



G88 Determination of Genetic Profile After Visualization of Fingerprint Marks With Dactyloscopic Powders

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After attending this presentation, attendees will learn the potential of DNA techniques to the analysis of latent fingerprints after visualization with dactyloscopic powder as an important application in forensic caseworks.

This presentation will impact the forensic science community by providing a new perspective of DNA analysis in forensic investigations.

With modern PCR-based technologies, it is possible to obtain a genetic profile from very small amounts of DNA. Due to this, intensive research has opened many new sources for forensic genetic investigation.

Since their introduction in forensic investigations, latent fingerprints recovery and analysis are still maintaining their importance, and the search and archiving of fingerprints is still one of the most important procedures during criminalist investigation. The powdering method is often used for visualization because it is easy, inexpensive, and gives immediate results. The technique relies on the mechanical adherence of fingerprint powder to the moisture and oily components of the skin ridge deposits. Unfortunately, sometimes it happens that the curve and loop patterns are unclear/incomplete, so the fingerprint may not be useful for identification purposes.

Today, latent fingerprints are not commonly used for DNA typing even if they could be considered useful DNA sources, as reported in previous publications which have demonstrated that even a single skin contact can transfer enough DNA for successful STR typing and that fingerprints are a possible DNA source for forensic DNA investigation.

The amount of DNA contained in a latent fingerprint was found to be independent of handling time, dependent on the individual handler and the substrate's characteristics. The success rate in obtaining a genetic profile (partial or complete) from a latent fingerprint will depend on the individual who has touched the surface (good or bad shedder), the activities of the individual prior to touching the substrate, and the nature of the substrates. In forensic casework, neither the shedding nature of the individual nor the activities of the individual prior to touching the object are usually known.

To help address these aspects, a study was conducted on the effect of fingerprint enhancement methods on subsequent STR profiling.

First, a systematic study typing blood traces deposited on five different surfaces, both porous and non-porous, treated with eight types of dactyloscopic powders was performed. Three different DNA extraction methods were used.

In the second part of the study, the possibility of obtaining DNA profiles from latent fingerprints on the same five surfaces enhanced with the eight different powders used in the first part of the study was analyzed. On fragments of the cotton swabs used for recovering DNA from latent fingerprints, extraction procedures with two methods were performed. In order to obtain the greatest number of interpretable profiles, they adopted strategies in the extraction step, using techniques that would guarantee the more purified eluted DNA as possible, and in the amplification reaction, improving its sensitivity compared to the small amount of isolated DNA. Considering the low amount of DNA contained in latent fingerprints, all PCR reactions were carried out three times to obtain a consensus genetic profile.

The work in this study has demonstrated that DNA profiling can be performed on fingerprints left on different substrates and the nature of the substrate will affect the amount of DNA that can be recovered for DNA typing analysis.

In the first phase of the study, a profile was obtained in 92% of the 120 samples analyzed, with the percentage of full profiles of 60%; in the second part, in 55% of the 80 samples analyzed the authors obtained a profile, complete in 32.5% of cases. The substrates that have led to the largest number of profiles have been the metal and the glass, probably due to the lower adhesion of the powders to these surfaces.

From the results obtained, it seems that the powders used in latent fingerprints enhancement, rather than having a direct inhibitory effect on extraction and amplification of DNA, may cause partial degradation of DNA, thereby reducing the efficiency of amplification reaction.

Genetic Profile, Latent Fingerprints, Dactyloscopic Powder