THE EFFECTS OF AIR CURRENT ON HIGH VELOCITY IMPACT SPATTER

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Abstract

The flight of high velocity impact spatter has been well documented over the years. A recent case however, posed a deviation into the research that required further investigation. The case involved a shooting victim that had been killed with a six-inch .357 magnum revolver. There was no exit wound, and the only bloodstain pattern evidence came from back-spatter and pooling. When I responded to the scene many elements became apparent that would later prove to be quite challenging in the attempt to reconstruct this incident.

The victim received a contact wound to the forehead causing a large portion of the brain to exit the wound. Although evident, EMS personnel proceeded with advanced life support and transported the victim to the hospital. Upon assessing the patient, the emergency room physician immediately pronounced the victim dead.

Arriving at the location, I found the scene altered to such a degree that the only bloodstain pattern evidence that could not have been caused by artifact of EMS was that of high velocity impact spatter. I found items that were blood soaked but had been thrown off of the bed. This caused cast off and transfer patterns, which were hard to distinguish from the actual event. It was clear that the only bloodstain pattern that EMS could not have produced was high velocity impact.

The next apparent problem was that the room measured 10' x 12' with a full size bed near one wall and contained a box fan sitting on a dresser approximately 3½' off the floor (see fig.1). After surveying the scene, I found the fan was directed at the side of the bed with an angle of approximately 35 degrees. The fan, now turned off, was later confirmed to have been on when EMS arrived. However, I was unable to determine to what speed the fan had been set.

Due to the lack of spatter found on the adjacent walls in the room next to the bed, I worked on the pretense that the victim was lying in a supine position when the shot was fired. I found evidence of ninety-degree spatter on the nightstand and the cabinet next to the bed. These spatters measured 2-3 mm in diameter but never reached the adjacent walls that were within 27" of the bed.

After examining the victim's and the suspect's clothing, I found evidence of high velocity impact spatter deposited on both. The suspect never gave a statement to the police regarding his position in the room or to that of the victim's position when the gun was discharged. The only information he gave were utterances made while EMS and local law enforcement was initially on the scene. Investigators were told that the victim had been playing with the weapon and the suspect attempted to get it away from her when it discharged. However, examination of the victim's hands at the hospital showed an absence of high velocity impact spatter and no smudging or stippling that would be evident with cylinder flash had the victim been holding the weapon in the fashion that would have caused her wound.

The high velocity impact spatter that was found was deposited on the front of the victim's shorts and the rear of the suspect's shirt and pants. EMS had cut off the victim's shirt and left it lying in the pool of blood on the bed. With no information on how the victim and the suspect were positioned, I proceeded with experiments to try to reconstruct every possible scenario.

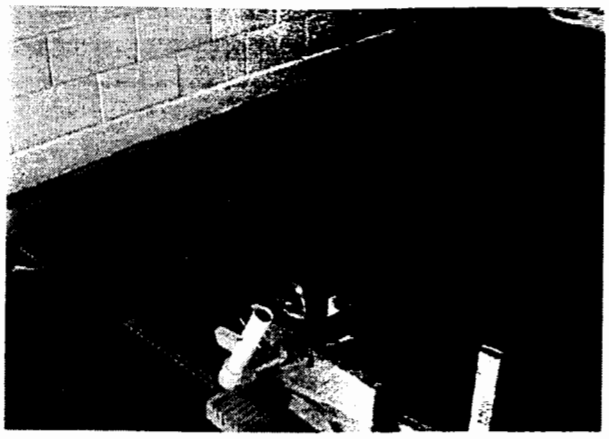
There were two questions that needed to be answered:

1. Did the high velocity impact spatter fall at a near 90-degree angle and deposit on the rear of the suspect's pants while he was lying next to the victim?

2. Could the suspect have been standing in front of the victim and been struck with near 90-degree High velocity impact spatter on the rear of his pants?

The sole purpose of this experiment was to determine if air current created by the fan at the shooting scene could cause high velocity impact spatter to change directions, or"blowback", onto the rear of the suspect's pants.

The first problem to be addressed was to replicate high velocity impact spatter. I have used the method of firing a bullet through blood soaked material in the past but to match the spatter of the scene environment I would have to conduct the experiments inside a room. I had to create a technique to duplicate this spatter without the use of a firearm.



I have always been instructed that high velocity impact spatter is caused by blood being impacted or disrupted by a force traveling 100 fps or faster. Having used a paint ball marker for training in my law enforcement career, I knew that when I ran out of paint balls the gun would still fire the compressed air. My particular gun fires a paint ball at 300 fps, so I used this in my tests. I found that I could replicate the spatter that I would need continuing my experiments.

