B180 Obtaining STR-Quality Touch DNA From Archived Latent Fingerprints

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After attending this presentation, attendees will understand the importance of collecting and extracting touch DNA evidence from each contact surface for both freshly collected and archived fingerprints.

This presentation will impact the forensic science community by helping attendees to better understand the fragility of such evidence and recognize the need to develop a successful protocol for extracting and typing the highest-quality DNA possible from these types of DNA sources.

Customary collection methods for latent fingerprints discovered at crime scenes involve powder dusting and tape-lifting the prints, followed by attaching the fingerprint-containing adhesive to paper backing cards for storage, thus forming an archived latent fingerprint. Ultimately, this approach allows the crime scene investigator to preserve the latent print(s) but also sandwiches valuable touch DNA evidence between the adhesive and paper surfaces; however, it is uncommon for forensic laboratories to extract DNA that has been stored in this manner due to low success rates and minimal research on DNA extraction methods for archived fingerprints. Further, it is uncommon for investigators to physically collect fingerprints deposited on paper surfaces after on-scene enhancement and photography, leaving valuable trace DNA behind.

In this study, the goal was to determine if it would be possible to obtain sufficient high-quality DNA for successful Short Tandem Repeat (STR) amplification from archived fingerprints. Eight sets of fingerprints were collected from both glass and paper surfaces from five volunteers. From these, multiple variables were tested and compared, including freshly collected samples versus aged samples, glass deposition versus paper, black magnetic enhancement versus standard black dusting powder, and recovery of DNA from the adhesive surface of the archived sample versus the paper side. Two different silica-based solid phase column DNA extraction methods were tested. Following extraction, all samples were quantified using a real-time Polymerase Chain Reaction (PCR) -based human-specific assay and STR loci were amplified and analyzed using standard methods. As expected, "fresh" fingerprint samples yielded higher DNA concentrations (0.175ng±0.3ng) than "aged" fingerprint samples (0.126ng±0.3ng). Enhancement powder used did not affect DNA yield, as samples visually enhanced with black magnetic dactyloscopic powder yielded approximately the same DNA yield (0.166ng±0.3ng) as samples enhanced with standard black dusting dactyloscopic powder (0.136ng±0.3ng). Furthermore, STR-quality DNA was obtainable from both the adhesive sides (avg. 0.356ng±0.38ng) and paper sides (avg 0.211ng±0.27ng) of archived fingerprints. This data demonstrates two important findings. First, quantifiable touch DNA is obtainable from latent prints left on paper surfaces, and, thus, latent fingerprints deposited on paper should be collected from crime scenes for potential DNA analysis after on-scene enhancement and photography. Second, both the adhesive and paper surfaces of an archived fingerprint card should be processed for DNA analysis rather than processing only the adhesive side, the latter of which is standard protocol for labs attempting analysis of this sample type.

Three DNA collection methods were also evaluated: direct cuttings, double-swab technique with lysis buffer as the diluent, and single-swab technique with ultrapure water as the diluent. Of these methods, the double-swab technique yielded three times more DNA (0.497ng±0.45ng) than the other two collection methods. Interestingly, none of the samples showed signs of PCR inhibition, regardless of chemical treatment for fingerprint enhancement; however, only samples collected using the single-swab technique (n=5) yielded STR profiles. Of these samples, 60% yielded near-complete profiles; however, all samples showed electropherogram data indicative of DNA degradation.

The results of this study show that it may be possible to obtain STR-quality DNA from archived, paper-backed latent fingerprints. While these results are encouraging, it is well known that outdated methods for collecting latent prints often did not include the use of gloves or other personal protective equipment and that fingerprint brushes are/were often used for multiple collections without cleaning. Thus, future studies will include thorough contamination and source attribution studies as well as an evaluation of the effects of brush reuse for collection of latent fingerprints.

Touch DNA, DNA Extraction, Archived Fingerprints