TECHNICAL NOTE

Ashira Zamir,[1] *M.Sc., Eliot Springer,*[2*] *M.Sc., and Baruch Glattstein,*[3] *M.Sc.*

Fingerprints and DNA: STR Typing of DNA Extracted from Adhesive Tape after Processing for Fingerprints

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ABSTRACT: An exhibit that is often received for examination in cases of robbery or terrorist activity is adhesive tape. This type of exhibit can often, but not always, be successfully processed for fingerprints. The question arises whether or not it is possible to extract and type DNA after the tape has been sequentially processed for fingerprints. In this work, various donors left fingerprints on the adhesive side of tapes. The tapes were then sequentially processed for fingerprints using an alternate light source, cyanoacrylate fuming, and staining with BY-40 and then crystal violet. DNA was subsequently successfully extracted, amplified and typed for six STR loci.

KEYWORDS: polymerase chain reaction, short tandem repeat, fingerprint processing, development, adhesive tape, cyanoacrylate

As DNA testing methods rapidly progress, traditional treatment of various exhibits must be re-accessed in light of these advances. While some types of forensic examinations may interfere with DNA testing, others may be complimentary. In certain cases, especially when one examination might interfere with another, one must make the decision as to which examinations to omit. These decisions may be based on the evidentiary weight of the results of the examination, the chances of success, or other circumstances.

An exhibit that is often received for examination in robbery or bomb cases, among others, is adhesive tape. This type of exhibit can often, but not always, be successfully processed for fingerprints both on the adhesive and non-adhesive sides (1–3). In investigations where there are initially no suspects, successful development of fingerprints can be the key to solving the case. When development is unsuccessful, the question arises whether or not it is still possible to find and profile DNA from the exhibits. The probable source for the DNA is from shedded skin cells. To answer this question, tests were first made to see if DNA can be profiled on adhesive tapes after handling, and if so, can it still be done after the processing of the adhesive tapes for fingerprints.

[1] Scientific Officer, Biology Laboratory, Israel Police National H.Q., Division of Identification and Forensic Science (DIFS), Jerusalem, Israel.
[2] Head, Fingerprint Development Laboratory, DIFS.
[3] Scientific Officer, Toolmarks and Materials Laboratory, DIFS.
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Materials and Methods

The adhesive tape used for the experiments was an insulation, soft vinyl type, 1¾ in. width. At first, a strip was cut and one donor placed three fingerprints on the strip. The strip was then cut into three areas, each one containing a single fingerprint. A buccal swab from the fingerprint donor was collected as a reference for DNA profile comparison.

Next, an attempt was made to extract DNA from each piece of tape. Each piece was cut into very small pieces to facilitate the extraction process. Extractions were carried out both on the tape pieces and on the buccal swab, using a phenol/chloroform extraction method (4). Approximately 50 ng of DNA was extracted from each fingerprint. The DNA was then amplified using the PCR method for the following short tandem repeat (STR) markers: CSF1PO, TPOX, TH01, F13A, FESFPS, and VWA, using the CTT and FFV kits from "Promega" (5).

The products of these amplifications were run on 4% denatured polyacrylamide gels and visualized using silver staining (5). In the next stage, four donors each placed three fingerprints on separate strips of tape. Again, buccal swabs were taken from each fingerprint donor. The adhesive strips were then processed for fingerprints. The procedures used were, alternate light source examination (Polilight PL-10, from 415-555 nm), cyanoacrylate fuming, followed by staining with BY-40 (ethanolic) and then crystal violet (ethanolic) staining (6). The BY-40 and crystal violet solutions were prepared in accordance to the Manual of Fingerprint Development Procedures (6).

At the conclusion of the fingerprint processing methods, an attempt was made at extracting DNA using the same methodology as described above. The extractions of both the tapes and buccal swabs were amplified using the PCR method for the same STR markers as previously mentioned.

Results and Discussion

After DNA was successfully extracted and profiled from the adhesive tapes with undeveloped fingerprints, it was decided to proceed and see if this was possible subsequent to sequential, fingerprint development. As expected, fingerprints were successfully processed. Table 1 shows the results of the amplified DNA products. As can be seen (Table 1), with three out of the four donors, DNA was successfully typed for at least five of the loci. Only with donor two was there no success in receiving a profile. The DNA

TABLE 1—*DNA results after fingerprint processing.*

Donor #	Fingerprint No.	TH01	TPOX	CSF1PO	VWA	FESFPS	F13A
1	1	6,9	8,11	11,12	16,17	—	6,7
1	2	6,9	8,11	11,12	16,17	10,11	6,7
1	3	6,9	8,11	11,12	—	—	6,7
1	buccal swab	6,9	8,11	11,12	16,17	10,11	6,7
2	4	—	—	—	—	—	—
2	5	—	—	—	—	—	—
3	6	6,9	8,9	9,10	17,19	—	
3.2,5							
3	7	6,9	8,9	9,10	17,19	11,11	
3.2,5							
3	buccal swab	6,9	8,9	9,10	17,19	11,11	
				3.2,5			
4	8	7,9.3	8,8	11,12	14,17	10,10	6,7
4	9	7,9.3	8,8	11,12	14,17	—	6,7
4	buccal swab	7,9.3	8,8	11,12	14,17	10,10	6,7

profiles obtained from donors one, three, and four matched the profiles of their buccal swabs at most, but not all of the loci.

In a study where successful DNA extraction from adhesive was reported, no fingerprint processing methods had been applied (7). The reported source of the DNA was from epidermal cells that were pulled off the skin by the adhesive, which appears to be also the source in the present study. The literature dealing with the affects of fingerprint developing procedures on DNA typing generally deal with cases involving body fluids (8–11), (Elliot DA, Lavis A, Callaghan KSN, Ferguson KJ, Fleming RI, Melia LM, Murphy KA. The effects of fingerprinting techniques on blood grouping and DNA analysis. ESR Forensic, Auckland, New Zealand, personal communication).

The developing procedures in such cases usually include methods such as ninhydrin, DFO, amido black, DAB, etc. There have also been preliminary reports of the possibility of extracting DNA from samples handled by people (12). The fingerprint development procedures chosen here were in accordance with protocols used by our division on adhesive tapes in cases of serious crimes.

In casework relating to robberies or bombs, if one has to choose between fingerprint or DNA evidence, fingerprint evidence will almost always be preferable. The ability to extract DNA from evidence that has been processed for fingerprints provides the investigator with the possibility of obtaining an important added piece of evidence. This evidence becomes vital when DNA data bases are available or when no fingerprints are developed, and at a later point in the investigation, a suspect is developed.

If the fingerprint processing methods or some material from the adhesive tape had prevented DNA profiling, we would have had to isolate what caused an adverse effect. However, here it was apparent that none of the four developing methods used altered the DNA profile. UV was purposely not used in order to prevent DNA degradation, although in regular casework, it would have been used.

Conclusions

DNA was successfully extracted from adhesive tapes and profiled after the tapes had under-gone fingerprint processing techniques. In serious crimes, when adhesive tapes are submitted as exhibits, the possibility to be able to both process for fingerprints and profile DNA can present added, important information to the investigators.

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Additional information and reprint requests:
Eliot Springer, Chief Supt.
Division of Identification and Forensic Science (DIFS)
Israel National Police HQ
Sheikh Jarrah
Jerusalem, Israel 91906