

Debunking a False Gunfire Allegation Through Forensic Crime Scene Investigation: A Case Report

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Abstract: *A comprehensive examination of crime scenes and a detailed forensic analysis glass pane penetration provided significant insights into an alleged bullet-firing incident. This report employs forensic techniques, including laser ray projection and gunshot residue analysis, to determine the true nature of the incident. No evidence of projectile penetration was found. The glass pane exhibited radial and concentric cracks, along with ridges and Wallner lines. A pink curtain in front of the window remained unblemished, indicating that no projectile penetrated. The investigation meticulously ruled out the possibility of external projectile penetration, underscoring the importance of internal factors in this case. Additionally, the absence of any gunshot residue at the scene further supported the findings, reinforcing the need for detailed forensic work in crime scene investigations. These findings underscore the importance of meticulous forensic investigations in crime scene analysis and emphasize the necessity of precision in forensic fractography for resolving complex cases. The investigation revealed the absence of projectile penetration and an unblemished curtain, casting doubt on the initial claims. The analysis concluded that the glass pane was broken from within using a blunt instrument. This case underscores the importance of detailed forensic work in determining the truth behind crime scene evidence.*

Keywords: Forensic analysis, glass fracture, radial cracks, concentric cracks, forensic ballistics, gunshot residue, case report

1. Introduction

Glass is a trace element often encountered at crime scenes, offering critical insights during initial investigations and courtroom proceedings. Glass is an amorphous, transparent material commonly used in construction for its durability, refractive properties, and non-crystalline structure [1]. Window glass types—tempered, laminated, or annealed—significantly influence forensic analyses [2]. For example, tempered glass shatters into small cube-like fragments, whereas laminated glass holds together due to its interlayer, aiding forensic investigators in understanding fracture patterns [3].

In burglary, vandalism, and shooting incidents, glass evidence is often a critical investigative element, making it vital for forensic crime scene reconstruction [4]. Broken glass fragments often provide clues about the direction and magnitude of impact, as well as the nature of the object used, thereby establishing connections between suspects and crime scenes. In cases involving firearms, the analysis of glass penetration patterns can reveal the trajectory of a bullet, the caliber of the weapon, and the sequence of events leading to the crime [5]. Forensic glass analysis adheres to Locard's principle of exchange, focusing on the transfer and preservation of evidence [6]. Fractography, the detailed study of fracture surfaces, has become a vital forensic tool for analyzing glass breakage mechanisms [7]. By examining features such as crack propagation, stress marks, and Wallner lines, investigators can determine the direction, force, and cause of impact [8].

Glass penetration patterns help forensic experts differentiate bullet impacts from blunt object damage. Bullet penetration typically creates a cone-shaped fracture with radial cracks radiating outwards and concentric cracks encircling the point of impact [9]. High-velocity projectiles leave distinct stress marks and mirror zones on the glass pane, aiding in the identification of weaponry and trajectory [10]. Conversely, blunt object penetration generates irregular fracture patterns without concentric rings or cone fractures. Hackle markings and the absence of exit-side widening distinguish blunt object penetration from firearm-related damage [11]. The

Table 1 highlights the forensic comparison of blunt force glass penetration and projectile penetration.

By examining these features, investigators can reconstruct the sequence of events leading to glass breakage and differentiate between internal and external causes of damage. Proper crime scene investigation protocols, including evidence preservation and meticulous documentation, are essential for ensuring reliable forensic analysis and meaningful insights into complex cases [12].

This case report delves into a forensic examination of an alleged bullet-firing incident involving glass pane penetration. Through forensic techniques such as fractographic analysis and crime scene reconstruction, this investigation highlights the significance of detailed forensic work in resolving ambiguities and uncovering the truth behind crime scene evidence.

Table 1: Blunt Force vs Projectile-Induced Glass Fractures

Parameters	Projectile Penetration	Blunt Force Impact
Fracture Pattern	Predictable radial cracks from point of impact; concentric rings around entry site [13]	Irregular, sometimes with multiple impact points and chaotic crack propagation [14]
Fracture Type	high-speed projectile, it will form a cone or cone, and when a low-speed projectile strikes glass, it will cause radial fractures, which radiate outward from the point of contact. Concentric fractures may develop around the point of contact if a glass is securely held on all sides [15]	Conchoidal fractures, radial and concentric cracks [16]
Beveling Characteristics	Entry side: smaller hole with inward beveling; Exit side: larger hole with outward beveling [17]	Minimal or absent
Point of Impact	localized entry point Sharp; may show beveling depending on direction	Often diffused or multiple; may show crushing.
Force Characteristics	High velocity; concentrated kinetic energy at a single point	Low to moderate velocity; force distributed over larger area.
Glass Fragment Distribution	Fragments often projected outward (exit side), indicating direction of force	Fragments may remain attached or fall near impact site
Diagnostic Indicators	Symmetrical radial cracks; possible gunshot residue (GSR) near entry site	Lack of symmetry; possible tool marks or residue
Forensic Interpretation	Indicates firearm discharge or projectile impact	Suggests manual assault, robbery, accident, or vandalism

