

Recovery of STR DNA from Surfaces of the AR15 Semi-Automatic Rifle Using the Single 4N6FLOQSwab Method

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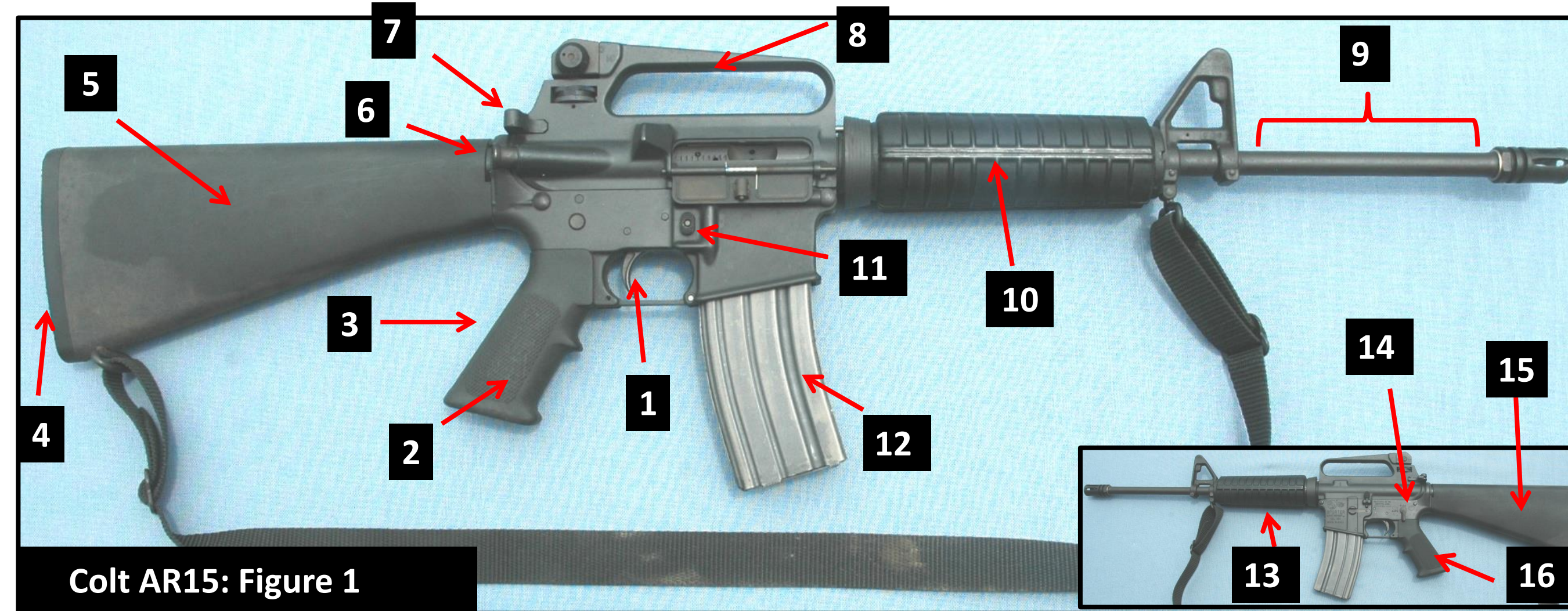
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BACKGROUND

The recovery of biological evidence from firearms is crucial to criminal investigations. Whether the case involves mass shooting or unlawful possession, systematic and hypothesis-driven evaluation of “touch” DNA evidence on a firearm will be greatly enhanced with improvements in swabbing techniques, sample extraction, and downstream data analysis. The quantity and quality of DNA recovered from firearms can vary greatly due to the physiology of the handler/shooter, the frequency of handling and cleaning the surfaces of the firearm, the type of firearm, the number of contributors, and sample collection methods. A popular method of collecting DNA evidence from a firearm is the double swab method, whereby a wet swab is first used to hydrate and collect the biological material, followed by a dry swab to collect as much of the remaining sample as possible. Many forensic testing laboratories will opt to combine the wet and dry swab in a single extraction. This swabbing technique will often be coupled with swabbing multiple firearm surfaces at the same time. While these approaches can maximize the quantity of total DNA collected, the probative value from such samples can diminish due to the possible creation of artificial mixtures that can render any profile data from a firearm useless. In this study, we evaluate the recovery of “touch” DNA samples by using a single swab method on several individual surfaces of the Colt AR15, a popular semi-automatic rifle.

