

TECHNICAL NOTE

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DNA Profiling from Heroin Street Dose Packages

ABSTRACT: A large amount of heroin street doses are seized and examined for drug content by the Israel police. These are generally wrapped in heat-sealed plastic. Occasionally it is possible to visualize latent fingerprints on the plastic wrap itself, but the small size of the plastic item and the sealing process makes the success rate very low. In this study, the possibility of extracting and profiling DNA from the burnt edge of the plastic wrap was investigated. The idea was based on the assumption that epithelial cells might be trapped during the sealing process. The results show that there are sufficient quantities of DNA deposited at the “amorphous” burnt edges of sealed street doses for DNA profiling to be carried out. A controlled experiment using a known donor was performed. This subject carried out sealing of “street drug” packages and consequent DNA extractions were performed to show that known DNA profiles could be recovered from such packages, as a result of handling by the “packer.” “Square-like” burnt edges did not yield DNA profiles, probably because of differences in the sealing process. It was also shown that DNA could be recovered from the plastic wrap itself and not only from the amorphous burnt edges. As heroin dealers and drug users are often involved in other crimes and run-ins with the law, the effective extraction and addition of their DNA profiles from such items of evidence to the newly established DNA database in Israel provides new avenues in the continued fight against crime and drug traffickers.

KEYWORDS: forensic science, fingerprint, DNA typing, heroin, street doses, plastic

A large quantity of heroin street doses are seized every year by the Israel Police and are analyzed for drug content in the Division of Identification and Forensic Sciences (DIFS). The street doses are generally wrapped in plastic, which is heat-sealed, causing the formation of burnt edges.

Fingerprints and deposited DNA are two of the most important forms of evidence in terms of their ability to individualize persons (1). However, drug doses wrapped in plastic often cannot be successfully processed for fingerprints. This is mainly because of the small size of the plastic wrap and the heat-sealing process. Occasionally, a few visible fingerprint ridge details are observed on the burnt edges (Fig. 1), but these cannot be used for fingerprint identification due to the plastic deformation. With the increasing sensitivity of DNA analysis techniques, success has been reported regarding the recovery of DNA from various surfaces (2,3). It appears from the results that the recoverability of DNA is largely dependent on the surface type.

The aim of this study was to examine whether or not DNA could be extracted and typed from the burnt edges of the plastic wrap. We assumed that some epithelial cells from the drug trafficker's fingers that shed during the sealing process were “trapped” in the plastic burnt edges.

Materials and Methods

Exhibits

Plastic wrappers containing heroin street doses seized between the years 2001 and 2005 were randomly collected from various DIFS cases. Two different types of burnt edges were observed “square like” and “amorphous” (Fig. 2), depending on the method the drug trafficker used for handling and sealing the drug packages. It appeared that in the “square-like” edges, the sealer paid more attention to the shape of the final product, in comparison with those packages with “amorphous” edges.

In the first phase of the experiment, burnt edges (both types) were cut off from 35 street doses and processed for DNA typing.

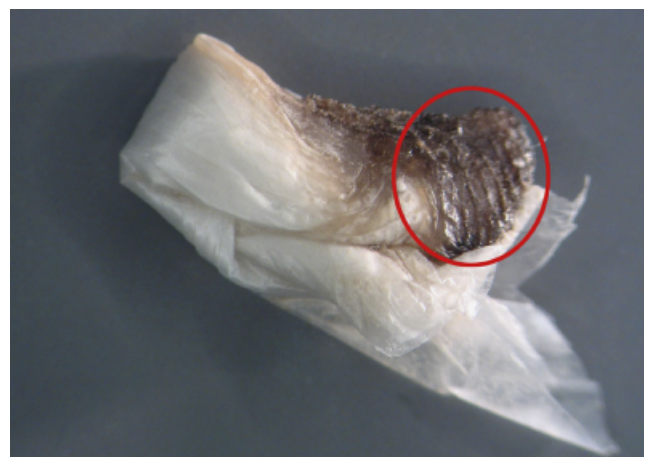


FIG. 1—A few visible fingerprint ridges details (in the circle) are occasionally observed on the burnt edges of heroin street doses.

