptive based upon qualitative method and on secondary sources like books, journals, e-sources, theories and relevant provision with decided case laws.

Researcher shall use the quantitative method within the lens of descriptive approach. It is all about systematic analysis of phenomenon by collecting quantified material and applying mathematical, statistical and calculating techniques, in order to reach the reasonable conclusion, I shall use the aforesaid all tools required to conduct the quantitative research.

#### **Research objectives:**

The main aims and objectives of present study are:

- To examine the role of ballistic expert.
- To analyze the responsibility of ballistic expert.
- To improve awareness and understanding forensic science amongst citizens

### **4. Discussion**

Ballistic imaging systems will facilitate solve gun crimes by comparison pictures of cartridge cases, that are recovered from a criminal offense scene or test-fired from a taken gun, to a info of pictures obtained from past crime scenes. However, many U.S. municipalities lack the resources to method (i.e., enter pictures into the info and rummage around for matches) all of their recently non heritable cartridges, and external laboratories are usually underneath capacitated and generate hits (i.e., matches between new cartridges and info entries) solely when long delays.

The word “Ballistics” is etymologically derived from the Latin word „ballista“ and refers to a body in motion. Ballistics is that a part of rhetorical science that deals with the study of motion of projectiles. Projectile is thought as a body projected by force principally from firearms, particularly through air.[1](Hacker 2010) The science of projectile so involves the study of firearms. Rhetorical ballistics is that the study of firearms, ammunition and explosives with a read to reconstruct the crime scene accurately. It’s currently become an integral a part of the crime investigation because the reconstruction will cause several evidences which might be utilized in a given case with major effects. The overall truth of ballistics is that no missiles discharged from a similar or totally different firearm bear a similar trace marks.

Thus, as an instance, every rifled piece leaves its own striations (a form of tell-tale fingerprint) in terms of barrel and striker markings on the pink-slipped bullet and cartridge case severally. This makes it attainable to trace a bullet or cartridge to the actual weapon that is in question. If a proof bullet has constant category characteristics and matching individual characteristics to check bullets pink-slipped from a „suspect firearm“, the piece examiner will conclude that the bullet was pink-slipped from the suspect piece.[2](Anon 2002) A thriving demonstration of those facts by the utilization of comparison magnifier in conjunction with photomicrography is often the foremost valuable and foolproof proof. Trajectory consultants work closely with the police work officers, members of the community and judiciary before whom they eventually seem as freelance skilled witnesses. They, play a very important “complementary” role in making certain justice within the trendy society. With the help and experience of ballistics, it’s currently attainable not solely to tally the cartridge pink-slipped with the piece used, however variety of alternative necessary factors additionally, although with varied degrees of chance.

Among these factors is that the vary of fireplace, the approximate time once the piece was discharged and alternative queries of comparable nature. The aim of the paper is to know about the effectiveness of ballistic imaging as evidence in Pakistan.

#### **An Outlook on Ballistics – An International Perspective**

For abundant of the 20th century, the rhetorical science of firearms identification was AN intensively individualized activity. A firearms examiner inspected ballistics proof (spent cartridge cases and bullets) underneath a comparison magnifier, shaped a mental pattern of distinctive marks and options, and tried to match that pattern against alternative exhibits. Establishing connections between completely different cases trusted the memory recall of the firearms examiner or having the ability to acknowledge options from pictures in open case files or postings on bulletin boards. Hence, looking through massive amounts of trajectory proof and validatory a match was a labor intensive and long task. (Cork et al. 2010) Circumstances began to amendment speedily within the late Nineteen Eighties and Nineties as advances in assembling and looking out

computerized image databases were applied to rhetorical proof analysis

The advent of the Federal Bureau of Investigation DRUGFIRE system (for cartridge cases) and the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF)-funded BULLETPROOF system (for bullets) made the first significant breakthroughs, permitting individual law enforcement agencies to begin searching new ballistics proof against huge volumes of already-captured pictures and suggesting possible "hits." The late-1990s formation of the National Integrated Ballistic Information Network (NIBIN), under ATF, condensed down the previously formidable geographic barrier by linking the image databases across multiple agencies and permitting searches within regions of the country.[4]