EXPERIMENTAL SETUP and RESULTS

A total of 16 individual surfaces of a Colt AR15 rifle (belonging to a right handed male owner/shooter) were swabbed for DNA using the COPAN 4N6FLOQSwabs™ (Copan Italia, Brescia, Italy) that were pre-wetted with 15 uL of sterile water. Swabbed areas and sample numbers are shown in Figure 1. Individual swabs 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 Thermo Fisher. DNA quantitation was performed using the Quantifiler® Human DNA Quantification Kit by Thermo Fisher. The AmpFLSTR® Identifiler® Plus PCR Amplification Kit by Thermo Fisher was used for DNA amplification (28 cycles). The fragments were run on the Applied Biosystems® 3130 Genetic Analyzer and the analysis was performed with GeneMapper® ID-X v1.4. DNA profiles that are attributable to the owner/shooter (full reference profile of 28 alleles) were obtained from 14 out of the 16 areas swabbed on the AR15 (table).



Colt AR15: Figure 1

DISCUSSION

This experiment demonstrates that useful DNA profiles can be obtained from a semi-automatic rifle by swabbing individual surfaces with the 4N6FLOQSwab. DNA profiles were obtained from surfaces that correspond to a normal carrying / loading / firing posture for this type of firearm (with the exception of Item #3: back side of the pistol grip). No correlation was observed between the size of the area swabbed and the number of alleles detected or the quality of the DNA profile generated, suggesting that swabbing larger (or more) areas is not necessarily better. The swab from the magazine (sample #12) yielded the highest DNA quantity and a DNA profile that is fully consistent with the owner’s DNA profile. However, two minor alleles from a second unknown contributor were detected as well. Swab #15 (Left stock) revealed a partial profile that is consistent with the owner but with one sister allele (11) dropping out at CSF1PO and a full dropout at D2S1338. That sample also revealed two minor alleles (8,9) at D5S818 from an unknown contributor. These two alleles could have added artificial complexity to all useful single contributor profiles found elsewhere on the firearm had the double swab/universal swabbing technique been utilized. Therefore, practitioners are urged to consider using the single 4N6FLOQSwab technique for collecting “touch” DNA evidence from specific areas on firearms as a viable alternative to the double swab technique.

Summary of Results: Samples Collected from Colt AR15 with COPAN 4N6FLOQSwabs™

Swabbed Area Sample #	DNA Quantity (ng/ul)	#Alleles Detected (28 max.) AT=30 RFU (+) = additional alleles
1. Trigger	0.0010	Partial (8/28 peaks)
2. Pistol Grip (R. Side)	0.0007	Partial (8/28 peaks)
3. Pistol Grip (Back Side)	0.0016	None (0/28 peaks)
4. Butt Plate	0.0009	Partial (5/28 peaks)
5. Stock (R. Side)	0.0017	Partial (18/28 peaks)
6. Forward Assist	0.0009	Partial (6/28 peaks)
7. Charging Bar	0.0031	Partial (10/28 peaks)
8. Carrying Handle	0.0030	Partial (11/28 peaks)
9. Barrel	0.0010	Partial (8/28 peaks)
10. Forearm (R. Side)	0.0011	Partial (13/28 peaks)
11. Magazine Release	0.0053	Partial (24/28 peaks)
12. Magazine (all surfaces)	0.0122	Full (28+/28 peaks)
13. Forearm (L. Side)	0.0021	Partial (12/28 peaks)
14. Safety (L. Side)	0.0004	Partial (8/28 peaks)
15. Stock (L. Side)	0.0060	Partial (25+/28 peaks)
16. Pistol Grip (L. Side)	0.0003	Partial (2/28 peaks)
17. Negative CTL	0.0000	(0/28 peaks)