Materials

1. Brass Eagle Paintball marker(Stingray model)
2. ¾" x 5 ½" PVC tubing
3. ¾" PVC elbow with ¾" O-ring
4. ¼" brass wire
5. 50ml beaker
6. 10ml graduated cylinder
7. 5ml pipette
8. ¾" wood framing
9. 22" x 28" poster boards(as needed)
10. 30' X 20" tarp(general use)
11. wadding material
12. Lakewood 20" box fan (three speed)
13. Blood
14. Jig to hold gun

The ¾" x 5 ½" PVC tubing is drilled and the brass wire is placed through the tube to form an X. This should be done about 2 ½" from the muzzle end of the tube. This allows the wadding to only go down the tube that distance (see fig. 2).

The O-ring is placed over the end of the Paintball gun barrel. The ¾" PVC elbow is then placed over the barrel and the O-ring making a good seal (see fig.2).

The 5 ½" PVC tube is then fitted into the elbow with the wadding restrictors at the opposite end.

On this particular paintball gun, the barrel can move freely and rotate both clockwise and counter clockwise. To limit this rotation, I placed a wooden shim in-between the barrel and the gun frame. This allowed the barrel to stay in place after being rotated to the desired angle.

The paintball gun was now ready for loading. I experimented with different material, finally using strips that I cut from plastic grocery sacks. This material was very light, yet made an adequate seal for the blood prior to

firing the gun. I then placed 2ml. Of blood into the muzzle of the tube and fired the gun immediately. Failure to fire the gun in a timely fashion would allow the blood to seep past the wadding, causing a poor pattern.

The gun would then be fired, causing the air to impact the wadding. The wadding would then in turn impact the blood setting on top and produced the desired pattern.

I now needed a fan of similar design and adjustable speeds as the one at the scene on the day of the incident. I was able to locate a 20" box fan similar to the one at the scene. I found a Lakewood box fan, model 200DS that had three different speeds. The fan had five blades and produced the following:

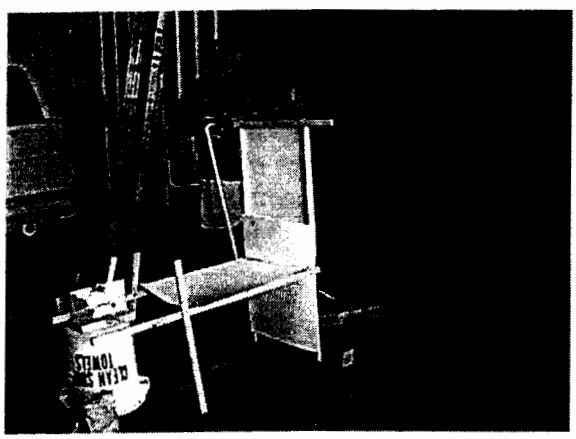
LOW SPEED	MEDIUM SPEED	HIGH SPEED
500 RPM	700 RPM	1000 RPM

The total cubic foot movement of the fan was 2000.

Method

The scene was reconstructed with the use of measurements taken on the day of the investigation. Target material was introduced to replicate high velocity spatter fired from a height of approximately 27" from the floor at a 75-degree angle. This was performed with the fan in the off position, then at the medium speed, and then at the high speed setting. The blood used was drawn from my body by venipuncture and placed into a sterile container with heparin treatment. The blood was loaded at near body temperature and fired over the target material.

The experiment was conducted in the wash bay of the Tippecanoe County jail garage. A tarp was hung to contain as much of the blood as possible. The frame was then assembled to hold the targets. One target would simulate t victim and/or suspect lying on the bed and the other would simulate the suspect standing next to the bed. After framing and attaching the target material, the fan was positioned at an angle of approximately 49-degrees so it would blow onto the target area and in the opposite direction of the paintball gun. It is my belief that the victim was lying across the bed, so I placed my targets with those measurements in mind. The paintball gun was positioned 27" from the floor with the (victim/suspect) target 21" from the floor in a horizontal position. The bed measured 54" in width and the evidence indicated the victim's head was positioned in the middle of the bed. The adapted tube on the paintball gun was placed 27" from the ending edge of the target. The vertical target was placed flush with the horizontal target. Giving the benefit in the suspect's favor the vertical target stood 56" from the floor to the top of the target.



- The first blood was impacted and distributed to the targets with the fan in the off position.
- The second blood was impacted and distributed to the targets with the fan on the medium setting
- The third blood was impacted and distributed to the targets with the fan on the high setting

RESULTS:

FAN IN OFF POSITION

The results that occurred when the loaded blood was fired were as expected. Most of the small droplets of .5 mm and smaller traveled no more than 28". The front and rear of the vertical target had minimal droplets, a result of falling spatter. There were no droplets deposited on the lower vertical target.