Automated ballistics imaging and analysis systems, admire the integrated identification system (IBIS) have advanced gun enforcement operations by permitting pictures of gun crime proof to be chop-chop compared to an outsized inventory of proof collected from alternative crime scenes. When small-arm examiners ensure candidate matches, detectives will use the data generated by the links among gun crimes to assist solve their cases.[5](Braga & Pierce 2004) Links between recovered cartridge casings represent the overwhelming majority of trajectory matches created through wader. Sadly, the two-dimensional grayscale photography utilized by the initial wader instrumentality was typically not refined enough to counsel potential matches between typically extremely broken bullets from separate crime scenes. Through the acquisition of three-dimensional measurements, the BulletTrax-3-D image acquisition technology was specifically designed to boost the flexibility of enforcement agencies to form bullet matches through machine-controlled trajectory imaging and analysis.[6](Braga & Pierce 2011)

At least 69 % of homicides involve a gun. For homicides and different gun crimes during which firearms, fingerprints and polymer proof don't seem to be recovered (e.g., the shooter fires from a distance and doesn't leave the gun at the crime scene), trajectory imaging are often a valuable crime-solving tool. Gun-specific markings square measure left on the spent cartridge case, hereafter brought up as a cartridge, once a gun is unemployed, and trajectory imaging compares the markings on the cartridge to the markings on antecedently recovered cartridges; trajectory imaging of bullets is additionally potential however has been abundant less eminent than trajectory imaging of cartridges, and our study restricts itself to cartridges.

The National Integrated Ballistic Information Network (NIBIN), developed by The Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) in 1999, uses computerized imaging technology (in particular, the Integrated Ballistic Identification System (IBISTM) created by Forensic Technology, Inc.) to maintain a national database of 2 or 3 D images of cartridges that are either recovered from crime scenes (referred to here as evidence) or test-fired from confiscated weapons (referred to as test-fires), and computes similarity scores between a newly acquired cartridge and the database entries.

The computer code generates an inventory of (e.g. 10 or 20) doable matches, that area unit after analyzed by somebody's examiner to work out whether or not there are a unit any confirmed hits. Confirmed hits will doubtless reveal links between crimes or generate a chilly hit between a confiscate weapon and a past crime, each of which may be helpful in resolution gun crimes. The success of this approach hinges on the established proven fact that bound firearms tend to be utilized in multiple gun crimes.

It took almost a century to improvise the ways of ballistics technology and it's approach towards criminals investigations and this was mainly because of the admissibility of such evidence, to make such evidence admissible one has to be well versed with the latest imaging technologies and this posed as a challenge to many experts in and around the world. But as the times change and the crimes become improvised, new enactments and providing were brought into view in this regard.

### **The Importance of Ballistic Evidence**

While gun violence has diminished since the first Nineties, several Americans still die by shooting and plenty of additional area unit still stricken by non-fatal gun violence. In 2009, a complete of 9,146 folks was dead with firearms and it's calculable that another 48,158 were treated in hospitals for shooting wounds received in assaults. Analysis suggests that the majority of urban gun violence is committed by a comparatively little range of extremely active criminals. Crime guns area unit consumer goods and, if not recovered by enforcement, is employed in multiple violent incidents. This presents a challenge and a chance for strategic gun enforcement operations.

As the IBIS technology developed, a number of firearms examiners and other researchers tested the system's performance. Some analysts scrutinized particular parts of the IBIS comparison process, such as the default comparison pass and 20 percent threshold for detailed image scoring and ranking. However, a bulk of the analysis targeted on execution problems raised by the creation of large-scale reference trajectory image databases.

### **Crime Scene investigation in Pakistan: A Perspective**

Crime scene investigation is an important tool in criminal investigation process. Proper processing of crime scene is a prerequisite for successfully solving a criminal case. In Pakistan, local policemen are not

properly trained and equipped with the necessary items required for systematic processing of crime scene including proper identification and collection of evidence. Certain capacity building measures and improvements must be needed for proper processing of crime scene in Pakistan. This article focuses the current situation and strategies being practiced in Pakistan followed by suggestions for capacity building measures in this field.

