

A Study to Examine the Quantity of Touch DNA from the Surface Area of Pistol Components and Ammunition

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Maher Nouredine^{1*}, James A. Bailey², and Santina Casticiano³

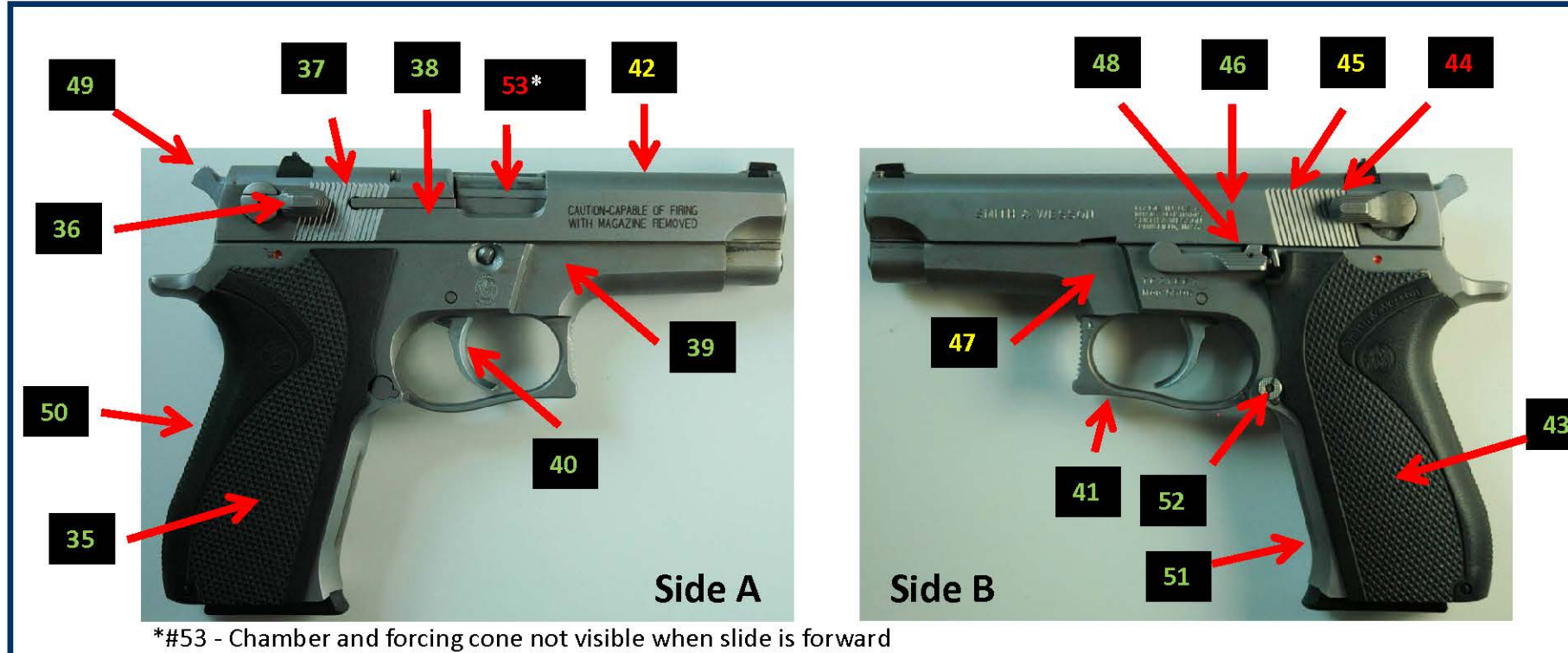
¹ForensiGen, LLC, Oak Ridge, NC
²Minnesota State University Mankato, MN
³COPAN Italia, Brescia, Italy
 * Corresponding Author: mnouredine@forensigen.com

BACKGROUND

Approximately 1.4 million handguns are manufactured annually in the United States. An additional 700,000 handguns are imported. Of the handguns manufactured over a ten-year period, the percentage of revolvers declined while the percentage of pistols increased from 28 to 80 percent. Subsequently, investigators routinely examine pistols for latent impressions and DNA. Biological material containing DNA template from perspiration and epithelial cells are the source for "touch DNA". DNA can be present on different parts of the pistol, magazine, as well as ammunition. The quantity of DNA recovered by swabbing can fluctuate based on factors such as the physiology of the subject as well as the frequency of contact with the pistol and cleaning procedure. Two physiological factors that may influence the presence or absence of touch DNA is xeroderma, dry skin and hyperhidrosis, a condition characterized by abnormally increased perspiration. It is estimated that 2.8% of the population of the United States have hyperhidrosis. Consequently, subjects with hyperhidrosis can have a propensity to leave more touch DNA than others. Swabbing methods can also have an impact on the recovery of touch DNA. For instance, swabs from textured surfaces can yield a higher quantity of DNA template than smooth surfaces.

