Gunshot residue patterns on skin in angled contact and near contact gunshot wounds

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Gunshot residues

Gunshot residue (GSR) is principally composed of burnt and unburnt particles from the **explosive primer**, the **propellant**, as well as components from the **bullet**, the **cartridge** case and the **firearm** used.
The pattern of gunshot residues

- distance between muzzle and target
- the muzzle-target angle
- target
- weapon
- type of ammunition
Distance Determination and Gunshot Residue
จำแนกอาวุธปืน

- ปืนกลัน (PISTOL)

  ลูกโมง (REVOLVER)

  กึ่งอัตโนมัติ (SEMI-AUTOMATIC)

- ปืนยาว (RIFLE)

- ปืนที่ใช้ในการสงคราม
กระสุนปืน (Cartridge)

- ลูกกระสุนปืน (Bullet)
- ปลอกกระสุนปืน (Cartridge case)
- ดินส่งกระสุนปืน (Powder)
- ขนานท้ายกระสุนปืน (Primer Cap)
1. Center fire

40 S&W Centerfire Cartridge
1. Initiator นิยมใช้  Lead Stypnate (PbO$_2$C$_6$H(NO$_2$)$_3$)

2. Oxidizer นิยมใช้  Barium nitrate (Ba(NO$_3$)$_2$)

3. Fuel นิยมใช้  Antimony Sulfide (Sb$_2$S$_3$)
2. Rim fire

Illustrated by firearmsID.com
3. Pin fire
ขนาดของอาวุธปืนและกระสุนปืน

1. หน่วยนิ้ว เชน .22 .25 .32 .38 .45
2. หน่วย มม. เชน 9 มม. 11 มม.
3. หน่วย Gauge/Bore เชน 12-Ga, 20-Ga

Standard Pistol Rounds

--- = 1 inch

.22 9mm 10mm .45 .38 .357 .44 .50
Objective

The goal of this study was the reproduction of shape and pattern of gunshot residues in near contact and contact gunshot wounds.

To investigate the shape and direction of soot deposits with regard to the muzzle according to

- different muzzle-target angles
- firing distances
- type of ammunition
- weapon and barrel length
Muzzle-target angle (β)
Types of ammunition and weapons

.38 SPECIAL (LRN) revolver cartridges fired with a Smith and Wesson revolver
9 mm LUGER (FMJ) pistol cartridges with a SIG Pistol P 210
Types of ammunition and weapons

- 150 mm barrel
- 250 mm barrel
- 650 mm barrel

.22 LONG RIFLE cartridges
Targets

calf skin leather fixed on soap and gelatine blocks
to simulate skin and underlying soft tissue
Results
Gunshot residues on the target surface

.38 Spl. LRN metal piercing revolver with Smith and Wesson revolver
9mm Luger pistol cartridges fired with SIG Pistol P 210
.22 L.R. cartridges fired with 150mm barrel
Conclusion

1. Gunshot residues on the target surface can be differentiated in an inner and outer powder soot zone.

2. The outer powder soot zone is much less visible than the inner powder soot zone and may lack on human skin.
Effect of muzzle-target distance

.38 SPECIAL (LRN) revolver cartridges fired with Smith and Wesson revolver. Arrow indicates direction of bullet: muzzle-target angle = 20°
9 mm LUGER (FMJ) pistol cartridges fired with SIG Pistol P 210

Arrow indicates direction of bullet: muzzle-target angle = 20°
Effect of muzzle-target distance

.22 LONG RIFLE cartridges fired with 150 mm barrel

Arrow indicates direction of bullet: muzzle-target angle = 20°
Conclusion (cont.)

3. With increasing muzzle target distance both inner and outer powder soot halo increase in size and decrease in density.
Effect of muzzle-target angles

.38 SPECIAL (LRN) revolver cartridges fired with Smith and Wesson revolver. Arrow indicates direction of bullet
Effect of muzzle-target angles

9mm LUGER (FMJ) pistol cartridges fired with SIG Pistol P 210
Effect of muzzle-target angles

.22 LONG RIFLE cartridges fired with 150mm barrel
Conclusion (cont.)

4. In angled shots the inner powder soot halo shows an eccentric, elliptic shape which points towards the muzzle, regardless of ammunition, calibre and barrel length.

5. The outer powder soot points away from the muzzle in angled contact and close contact shots.
Effect of barrel

.22 LONG RIFLE cartridges fired
Contact shot with unusual soot pattern


converted Rhoner blank cartridge pistol, Model SM 12, cal. 6.35 mm
Conclusion

1. As the shape of gunshot residues depending on the type of weapon and ammunition.
2. Gunshot residues on the target surface can be differentiated in a inner and outer powder soot zone.
3. The outer powder soot zone is much less visible than the inner powder soot zone and may lack on human skin.
4. With increasing muzzle target distance both inner and outer powder soot halo increase in size and decrease in density.
5. In angled shots the inner powder soot halo shows an eccentric, elliptic shape which points towards the muzzle.
6. The outer powder soot points away from the muzzle in angled contact and close contact shots.
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Near Contact
Thank you

อาจารย์ ผศ.ดร.รณรงค์ นิมพาธิ
อาจารย์ที่ปรึกษาสัมมนา
Thank you

พ.ต.อ. พฤฒินิภัศ ศรีชัย

ตำแหน่ง นาท. (สน 4) กชช. สพธ. 3

ที่ปรึกษาสัมมนา
Thank you