FAN ON MEDIUM SPEED

With larger droplets traveling a shorter distance, this aspect proved more interesting. Droplets were being deposited on the rear of the lower vertical target. These droplets indicated that they were falling then striking the target at a 19-degree angle. There was a larger concentration of .5 mm droplets at the first third of the 28" horizontal target. Droplets of 1 mm and larger were seen at the last third of the horizontal target.

FAN ON HIGH SPEED

The more the air current increased, the higher the concentration of small droplets - .5 mm - 1 mm in size would deposit on the horizontal target. There was a larger concentration of 1mm and larger at the last third of the horizontal target. The rear of the vertical target had an increase of droplets striking the surface at different degrees. Each indicated that it was falling at various attitudes, striking from 19-degrees – 23-degrees. No droplets struck the rear of the vertical target at an angle of more than 30-degrees.

Conclusion

This experiment was to determine if air current from a fan located at the scene of a shooting could have caused high velocity impact spatter to deposit on the rear of the suspect's pants at an angle of near 90-degrees, while the suspect stood facing the victim.

I conclude that there was a definite effect on the droplets in the high velocity impact range and that it was possible to deposit high velocity impact spatter on the reverse side of the facing target area. However, it was not possible to deposit high velocity impact droplets at a near 90-degree angle on the rear of this target. All of the high velocity impact spatter on the rear and side of the suspect's pants were near 90-degree range. The most acute angle of attack that the experiment was able to produce, was 23-degrees. This was while the fan was operating in the high setting. It is my conclusion that the suspect was not standing and facing the victim when the shot was fired.

There are some disagreements concerning my reproduction of high velocity impact spatter. Some believe this experiment projects the blood instead of impacting it. I was able to replicate these droplets and direct them in the direction I wanted them to go. The flight of these droplets followed the same rules of physics as taught and duplicated in similar tests done with blood soaked material struck with a bullet. This may prove valuable when analyzing crime scenes with similar environmental situations. I encourage others to experiment with this method to see if you achieve similar results.

Figure 1

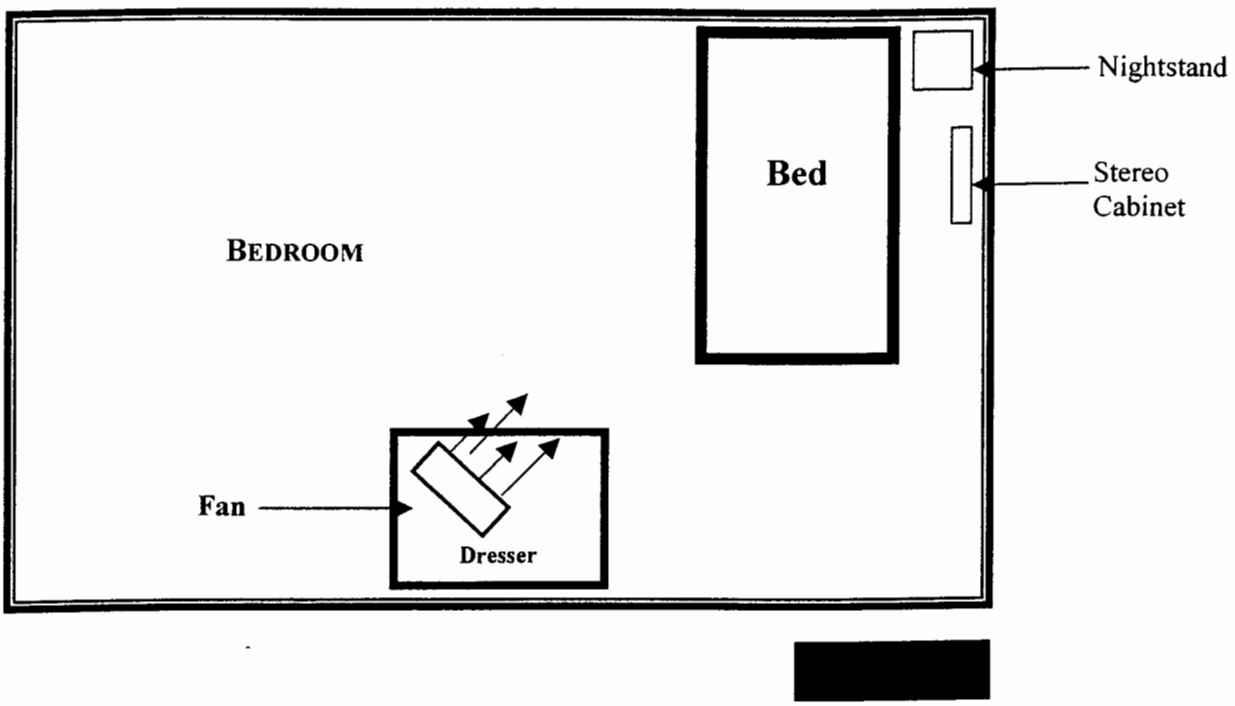


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Figure 2