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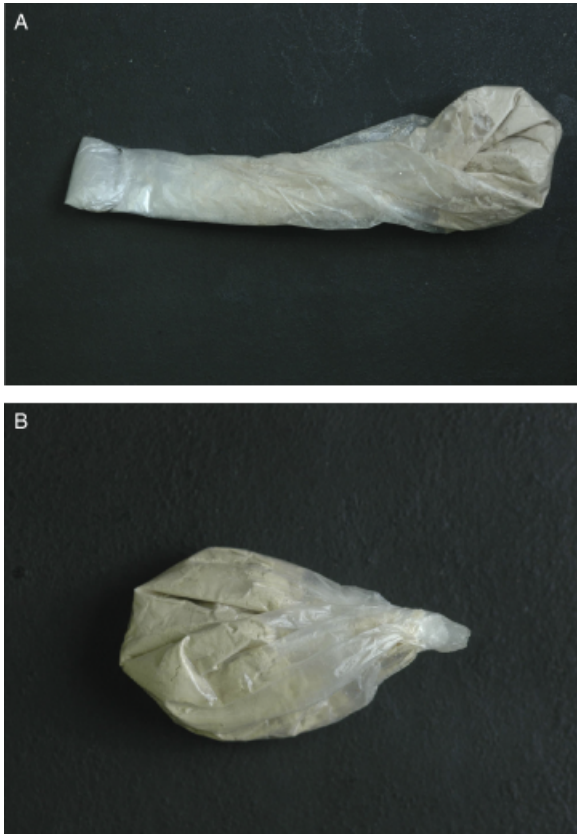


FIG. 2—Two different types of burnt edges are observed: (A) “Square like” and (B) “amorphous.”

In the second phase of the experiment, a controlled experiment was carried using a known donor, who imitated street drug sealing. The sealing process was carried out using new and clean

plastic bags that were heated to the melting point and then pressed with the donor’s fingers for better attachment of the edges. DNA analysis was then performed from two areas from each of the nine packages: the burnt plastic edge and the plastic area that contained the drug (18 samples in total).

In the third phase, nine additional heroin street doses from various DIFS cases (“amorphous” type only) were analyzed for DNA. Two different areas from each of the nine plastic packages were sampled: the burnt plastic edge and the plastic wrap that contained the drug (18 samples in total).

The same DNA protocol was used for all the three phases.

DNA Extraction and Profiling

DNA was extracted from the burnt edges and the plastic wrap of the above exhibits using 5% Chelex 100 (4) and concentrated using Microcon YM-100 (Millipore Corporation, Bedford, MA). The extracted DNA was then quantified using the Quantifiler™ Human DNA Quantification Kit (Applied Biosystems, Foster City, CA) on an Applied Biosystems 7000 Prism instrument, according to the manufacturer’s instructions (5). Between 1 and –1.3 ng of DNA was then amplified using the AmpFISTR® SGM Plus™ kit, in accordance with the manufacturer’s recommendations (Applied Biosystems) (6). The amplification was carried out on a GeneAmp PCR System 9700 (Applied Biosystems). Amplified PCR products were analyzed by an ABI PRISM® 3100 Genetic Analyzer (Applied Biosystems). Electrophoretic separation was carried out using a 50 µm capillary, 36 cm long loaded with a POP-4 polymer. The running conditions were as follows: 30 min running time, 5 sec injection time, and 60°C oven temperature. Allele sizes were analyzed using Genescan® 3.7 and Genotyper® 3.7 analysis softwares (Applied Biosystems).

Results and Discussion

In phase one of the study, DNA was recovered and profiled from 16 out of a total of 20 “amorphous”-type burnt edge samples.

