B125 Gunpowder Stipple Patterns of Commonly Encountered Small Firearms

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After attending this presentation, attendees will learn about a process for developing, recording and comparing arithmetical data relating to the potential for specific firearms and ammunition to create gunpowder stip- pling patterns.

This presentation will impact the forensic community and/or humanity by demonstrating the documentation of data relating to gun- powder stippling patterns in a structured arithmetical format allows for clearer scientific discussions in general and oral courtroom presentations in particular.

Gunpowder stippling patterns on human skin have long been recog- nized as a valuable indicator of the distance between a discharging firearm muzzle and the surface of skin first perforated by the resulting fired bullet. The first level of apparent gunpowder stippling pattern evaluation is gen- erally performed during autopsy by forensic pathologists where-in conclu- sions are developed defining the stippling injury's source/cause. Unfortunately, in most cases where an apparent gunpowder stippling pattern is present on a deceased body, no samples of the injured tissue or even the embedded particulate are collected as evidence. Many times it is not possible to verify an original autopsy designation of the injury pattern as being caused by gunpowder impact without autopsy samples because of the limiting quality of photographic images taken for documentation pur- poses. In cases involving multiple gunshots on the scene it may be difficult to determine, without microscopic examination of embedded particulate, if the bullet entry wound in exposed skin is in fact the result of direct gunfire or if the skin is a secondary target and associated stippling is caused by debris from the bullet exiting the primary target material.

The next level of interpretation of gunpowder stippling patterns involves a process by which the distance between muzzle and skin is deter- mined. Clearly, gunpowder particles exiting the muzzle of a firearm, along with the fired bullet, at the time of discharge will have velocities that vary dramatically from one another but many will have at least the same velocity as the fired bullet. Particle size will also vary depending on the amount of burn that the gunpowder particle has experienced before it exits the muzzle. The size of the particle, and therefore its mass, and its velocity at the time it contacts the surface of the skin directly relate to the seriousness of the injury produced. If the particle is too small and/or too slow, no injury will be produced. The temperature of the particle at the time of impact, espe- cially with respect to whether or not it is still burning, will also affect the severity of injury visible in the skin.

The study currently underway is focusing on a system of documenting gunpowder stippling patterns produced by several different hand guns and several different brands and loads of hand gun ammunition. The firearms were fired into white, smooth surfaced, one half inch thick, ceiling tiles (suspended ceiling design) cut to rectangles approximately 8 ½ by 11 inches. Any gunpowder particle impact point that exhibited fractured surface characteristics, or greater damage such as surface perforation, were considered to have enough energy to produce a stipple mark in skin and were included in stipple concentration counts. A template of concentric circles drawn at one inch, two inches, three inches, and four inches from the center point was prepared on clear mylar sheet stock and this was used as an overlay on top of the test fire ceiling tile panels with the center point placed dead center on the bullet defect in the panels. The circles were scribed into quarters and counts for stipple marks were made in one quarter of the circle. The counts, for purposes of this presentation, are reported as the number of stipple marks per square inch, and are classified by definition as "First Order Quarter-Arc Density" for the particle damage count in the quarter of circle area from center point to the quarter arc at one inch out from the center, "Second Order Quarter-Arc Density" for the total particle damage count in the quarter of circle area from center point to the quarter arc at two inches from the center point, and so on.

Three different semi automatic pistols of the 9mm caliber class were tested and found to produce the following results:

Colt Mustang Pocketlite .380 Auto, (9x17mm) with 2 ¾ inch barrel: At a six inch muzzle to target distance, First Order Quarter-Arc Density = 76.4 stipple marks per square inch; Second Order Quarter-Arc Density = 63.05 stipple marks per square inch; and no marks were present beyond the two inch radius arc. At a twelve inch muzzle to target distance, First Order Quarter-Arc Density = 19.1 stipple marks per square inch; Second Order Quarter-Arc Density = 12.1 stipple marks per square inch; Third Order Quarter-Arc Density = 10.6 stipple marks per square inch; and no marks were present beyond the three inch radius arc. At an eighteen inch muzzle to target distance, First Order Quarter-Arc Density = 2.5 stipple marks per square inch; Second Order Quarter-Arc Density = 3.1 stipple marks per square inch; and no marks were present beyond the two inch radius arc.

Makarov 9mm, (9x18mm), with 3 5/8 inch barrel: At a six inch muzzle to target distance, First Order Quarter-Arc Density = 57.3 stipple marks per square inch; Second Order Quarter-Arc Density = 43.3 stipple marks per square inch; Third Order Quarter-Arc Density = 20.3 stipple marks per square inch; and no marks were present beyond the three inch radius arc. At a twelve inch muzzle to target distance, First Order Quarter-Arc Density = 24.2 stipple marks per square inch; Second Order Quarter-Arc Density = 24.8 stipple marks per square inch; Third Order Quarter-Arc Density = 20.4 stipple marks per square inch; Fourth Order Quarter-Arc Density = 16.2 stipple marks per square inch; and no marks were present beyond the four inch radius arc. At an eighteen inch muzzle to target distance, First Order Quarter-Arc Density = 5.0 stipple marks per square inch; Second Order Quarter-Arc Density

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= 5.1 stipple marks per square inch; Third Order Quarter-Arc Density = 3.8 stipple marks per square inch; Fourth Order Quarter-Arc Density = 3.2 stipple marks per square inch; and no marks were present beyond the four inch radius arc.

Beretta 9mm Luger, (9x19mm parabellum) model 92FS with 4 ¾ inch barrel:
At a six inch muzzle to target distance, First Order Quarter-Arc Density = 183 stipple marks per square inch; Second Order Quarter-Arc Density = 139 stipple marks per square inch; and no marks were present beyond the two inch radius arc. At a twelve inch muzzle to target distance, First Order Quarter-Arc Density = 43.3 stipple marks per square inch; Second Order Quarter Arc Density = stipple marks per square inch; Third Order Quarter-Arc Density = 32.7 stipple marks per square inch; and no marks were present beyond the three inch radius arc. At an eighteen inch muzzle to target distance, First Order Quarter-Arc Density = 15.3 stipple marks per square inch; Second Order Quarter-Arc Density = 14.6 stipple marks per square inch; Third Order Quarter Arc Density = 12.7 stipple marks per square inch; and no marks were present beyond the three inch radius arc.

Gunpowder, Stippling, Pattern

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