2. Case Presentation

In southern Kolkata, a troubling pattern of gunfire reports near the local police station has raised alarms within the police administration. Recently, an individual approached the station, stating that gunfire had erupted in their apartment. At approximately 12:35 AM, an individual allegedly confronted them near their door, firing shots and shouting insults. The

individual presented two empty shell casings found just beneath the sunshade, highlighting the severity of the situation. Moreover, they pointed out a shattered glass pane in their window, which was a direct result of the gunfire. In response to the urgency of this incident, the forensic team was dispatched the next day to investigate the matter officially. They meticulously examined the room on the second floor of the three-story building (

Figure 1) where the chilling event took place, emphasizing the community's need for safety and justice.





Figure 1: 3-story building where gunshot penetration was reported in the window of the 2nd floor.

The forensic team carried out a scientific examination of the crime scene in the presence of police personnel and the complainant. The dimensions of the room were approximately 11 feet 2 inches long from east to west and 9 feet 9 inches wide from north to south. The room had one door and two metal-framed glass windows, one on the northern side and one on the western side. The western-side window was found to be broken approximately 4

Figure 2), with a maximum length of 10 inches and a minimum width of 15 inches. The bottom of the window was approximately 4 feet 3 inches above the floor. A metal wardrobe, with two trolley bags atop it, stood directly across from the broken window pane. Additionally, a study table and a wooden chair were placed on the eastern side of the room. No other furniture or household items were observed inside the room.





Figure 2: Glass penetration initially reported as bullet impact.

The FSL (Forensic Science Laboratory) investigator placed a tripod on the road surface in front of the window and sent laser rays through the broken portion of the western side glass pane at different angles. One team member marked the points where the rays touched the ceiling and walls of the room. No evidence of projectile penetration or flaking/peeling plaster was detected at the marked points inside the room. The authors examined the ability of broken glass pane to propagate cracks. Considering the radial cracks, concentric cracks, ridges, Wallner lines, etc., the investigator opined that the window glass pane was broken from the inside by a blunt instrument. A pink curtain was hung in front of the window in the room. There were no signs of burning or any holes on the curtain, especially near the area where the glass pane was broken. This confirmed the curtain remained undisturbed. The complainant reported that empty cartridges were found on the ground directly below the sunshade. This location was directly under the sunshade on the ground floor. All the window sunshades on every floor were in the same position. If an object had ricocheted from the window, it would have likely bounced onto the road. This indicates that the cartridges were not found in the reported area.

3. Discussion

Following a detailed scene examination, forensic experts concluded that a blunt object from within the room had broken the glass pane, eliminating the possibility of an external projectile. The presence of Wallner lines provided additional evidence supporting the conclusion of an internal blunt force impact. To substantiate this conclusion, the investigator collected swabs from the broken window pane and fractured glass, adhering to standard procedures. These were then sent to the forensic science laboratory for testing to confirm the presence of gunshot residue and determine the cause of the glass breakage. Ballistics experts concluded the glass pane was shattered from within by a blunt object, with no gunshot residue (G.S.R.) detected at the scene. Upon receiving the forensic report, after thorough investigation and interrogation of the complainant, the police filed a

chargesheet, and the case proceeded to court. The court found the complainant guilty, and he was released after paying a fine and writing a bond pledging not to engage in such activities in the future.

4. Conclusion

A comprehensive examination of the crime scene, coupled with an intricate forensic analysis of the glass pane penetration patterns, revealed critical insights into the alleged bullet firing incident. The investigation revealed no evidence of projectile penetration and an intact curtain, raising doubts about the initial claims. By utilizing laser ray techniques, forensic specialists meticulously project beams through fragmented glass, confirming the lack of any penetration signatures. Gunshot residue analysis of the collected swab confirmed the absence of residue. Furthermore, a thorough assessment of the glass revealed distinct features: radial cracks radiating outwards, concentric cracks forming circular patterns, ridges, and Wallner lines indicative of stress fractures. These elements led the investigator to assess whether the glass pane had been forcibly broken from the interior using a blunt instrument rather than as a result of an external gunfire incident. The absence of cartridges in the vicinity further contradicted the initial narrative. In a remarkable display of forensic expertise, the team meticulously reconstructed the series of events, unveiling the actual sequence of events that transpired. This case report highlights the critical role of detailed forensic investigations and precise fractography in resolving complex crime scenes.

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