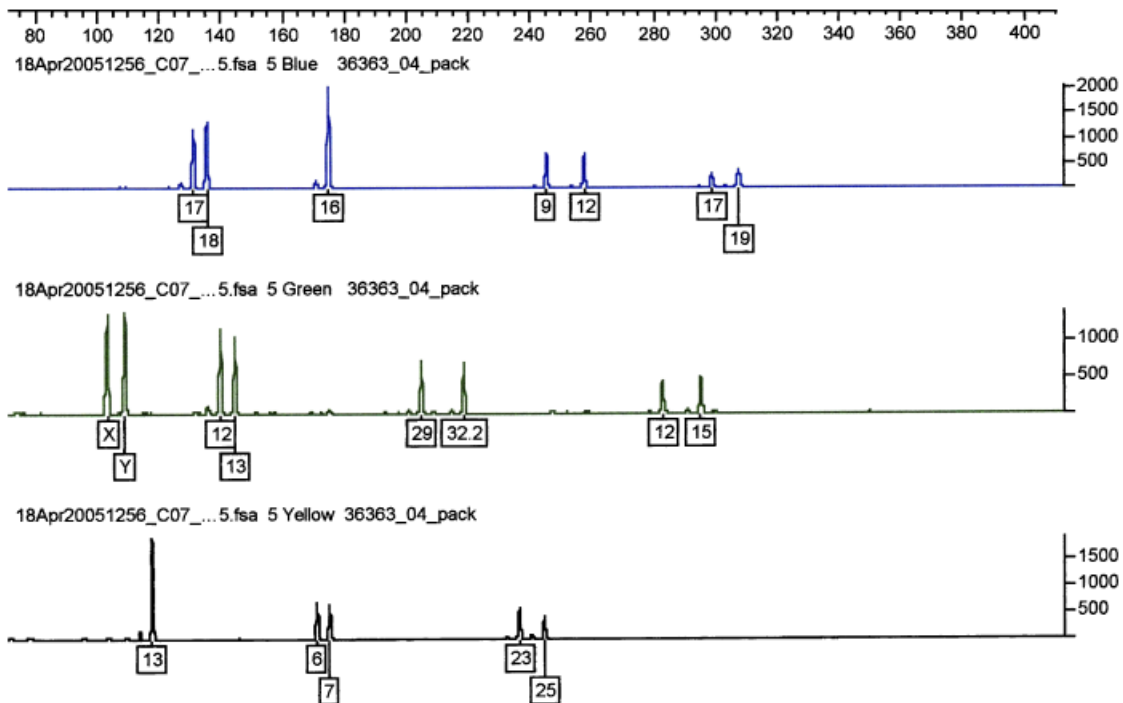


FIG. 3—Single DNA profile obtained from “amorphous” plastic burnt edges of a heroin street dose.

