TOUCH DNA IN FORENSIC SCIENCE: THE USE OF LABORATORY-CREATED ECCRINE FINGERPRINTS TO QUANTIFY DNA LOSS

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Touch samples typically contain a limited quantity of DNA, which can be further reduced by the manipulations of collection and analysis. It has not been clear, however, at which point(s) during the processes the DNA is lost, as there has not been a reliable positive control to track it through the analysis processes. A careful evaluation of the steps of collection and extraction lead to the definition of three key fail points at which the DNA in a sample could be reduced: 1) remaining on the substrate; 2) retained on the swab; or 3) lost during the manipulations of DNA extraction. To track loss at each point, a method to generate mock eccrine fingerprints containing known quantities of DNA was developed and optimized. Three process controls were used to monitor DNA loss: a) depositing the mock fingerprint on a surface (surface sample); b) pipetting the mock fingerprint onto a swab (swab sample); and c) adding the mock fingerprint directly to the lysis buffer (direct sample).

A five-point standard curve of mock fingerprints for each of the key fail points was generated by plotting DNA recovered vs DNA deposited. Twenty replicate mock fingerprints were produced for each point (0.00 – 9.00 ng DNA deposited). A five-point, one hundred sample standard curve was constructed for each of the three process controls (surface, swab and direct) on the surfaces of glass slides. The average R^2 value of 0.9933 confirmed the validity of the model and increased confidence in the data. Results showed that an average of 74% of the DNA deposited on glass in a mock fingerprint was lost during the combined collection and extraction procedures. More specifically, 16% remained on the slide, 24% was retained on the swab, and 34% was lost during extraction.

Three additional items, selected to represent surfaces where biological evidence might be deposited at a crime scene, were subsequently included in developmental testing of the baseline protocol. The collection/analysis of mock fingerprints from the steering wheel, glassine (drug) baggies, and brass door plate resulted in average total percent DNA losses of 77%, 56% and 61%, respectively. The reduced loss with the drug baggies and door plate was mainly due to a decrease in the quantity of DNA left on the surface (1% and 6%). These results will be discussed further.

Through examining the process flow to demonstrate key fail points, targeted process improvements will bring touch DNA samples into even more routine use with standardized, optimized procedures.