A35 Development of Optimized Recovery and DNA Typing Methodologies for the Analysis of "Touch and Contact DNA" Samples

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The goal of this presentation is to provide an understanding of new methodology for the collection and DNA typing of epithelial cells collected from touch and contact DNA samples.

This presentation will impact the forensic science community by providing a characterization of the biological material in touch or contact DNA evidence and providing strategies for DNA recovery and analysis from isolated cells.

In forensic casework analysis, it is sometimes necessary to obtain genetic profiles from increasingly smaller amounts of biological material left behind by persons involved in criminal offenses. The ability to obtain DNA profiles from trace biological evidence is routinely demonstrated with so-called "touch DNA evidence" (generally perceived to be the result of DNA obtained from shed skin cells transferred from donor to an object or person during physical contact). While these studies clearly demonstrate the ability to obtain genetic profiles from trace biological evidence (e.g., paper and documents, keyboards, bedding and fabrics, shoe insoles, firearms and cartridge cases and drinking containers), they often employ a "blind-swabbing" approach and therefore fail to include an evaluation of the type of cellular or genetic material that may be present in such samples. This often results in the presumption that the DNA profiles are obtained from shed skin cells as opposed to, for example, saliva traces without any scientific basis for this assertion. This possible misrepresentation of the source of biological evidence could place undue weight to a given piece of evidence. It is therefore essential that methodologies for the analysis of biological material from touch and contact DNA samples allow for a skin vs. non-skin tissue source identification and allow for a demonstration of a direct link between the biological material and recovery of DNA profiles from it.

The goal of this work was focused on the development of collection strategies for the recovery of biological "particles" from contact DNA samples and also the recovery of DNA profiles from the collected particles. For initial method development, buccal epithelial cells were used as they would be expected to be more stable than shed biological "particles." Buccal smears were prepared directly on a low retention polymer material. Individual or multiple buccal cells (five and ten cells) were then collected using a water soluble adhesive and immediately placed into a tube containing reagents for direct cellular lysis. Amplification of the lysates was then performed using LTDNA protocols. Using the developed collection and typing methodologies, STR profiles were obtained from as little as one buccal epithelial cell. No inhibitory effects from varying cell staining reagents were observed. With the success of the developed collection and typing methodologies developed, these methods were applied to the analysis of contact and touch samples. Contact samples were prepared by placing the low retention polymer material in direct contact with worn clothing items (shirts, pants, and hats) or human skin. The structural nature and quantity of the biological material presence was then determined with the aid of various staining techniques, with a possible nucleus observed in only a few particles within each sample. In order to obtain STR profiles from the contact samples, increased numbers of "particles" needed to be collected (e.g., 100 "particles" in some cases). The collection of only "nucleated" particles, if identified, may result in improved recovery of genetic profiles. Therefore, additional work will be needed in order to further characterize the nature of the biological "particles" present in contact and touch samples in order to determine the most suitable type and quantity of "particles" needed for analysis. Despite the need for additional work, the results of this initial work provide an indication that it will be possible to perform a more comprehensive molecular-based approach to the characterization, analysis, and interpretation of trace biological material recovered from touch and contact samples.

Touch/Contact DNA, Epithelial Cells, DNA Analysis

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