Crime scene processing is one of the most crucial aspects of active and successful criminal investigations. True crime scene investigations which primarily deal with the identification, collection, proper packaging, transport and analysis of evidence material is the result of forensic science. If schematically searched and properly handled, various tentative evidences found on the crime scene can become effective forensic evidences (Doyle 2010). The difference between a local policemen and trained crime scene investigator is that the latter being aware of sensitivity of crime scene puts serious efforts to identify and collect forensic evidence from the scene. Crime scenes which are not managed well would lead to either loss of evidence or poor quality evidence resulting in erroneous exonerations or convictions in a criminal justice system (Edwards 2005). In the past, it was practiced that it is duty of the local policemen to manage and process a crime scene followed by evidence collection for downstream forensic investigations. It has been speculated for a long time that forensic analysis begins at the laboratories and not from the crime scene (Crispino 2008; Millen 2000). However, in recent years, courts are relying heavily on the forensic analysis of evidences collected from the crime scene thus adapting more objective approach for final verdict (Julian, Kely, and Robertson 2012). As the importance of crime scene is appreciated, its role in modern day policy making and model buildings has also been evaluated to reduce the risk of crimes and for also crime prevention. Evidence documentation and reason of its collection is also considered an important part of intelligence-led policing, which further necessitates the requirement of properly trained and experienced crime scene personnel to process the crime scene. Intelligence-led policing is an outcome of proper crime scene analysis and manifestation so that the information extracted could be used to develop forensics intelligence. Traces or information collected from crime scenes are also helpful in building future security models based on these intelligence (Ribaux, Baylon, Roux, et al. 2010; Ribaux, Baylon, Lock, et al. 2010). Some proceedings examples from past are evident that proper crime scene investigation may also help judicial procedures to prevent wrong convictions (Sorochem 2008). The evidence collected from the crime scene plays an important role in identification and individualization of a criminal present at the crime scene (Kaye 2010). So there is a need of application of proper techniques and protocols for evidence collection, handling, storage and subsequent delivery to the forensic laboratory necessary for downstream testing of evidence material. Most of the time, due to non-availability of suitable techniques and training, the evidence may go unrecognized so not collected at all or if collected but not preserved by using right protocol it may get compromised so render no value for laboratory procedures (Peterson et al. 2013).

#### ***Importance of crime scene investigation***

There are examples in past where lack of expertise and poor handling of evidence at crime scenes lead to negative impact on final verdict. Poor handling, preservation and incomplete crime scene investigation left gap in evidence in O j Simpson famous trial leading to fail in getting conviction. In spite of mountain of evidence given by prosecutor, serious doubts had been created by defense on evidences (Schuetz 1995; Chen 2014). Impact of lacking proper training also influenced the crime scene processing including evidence collection and subsequently case investigation as well. For example, in the case of O J Simpson, both the first responder and crime scene supervisor were not properly trained and were lacking basic information of crime scene technicality. So it also has proven to loss the conviction in spite of pile of evidences (Reid 2018).

#### ***Crime scene processing in Pakistan---A much neglected area***

Crime scenes are often investigated poorly in developing countries like Pakistan because forensic science is rarely considered a part of the process. Importance of crime scene investigations has not only neglected but also has not been high-lightened so taken it for granted in past decades. One reason of substandard crime scene processing in Pakistan is due to lack of many of the crime-solving technologies which have already been utilized in developed nations. However, the nature and magnitude of terrorist attacks, activism in judicial institutions, extensive media engagement and growing public awareness have put pressure on police force to look beyond traditional methods of investigation. Though forensic methodologies are not infallible but going forensic is unavoidable if the police are to respond to the innovations taking place in the field of crime (Reyes 2017). Capacity of the policing in Pakistan to deliver on cracking a case is severely diminished by the lack of forensic services, inadequate training and equipment. As we know an efficient functioning police service is required for solving many hideous crimes (Abbas 2011).

Punjab Forensic Science Agency (PFSA), Lahore has well established Crime Scene Units (CSU) with satellite stations located at Lahore, Bahawalpur, Dera Ghazi Khan, Gujranwala, Multan, Sahiwal, Sargodha, Rawalpindi and Faisalabad division of Punjab comprising professionally trained forensic scientist. Whenever

there is an unfortunate event of crime, CSU approaches the area of crime scene and after processing the crime scenes, retrieves the evidence materials transporting to their relevant laboratory housed in PFSA, Lahore (<https://pfsa.punjab.gov.pk/>). National Forensic Science Agency (NFSA) has its own CSU working at Islamabad covering most of the city and its nearby areas like Rawalpindi district and some part of Attock district. In Baluchistan province, crime scene investigations are mostly accomplished by the local policemen who are not well trained and also lack equipment necessary for the tedious task. Recently United Nations Office on Drug and Crime (UNODC) has provided two modern mobile CSU to Baluchistan province of Pakistan for capacity building of crime scene investigation process in the province (<https://www.unodc.org/pakistan/en/handing-over-of-two-mobile-crime-scene-investigation-units-to-balochistan-police.html>). Same scenario is in Khyber Pakhtunkhwa province where crime scene investigation process is handled by the local policemen too. Forensic Science Laboratory (FSL), Peshawar, has well established crime scene investigating units for proper processing of scene of crime, but it does not cover whole Khyber Pakhtunkhwa province (<http://www.kpfsl.gov.pk/content&id=163>). In Sindh province of Pakistan, crime scene investigation units are not yet available and crime scene processing is mostly done by the local policemen, however, significant efforts are being made by the local government in this regard.