EXPERIMENTAL SETUP and Results

This research examined the quantity of DNA on the surface area of a pistol and components. A 9mm Smith & Wesson Model 5906 pistol was handled by a right-handed subject/owner after being fired and stored without cleaning for a period of fourteen days before swabbing. The subject removed ten (10) rounds of 9mm full metal jacketed cartridges from a new box of Federal ammunition and loaded the magazine. The pistol, magazine, cartridges and the cartridge box were swabbed for DNA. Swabs were collected on the right and left sides of the grip, safety catch, slide serrations, slide, and frame. Swabs were collected from the trigger, top of the slide, back of the grip, front of the grip, slide release, hammer and magazine release. One swab was collected from the forcing cone in the chamber. Swabs were collected from four sides and the bottom of the magazine. In addition to the pistol, one swab was collected from each of the 10 cartridges loaded and unloaded from the magazine. Two swabs were collected from the cartridge box. The surface areas ranged from ~ 161.29mm² to 4193.5mm² on the pistol. All samples and appropriate controls were collected using the COPAN Crime Scene 4N6 FLOQSwabs™ (Copan Italia, Brescia, Italy) that were pre-wetted with sterile water. DNA samples were extracted using the COPAN nucleic Acids optimizers (NAO) a semi-permeable basket, which retains fluid until centrifuged with the PrepFiler Express™ on the AutoMate Express™ DNA Extraction System by Life Technologies. DNA quantitation was performed using the Quantifiler® Human DNA Quantification Kit by Life Technologies. The AmpFLSTR® Identifier® Plus PCR Amplification Kit by Life Technologies was used for DNA amplification, the fragments were analyzed with the Applied Biosystems® 3130 Genetic Analyzer by Life Technologies and the analysis was performed with GeneMapper® ID-X v1.4.



*#53 - Chamber and forcing cone not visible when slide is forward

4N6FLOQSwab

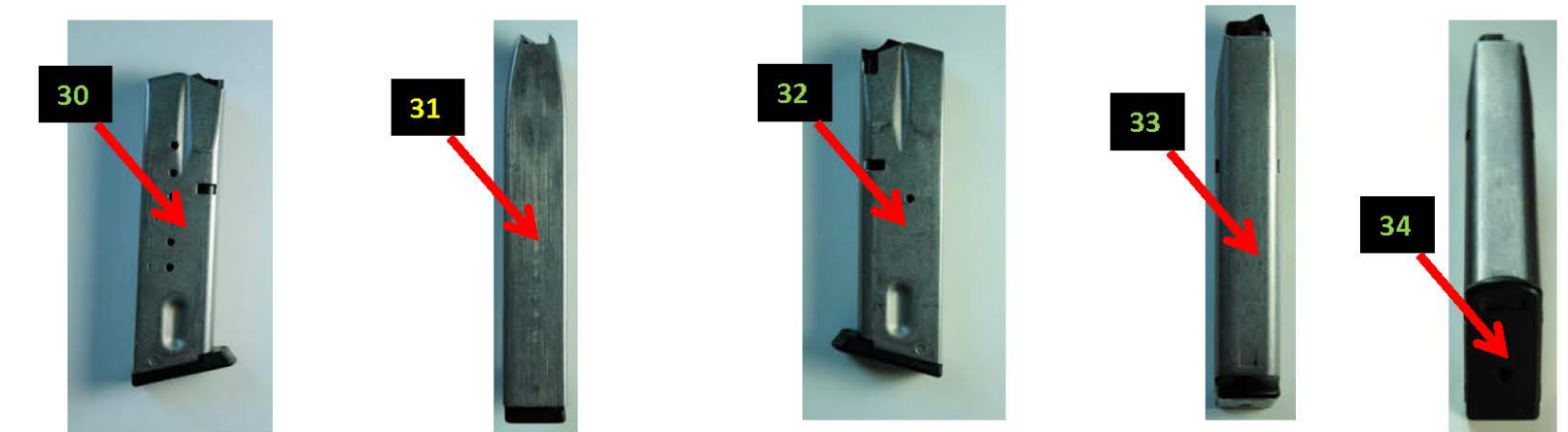


NAO Basket



Samples Collected from PistolIN6			
Location of sample	Surface Area	DNA Quantity (ng/ul)	Profile/Alleles Detected AT=50 RFU: 28 peaks max
35. Side of Grip (Side A)	4112.9mm ²	0.11	Full (28/28 peaks)
36. Safety Release (Side A)	161.29mm ²	0.11	Full (28/28 peaks)
37. Slide Serrations (Side A)	322.58mm ²	0.08	Full (28/28 peaks)
38. Slide (Side A)	4193.5mm ²	0.30	Full (28/28 peaks)
39. Frame (Side A)	2177.4mm ²	0.55	Full (28/28 peaks)
40. Trigger (Side A)	322.58mm ²	0.06	Full (28/28 peaks)
42. Top of Slide (Side A)	3145.2mm ²	0.15	Partial (6/28 peaks)
50. Back of Grip (Side A)	2258.1mm ²	0.30	Full (28/28 peaks)
41. Trigger Guard (Side B)	887.10mm ²	0.63	Full (28/28 peaks)
43. Side of Grip (Side B)	4112.9mm ²	0.47	Full (28/28 peaks)
44. Safety Lever (Side B)	161.29mm ²	0.00	Not Detected
45. Slide Serrations (Side B)	322.58mm ²	0.11	Partial (16/28 peaks)
46. Slide (Side B)	4193.5mm ²	0.20	Full (28/28 peaks)
47. Frame (Side B)	2177.4mm ²	0.26	Partial (18/28 peaks)
48. Slide Release (Side B)	200.00mm ²	0.12	Full (28/28 peaks)
51. Front of Grip (Side B)	2258.1mm ²	0.21	Full (28/28 peaks)
52. Magazine Release (Side B)	161.29mm ²	0.07	Full (28/28 peaks)
53. Chamber and Forcing Cone	161.29mm ²	0.00	Not Detected
49. Hammer	161.29mm ²	0.21	Full (28/28 peaks)