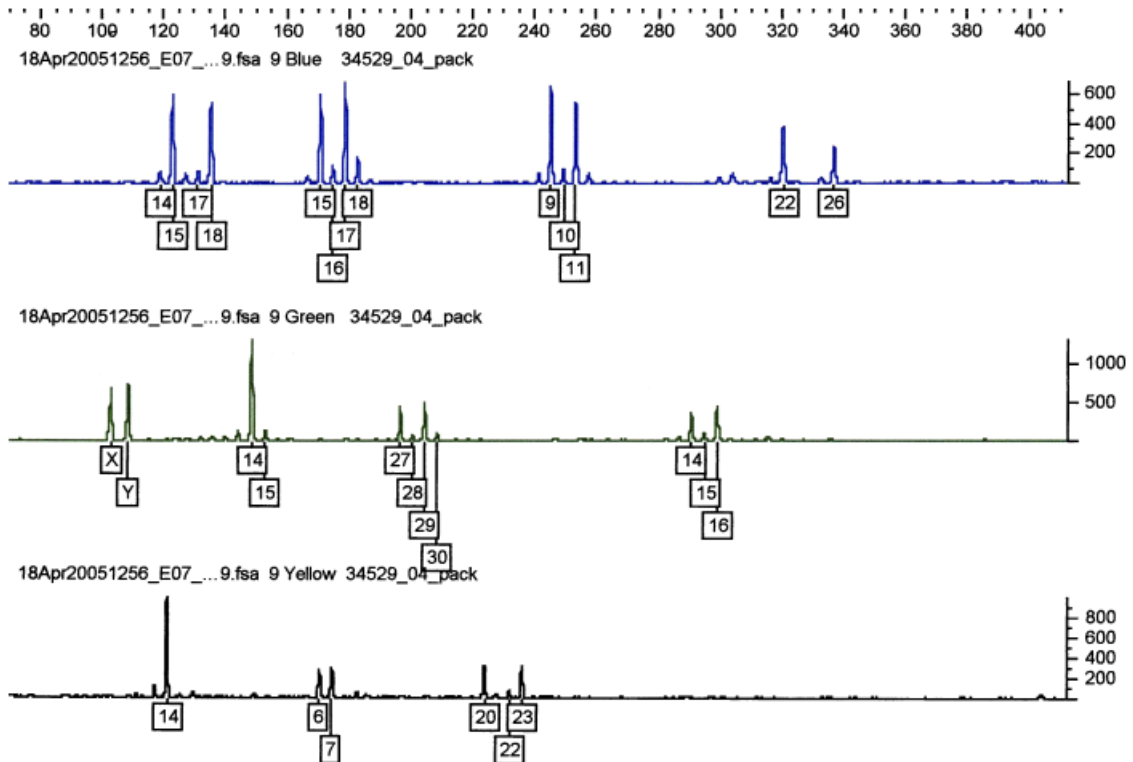


FIG. 4—Mixed DNA profile obtained from “amorphous” plastic burnt edges of a heroin street dose.

Most of them provided mixed profiles originating from at least two donors (Figs. 3 and 4). However, DNA could not be recovered from any of the 19 “square-like”-type burnt edge samples examined in this study. These negative results could be, for example, the result of a sealing process that did not entail human handling (i.e., heat sealer).

The fact that mixed DNA profiles were obtained was inconsistent with our basic assumption that each drug package was sealed by one person only. A possible explanation was that the additional source of the extracted DNA was from another donor, who had come in contact with the plastic package, perhaps after initial sealing and not only from the biological material trapped and embedded into the burnt edges. In order to solve the above issue, DNA was extracted from nine simulated drug packages (burnt edges and bags) handled only by one known donor. DNA profiles were obtained from the burnt edges and the bags themselves. All profiles obtained matched the DNA profile of the donor and no multiple profiles were observed. This simulated experiment suggests that the sealer deposited his DNA during the process of sealing and that other people who come in contact with these “doses” down the line also leave their genetic fingerprint as evidence (perhaps as a result of direct handling or being transported in body cavities, etc.).

With these results in mind, we started the third phase of the study and we examined nine additional drug packages (“amorphous” type only). Each one was examined in two areas. DNA profiles were obtained from four out of nine bag areas sampled and from six out of nine burnt edges. Five of the profiles were single and the other five were mixtures of at least two sources, always with one clear major profile.

The investigative interpretation of the third phase is that DNA identification from drug packages does not necessarily identify the “sealer,” as DNA from other people may also have been deposited

and recovered from the plastic wrap and not only from the burnt edges.

Conclusions

The results from this study showed:

1. DNA profiles can be obtained from small drug packages with “amorphous” burnt edge types and can be compared with the suspect’s DNA profiles. Although “square-like” burnt edges did not yield DNA in this study, it cannot be excluded that DNA profiles will be recovered in future analysis, as method sensitivity and sealing process could be changed.
2. DNA profiles could also be recovered from the bags themselves.

New avenues are now open to combat the ever-increasing drug problem. The importance of DNA profiling from heroin street doses will be greater than ever, as the DNA database has now been implemented in Israel.

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