Just lip prints? No: there could be something else

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DNA FROM LIP PRINTS?

The polymerase chain reaction (PCR) technique brought about a major advance in DNA study, and criminology experts have obviously noticed the possibilities that implementation of this technique can contribute to investigating criminal cases. It is now possible to extract and study DNA from very small samples, even those that are invisible or latent. Although preferred samples from which to obtain DNA are those from biological fluids, it is possible to obtain DNA from fingerprints (1).

The possibility of studying profiles of DNA obtained from fingerprints allows us to consider that invisible or latent lip prints (that is, lip prints from protective lipstick or long-lasting lipstick that does not leave any visible mark) may provide cell remains from which DNA can be extracted. The following study demonstrates an attempt to obtain DNA from latent lip prints on porous surfaces (paper handkerchiefs).

When dealing with latent traces, the first step is visualizing them by a developing process.

The developing of latent lip prints on porous surfaces is more recent than that for fingerprints. The first research showed that traditional reagents used for fingerprints are not successful (2).

It has recently been determined that lysochromes (above all, Sudan Black CI 26150) are quite effective in developing recent latent lip prints, as well as older ones, on porous surfaces (3).

Once the print has been detected, a trace is available from which to procure cell remains that can supply enough DNA to be analyzed by the PCR technique.

The aim of our work was to determine whether from a latent lip print developed with Sudan Black it was possible to extract DNA of sufficient quality and amount to be amplified, thereby providing potential usefulness for identification. For this first study, three loci will be amplified. The results can provide important information regarding:

- Whether it is possible to obtain DNA from a chemically processed latent lip print.
- Whether the DNA has sufficient quality for amplifying and defining the profile for loci vWA, FGA, and TH01.

METHODS

Sample preparation

Latent lip prints were prepared on paper handkerchiefs. After applying standard protective lipstick or long-lasting lipstick (Lipfinity, Max Factor® no. 19) on volunteers, 5 minutes were taken to wait for fixing. Next, lip prints were made on the paper bearer. After a minimum of 24 hours, these prints were developed with Sudan Black (powder) and processed for studying DNA.

Five volunteers (named A, B, C, D, E) collaborated in procuring samples. From each the following samples were obtained:

- A bucal sample (control sample);
- Three latent lip prints made with protective lipstick;
- Three latent lip prints made with long-lasting lipstick.

Development procedure with Sudan Black (powder) (4)

Using a brush, carefully apply a small quantity of powder on the surface in order to locate the latent print. Extend and continue applying until the print can be seen clearly.

DNA extraction

Three-millimeter side squares were cut out from all prints in order to attempt DNA extraction using the Chelex method (5). As a control, bucal samples from participating individuals were used.

DNA quantification

The amount and quality of DNA obtained were determined (Biophotometer Eppendorf®) and checked to ascertain whether enough DNA from all samples could be obtained for amplification. Quantities obtained from the different samples can fluctuate between 2 and 16.4 ng/μL. The minimum DNA for amplification recommended is 5 ng (6).

DNA amplification

The extracted DNA was typed at the STR loci HUMvWA, FGA, and TH01 following conditions described in the bibliography (6–8), with a final volume of 25 μL from

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doi: 10.1096/fj.03-0938lfe

which 10 μL of DNA extract was obtained. PCR was carried out in an Eppendorf ® Mastercicler. The PCR products obtained were subjected to electrophoresis separation. Amplified alleles were separated by electrophoresis in polyacrylamide gel (7). Products were visualized using a silver stain procedure.

RESULTS

The results are shown in **Table 1**. Samples marked as P L were originated by protective lipstick. Those marked L L come from long-lasting lipstick. From the samples studied, it was possible to discern the DNA profile for STR loci HUMvWA, FGA, and TH01. Profiles of each print matched those from control in all cases. No differences were detected between prints from protective lipstick and those formed with long-lasting lipstick.

DISCUSSION

These results indicate that latent lip prints on paper and developed with Sudan Black can be used as a potential DNA source for forensic identification, although it must be remembered that all samples in this essay were obtained under laboratory conditions. The prints were obtained with recently painted lips and therefore were good quality prints. When working on real samples, the researcher may encounter problems such as print or bearer pollution, poor conservation, etc., which will have to be solved in each case. Although this study worked with fresh prints, earlier studies have shown the capability of the developer (Sudan black) on old prints kept under environmental conditions without any kind of protection (3). Once the DNA extraction and amplification on recent prints are developed with Sudan black, the logical next step will be the study of old prints.

Despite the difficulties that may arise, the possibility of obtaining DNA from latent prints makes these traces doubly useful for identification: besides the traditional analysis of labial lines, it is possible to get a print maker's genetic profile.

In conclusion, the search for invisible or latent prints at a crime scene requires increasingly simpler, more sensitive, and effective methods. It is of paramount importance that the method used permit subsequent analyses. In many cases it can be verified that common reagents in biochemical and medical test methods can be useful for crime investigation. This is why the life sciences are an indispensable tool in criminal justice: they play a fundamental role in developing new methods and improving existing ones. FJ

TABLE 1. *Allele for vWA, FGA, and FGA STR loci*

Volunteer	Sample	vWA	FGA	TH01
A	Control	12, 14	20, 24	8, 9.3
	1 (PL)	12, 14	20, 24	8, 9.3
	2 (PL)	12, 14	20, 24	8, 9.3
	3 (PL)	12, 14	20, 24	8, 9.3
	4 (LL)	12, 14	20, 24	8, 9.3
	5 (LL)	12, 14	20, 24	8, 9.3
	6 (LL)	12, 14	20, 24	8, 9.3
B	Control	20, 20	22, 25	6, 9
	1 (PL)	20, 20	22, 25	6, 9
	2 (PL)	20, 20	22, 25	6, 9
	3 (PL)	20, 20	22, 25	6, 9
	4 (LL)	20, 20	22, 25	6, 9
	5 (LL)	20, 20	22, 25	6, 9
	6 (LL)	20, 20	22, 25	6, 9
C	Control	17, 18	19, 19	7, 8
	1 (PL)	17, 18	19, 19	7, 8
	2 (PL)	17, 18	19, 19	7, 8
	3 (PL)	17, 18	19, 19	7, 8
	4 (LL)	17, 18	19, 19	7, 8
	5 (LL)	17, 18	19, 19	7, 8
	6 (LL)	17, 18	19, 19	7, 8
D	Control	14, 15	18, 20	6, 9.3
	1 (PL)	14, 15	18, 20	6, 9.3
	2 (PL)	14, 15	18, 20	6, 9.3
	3 (PL)	14, 15	18, 20	6, 9.3
	4 (LL)	14, 15	18, 20	6, 9.3
	5 (LL)	14, 15	18, 20	6, 9.3
	6 (LL)	14, 15	18, 20	6, 9.3
E	Control	14, 17	24, 24	9, 9
	1 (PL)	14, 17	24, 24	9, 9
	2 (PL)	14, 17	24, 24	9, 9
	3 (PL)	14, 17	24, 24	9, 9
	4 (LL)	14, 17	24, 24	9, 9
	5 (LL)	14, 17	24, 24	9, 9
	6 (LL)	14, 17	24, 24	9, 9

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Received for publication September 25, 2003.
Accepted for publication January 7, 2004.