Although gun crime constitutes a small percentage of violent crimes, guns are used in two-thirds of homicides. Criminal assaults with guns are more lethal in comparison with those involving other common weapons, and the misuse of guns by criminals creates a sense of insecurity. of “no safe place“ for residents of a neighborhood where gunfire is common. It is therefore important for the Pakistani legislature to improve new laws on basis of ballistics so as to strengthen their core on criminal investigations.

## **5. Conclusion/Findings**

In the contemporary social context, the role and significance of ballistics can be overwhelming in administration of criminal justice. While of the one hand, the sophistication and complexities of modern weapons and arms and ammunition call for expert knowledge and skills in deciphering the nature, category and manner of use in specific cases, on the other, the effective interpretations of culpability and criminal liability require the blending of such knowledge in legal paradigm. In fact, the latter is important for bringing the guilty to the gallows and the innocent to freedom. Forensic ballistics is a “road not taken”. Although much progress has been made in the field, many questions remain that need to be answered for better adjudication.

It is only the innocent civilians who bear the brunt of these draconian laws, and because no fault of their own they are deprived of an opportunity to protect themselves. Therefore, steps must be taken to ensure that people have controlled access to guns. Thus, it is necessary to conclude that ballistics and firearms are essential aspects of investigation, which require the use of effective strategies to provide physical evidence and integrate scientific methods and deductive reasoning in the process of crime investigation. As there are some characteristic marks found on the cartridge case and projectile when the firearm is fired, experts in ballistics and firearms identification can distinguish these marks and made relevant conclusions. Due to the proper investigation, it is possible to use a well-developed imaging system that allows storing analyzing, retrieving, and matching high-resolution digital images of cartridge cases. It is crucial to use a computerized imaging system for ballistics identification to achieve success in the crime scene investigating process and ensure an accurate audit of firearms in the region.

As technology progresses, criminals adopt new technologies more quickly and in innovative ways, especially digital technologies. Crime scene management and investigation are key parts in the criminal investigation process. Local police who handle crime scenes may not be familiar with the latest techniques in crime scene processing or have inadequate resources; this may result in contamination of evidence or loss of precious evidence material. There is an immediate need of crime scene investigation units in Sindh, Khyber Pakhtunkhwa and Baluchistan province of Pakistan. It is true that crime scene investigation units are now established in PFSA, Lahore and NFSA, Islamabad but due to large population size in Pakistan most of the crime scene processing is dealt by local policing who do not have proper equipment and training to process the scene according to forensic needs. Establishment of crime scene units at district level is required along with capacity building of the already established crime scene units in Pakistan for proper pursue of justice.

## **6. Suggestions/Recommendations**

- More research needs to be undertaken and databases developed to ensure a reliable and adequate repository of information and processes for the forensic experts and judges to rely on.
- Changes need to be made in the Arms Act to balance the need for gun rights versus need for gun control.
- Pakistani policy makers need to keep in mind the scenario of Pakistan while framing laws and realize

that a strict anti-licensing policy is not helping as the criminals any ways have access to a vast illegal arms market.

- In order to survive as crime-control agents and answer to a more vigilant society, police organizations must focus on comparatively testable and hence more reliable means such as material evidence and crime scene science. In addition, it is critical for counterterrorism efforts in Pakistan that the evidence obtained from the crime scenes are well handled and preserved for downstream forensic laboratory examination so that identification process is accomplished.
- PFSA, established merely more than a decade ago, being the only complete forensics setup in Pakistan is not sufficient to cover the 200 million population so it is a cry-need to develop more forensic labs at provisional level with their functional CSU via regional satellite station in every province. Though PFSA CSU is modernized and up-to date for effective processing of crime scene
- in case of any unfortunate incidence, it is further suggested that satellite stations of CSU must be established at each district of Pakistan for prompt and timely access at the scene.
- Proper training of law enforcement agency prioritizing police force could prove a good strategy as first responders at the crime scene is highly important. It could have done by designating a department in police to such personnel's which are trained in this respect.
- Police must be provided with CSI vans supplemented with modern day forensics technology like evidence collection kits, UV flashlights, laser bullet trajectory devices, protective suits, latent print supplies, gunshot residue kits, blood stain evidence kits along with presumptive blood detection kits, potable and remote area lights among other equipment and supplies.

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