Samples Collected from Ammunition (9mm FMJ)			
Location of sample	Surface Area	DNA Quantity (ng/ul)	Profile/Alleles Detected AT=50 RFU: 28 peaks max
18. FMJ Cartridge	1068.4 mm ²	0.04	Partial (24/28 peaks)
19. FMJ Cartridge	1068.4 mm ²	0.03	Partial (19/28 peaks)
20. FMJ Cartridge	1068.4 mm ²	0.03	Partial (21/28 peaks)
21. FMJ Cartridge	1068.4 mm ²	0.03	Partial (20/28 peaks)
22. FMJ Cartridge	1068.4 mm ²	0.03	Partial (16/28 peaks)
23. FMJ Cartridge	1068.4 mm ²	0.02	Partial (12/28 peaks)
24. FMJ Cartridge	1068.4 mm ²	0.03	Partial (25/28 peaks)
25. FMJ Cartridge	1068.4 mm ²	0.02	Partial (20/28 peaks)
26. FMJ Cartridge	1068.4 mm ²	0.02	Partial (6/28 peaks)
27. FMJ Cartridge	1068.4 mm ²	0.02	Partial (21/28 peaks)



Samples Collected from Magazine			
Location of sample	Surface Area	DNA Quantity (ng/ul)	Profile/Alleles Detected AT=50 RFU: 28 peaks max
30. Right side	2903.2mm ²	0.25	Full (28/28 peaks)
31. Back of Magazine	2177.4mm ²	0.10	Partial (27/28 peaks)
32. Left Side	2903.2 mm ²	0.12	Full (28/28 peaks)
33. Front of Magazine	1935.5mm ²	0.21	Full (28/28 peaks)
34. Bottom of Magazine	483.87mm ²	0.11	Full (28/28 peaks)

CONCLUSIONS and DISCUSSION

It is possible to transfer DNA to any external surface during routine handling of the pistol, magazine, ammunition and ammunition box. In this study 19 surface areas of the pistol were swabbed for DNA and 14 areas resulted in complete profiles while 3 areas resulted in partial profiles. All profiles were consistent with the known subject/owner. There were only 2 areas with undetectable DNA profiles. Larger surface areas swabbed did not result in higher quantities of DNA. For example, a surface area of 161.29mm² swabbed resulted in a complete profile while another surface area of 3145.2mm² only produced a partial DNA profile. In addition to physiological factors affecting the transfer of DNA, there are other factors to consider when examining the pistol. Some include: the length of time the pistol was handled, the method of gripping the pistol, the amount of force exerted on the grip while holding the pistol, the amount of tension needed to move the safety lever, cocking the hammer or retracting the slide. For the magazine examined, 4 swabs resulted in complete DNA profiles and 1 had a partial profile. There were 10 cartridges swabbed in this study. The cartridges were manipulated using the fingers. As each cartridge was inserted, the magazine spring tension increased which required additional force to insert the next cartridge. Consequently, the last cartridge inserted into the magazine required the most force. In this study all cartridges loaded into the magazine resulted in a partial DNA profile. Differences between the cartridges and the pistol were the surface textures and types of metal. The cartridge surfaces were smooth and the pistol surface was textured. The cartridges were made of an alloy of zinc and copper while the pistol was constructed of stainless steel. An ammunition box and inner carton containing the cartridges were swabbed for DNA. Opening the ammunition box required more manipulation with the fingers and contact from the palmer surfaces than retrieving the cartridges from the carton once the box was opened. In this case a complete DNA profile was obtained from the exterior of the box and a partial profile from the inner carton. This data can aid criminal investigators and forensic analysts in developing testing strategies and assessing specific parts of a pistol, ammunition box and cartridges for biological evidence.

Samples Collected from Ammunition Box			
Location of sample	Surface Area	DNA Quantity (ng/ul)	Profile/Alleles Detected AT=50 RFU: 28 peaks max
28. Ammo Box Inner	16125.0 mm ²	0.04	Partial (22/28 peaks)
29. Ammo Box outer	30245.0 mm ²	0.22	Full (28/28 peaks)

