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Recovery of STR DNA Profiles from Fingerprints Developed on Adhesive Side of Duct Tape

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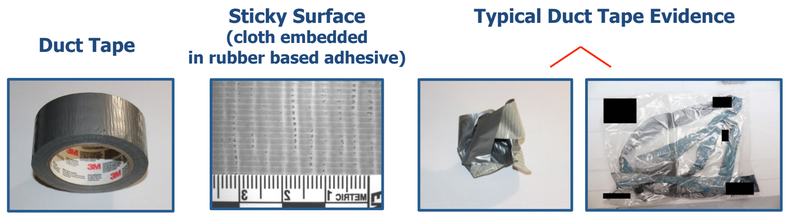
BACKGROUND

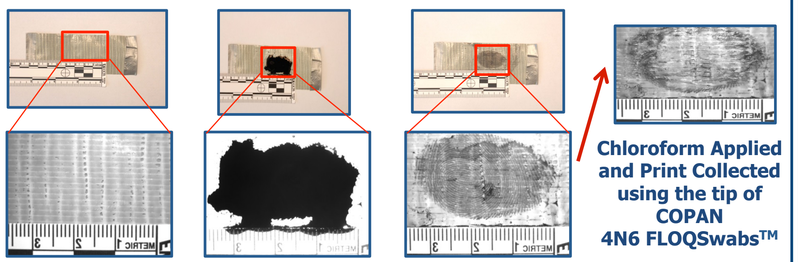
Duct tape is a type of physical evidence recovered from cases when individuals have been abducted or restrained during the commission of a crime. Sometimes pieces of duct tape are collected from recovered packages containing contraband. In these types of cases, recovery of DNA profiles is useful in identifying individuals who have had contact with the adhesive or non-adhesive sides of the tape. Removing tape from a tape dispenser or roll requires some personal contact and manipulation during the process. One technique for visualizing fingerprints on duct tape is by the use of a suspension powder method. Once the fingerprints are visible, the area can be first photographed and then swabbed with a COPAN 4N6 FLOQSwabs™ for recovering DNA evidence.

EXPERIMENTAL SETUP and RESULTS

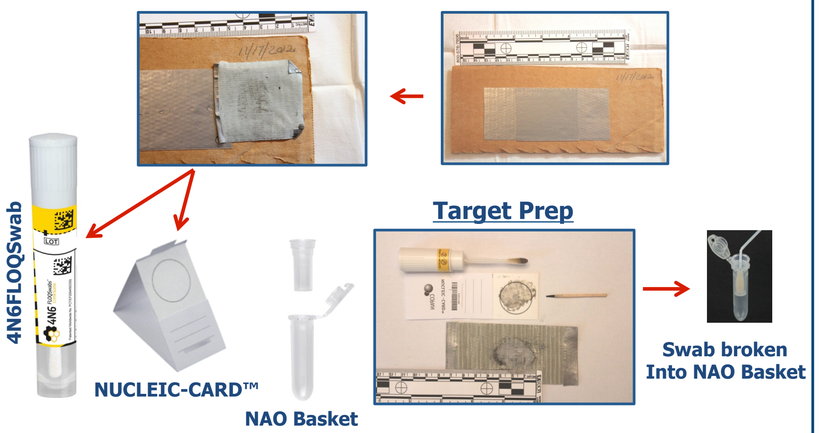
Pilot samples were first collected and analyzed to evaluate the recover of DNA (Table 1). For the experimental samples, donor fingerprints from a single individual were placed on the adhesive side of duct tape (50.8 mm x 101.6 mm) samples. The duct tape samples were then placed on another piece of duct tape (50.8 mm x 101.6 mm) affixed to a section of cardboard and stored over a period of 18 months (see Experimental Samples. At the time of testing, the top layer of duct tape was removed exposing the adhesive side of the tape. This area was processed with Black Wetwop™, rinsed with a stream of sterile water, and photographed. The Black Wetwop™ adheres to papillary ridge impressions in the adhesive and this area was swabbed for DNA. Approximately 500 ul of un-du® (containing heptane) or an aliquot of 500 ul of chloroform was deposited directly onto the print and the surface of the print was rubbed gently using a COPAN 4N6 FLOQSwabs™ or a sterile toothpick. After solubilizing the adhesive, the chloroform was absorbed directly into a COPAN NUCLEIC-CARD™. DNA samples were tested by analyzing a 1.2 mm punch or by extracting ¼ of the NUCLEIC-CARD using the COPAN nucleic acid optimizers (NAO™), a semi-permeable basket, which retains lyses buffer until centrifuged and with the PrepFiler Express Extraction Kit on AutoMate Express extractor by Life Technologies. Quantitation was performed using Quantifiler® Trio DNA Quantification Kit (Life Technologies). The AmpFLSTR® Identifiler® Plus kit (Life Technologies) (29 cycles) was used for PCR profiling of 4N6FLOQSwabs and extracted NUCLEIC-CARDS, while AmpFLSTR® Identifiler® Direct PCR Amplification Kit (Life Technologies) was used for PCR profiling of 1.2 mm punches. The 3130 Genetic Analyzer (Life Technologies) and GeneMapper® *ID-X* v1.4 Software were used for analysis. This method was effective in visualizing the fingerprint impressions and recovering the donor's full DNA profile from fingerprints collected on duct tape over a period of 18 months (Table 2). DNA profiles were obtained from the COPAN® 4N6 FLOQSwabs™ that mediated the solubilization of the adhesive and absorption of the organic solvent containing the DNA sample. The use of Wetwop™, chloroform, or heptane did not seem to interfere with downstream DNA analysis (Table 1).



