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Identifying the culprit from LCN DNA obtained from saliva and sweat traces linked to two different robberies and use of a database

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Abstract. This work refers to the identification of a criminal who committed, during a period of 6 months, two robberies in two different towns in Northern Italy. In the first robbery, we analyzed traces on a pillowcase used to carry the stolen goods. As the pillowcase showed no visible traces, we made a specific search for latent traces by means of a Crimescope CS-16 tunable forensic light source used in a special darkroom at a wavelength ranging from 415 to 490 nm: it revealed some interesting luminescent areas possibly due to biological traces (saliva). Subsequently, the latent stains were analysed with the alpha-amylase test, which gave positive results. The evidence available for the second robbery consisted in a pair of glasses left by the criminal in a bank. The glasses showed no visible traces, however, the surface in contact with the nose and ears were sampled using FTA-Paper to collect any residual sweat. The use of the database for the management of DNA profiles allowed us to link the two crimes that had occurred in two different places and at different times. In fact, the same complete male profile for 15 STRs was obtained both from the traces of saliva identified on the pillowcase used to carry the stolen goods (first robbery) and from the glasses frame surface which had been in contact with the nose (second robbery). Moreover, these results enabled the extraction of low copy number (LCN) DNA from uncommon evidence left at the crime scene, increasing the possibilities to identify the culprits. © 2003 Published by Elsevier B.V.

Keywords: Latent traces; DNA database; DNA profiles; STRs; LCN DNA

1. Introduction

Two real cases once again highlight the importance of STR analysis from extremely low levels of human DNA. Low copy number (LCN) DNA profiling [1,2] is a technique sensitive enough to analyze just a few cells, so that the range of forensic evidence is increased. Moreover, the increasing number of profiles that it is possible to obtain from trace evidence collected at the crime scene stresses even more the great necessity for a DNA

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database: through the automatic comparison of millions of genetic data it is fast and easy to link scene to scene and identify criminals, starting just from minute biological traces.

In this case, the evidence collected at crime scenes included:

- First robbery: one pillowcase used by the robber to carry the stolen goods and then left in an abandoned house.
- Second robbery: a pair of glasses worn by the robber and left inside the bank.

The DNA profiles we obtained were registered into our local DNA database [3].

2. Materials and methods

2.1. Latent traces detection

In order to identify latent biological traces, the pillowcase and the glasses underwent a Crimescope CS-16 inspection, a tunable forensic light source used in a specific darkroom at a wavelength ranging from 415 to 490 nm [4]: both evidence revealed some interesting luminescent areas possibly due to biological traces (saliva/sweat).

2.2. Saliva identification

In order to confirm the presence of saliva left on the pillowcase, the latent traces previously revealed were submitted to the *ACP Amylase Kinetic Test* [5], which gave positive results.

2.3. DNA extraction and typing

The saliva traces found on the pillowcase were cut and submitted to phenol–chloroform extraction [6]. The potential sweat residues in the glasses' surface in contact with the nose and the ears were first collected by FTA classic cards [7] and then submitted to the same phenol–chloroform extraction procedure. The products obtained were then purified using the QIAamp DNA mini kit [8] and quantified by slot-blot hybridization [9] with the chemi-luminescent signals recorded by GeneGnome CCD imaging systems [10]. For the amplification and typing, we used the *AmpFlSTR Identifiler PCR Amplification Kit* [11] following the manufacturer's recommendations. Electrophoresis was carried out on ABI Prism 310 Genetic Analyzer. Data were analysed by Gene Scan v.3.1 analytical software.

3. Results and discussion

The recent introduction of LCN DNA profiling using STRs has resulted in an expansion of the range of evidence types that may be analysed, concurrently improving the success rates of DNA profiling techniques on evidence collected at the crime scene that were known to be problematic or largely unsuccessful in the recent past. The results we obtained show that it is now possible to type successfully unusual evidence such as saliva traces as well as sweat residues even if, in both cases, the DNA amount extracted from the evidence was very low (<100 pg).

Furthermore, to achieve positive results it is still essential to provide continuing education in training crime scene officers for proper collection, careful preservation and packaging of the items. The same attention is needed in the lab where it is necessary to manage each case using appropriate analytical strategies in order to detect traces that are still present or need to be developed. We have also found that the use of convenient procedures for DNA extraction is still very crucial as well as its purification and quantitation. Above all, a dedicated step for the amplification of DNA extracted from evidence, in order to obtain a complete profile and to avoid any stochastic effects which may occur when amplifying samples with very low DNA quantities, is essential. In this regard, the use of *AmpFlSTR Identifiler PCR Amplification Kit* was the system of choice due to its high sensitivity and robustness.

Finally, the availability of a DNA database seems to be crucial for rapid solutions of many crimes, especially when they are committed in different areas: as soon as we entered the genetic results of the second robbery into our local DNA database, we were able to link the same profile to the two robberies, committed by the same criminal during a period of 6 months, in two different towns in Northern Italy. This produces a positive impact on citizens, as well as a consistently saves money because no other expensive investigations need to be performed.

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