Experimental Set Up



Experimental Samples

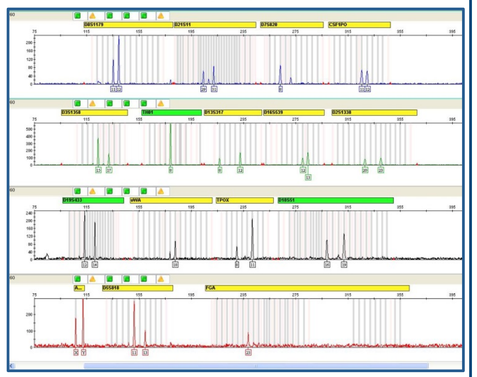


Pilot Samples

Sample #	Description	# Alleles Detected	DNA Quant (ng/ul)
1	Blank swab / Negative Control	0/31	0.000
2	Mock swab / Reagents Blank (no print)	0/31	0.000
3	Print treated with Chloroform (Rep #1)	31/31	0.190
4	Print treated with Chloroform (Rep #2)	31/31	0.260
5	Print treated with Heptane (Rep #1)	31/31	0.110
6	Print treated with Heptane (Rep #2)	31/31	0.100
7*	Print treated with Wetwop™ then Chloroform	29/31	0.040
8	Print treated with Wetwop™ then Heptane	31/31 alleles	0.110

Table 1

*Pilot Sample # 7: Wetwop™ / CHCL3



DISCUSSION

This project demonstrates that useful DNA profiles for matching and/or exclusions can obtained with 4N6FLOQSwabs from fingerprints deposited on Duct Tape, even after prolonged storage of up to 18 months. The method described here is compatible with finger print development process using suspension powder Wetwop™ and chloroform and collection of the sample with the 4N6FLOQSwabs. Other organic solvents such as heptane can also be used. Additional testing will be done using the NUCLEIC-CARD and 4N6FLOQSwabs to investigate fingerprints on duct tape. Variability in DNA quantities found in forensic samples should be expected. The process of exposing fingerprint evidence will require some degree of manipulation of duct tape surfaces, potentially introducing contaminant DNA. This contamination can be minimized through practice and the implementation of appropriate methods of exposing the sticky surface of duct tape from evidentiary samples.

Experimental Samples

Sample #	Sample Date	# Alleles Detected	DNA Quant (ng/ul)
1	1/1/2013	29/29 alleles	0.10
2	2/1/2013	0/29 alleles	0.00
3	3/1/2013	4/29 alleles	0.00
4	4/1/2013	24/29 alleles + C*	0.03
5	5/1/2013	0/29 alleles	0.00
6	6/1/2013	0/29 alleles	0.00
7	7/1/2013	0/29 alleles	0.01
8	8/1/2013	5/29 alleles	0.00
9	9/1/2013	9/29 alleles + C*	0.03
10	10/1/2013	18/29 alleles	0.02
11	11/1/2013	9/29 alleles	0.03
12	12/1/2013	0/29 alleles	0.00
13	1/1/2014	0/29 alleles	0.00
14	2/1/2014	21/29 alleles + C*	0.02
15	3/1/2014	23/29 alleles + C*	0.05
16	4/1/2014	20/29 alleles + C*	0.06
17	5/1/2014	21/29 alleles + C*	0.05
18	6/1/2014	21/29 alleles + C*	0.05
19	Negative CTL	0/29 alleles	0.00

Table 2

C* = Contaminant DNA

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