COMPARISON OF COLLECTION METHODS FROM TOUCH SAMPLES ON METALS AND WEARER SAMPLES FROM SIMULATED MIXTURES ON CLOTHING

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Successful forensic DNA analysis depends on the ability to collect, type and store biological evidence. Many forensic evidence samples present challenges to optimal collection and storage. Touch samples such as those from handguns and pipebombs may result in low DNA yields due to poor recovery (Bille *et al* 2009 J Forensic Sci. 2009 Sep;54(5):1059-67). Wearer DNA samples, epithelial cells deposited on clothing worn by an individual, may result in mixtures due to multiple wearers. Detection of the last individual to handle or wear an item is often an important determination in forensic science. Development of improved methods is important for optimal recovery of DNA and detection of the last wearer from these types of forensic samples. This is a two-part study on evaluating new methods of collection of biological evidence from 1) simulated touch samples from handgun metals and 2) wearer DNA samples from clothing worn by a habitual wearer followed by a second wearer.

Part I. Comparison of 3 swabbing methods for collection of touch DNA from metals

Stainless steel and brass metal plates were used to simulate handgun metals. Three different swabs, DNA sterile cotton swabs (SWAB A), DNA free cotton swabs (SWAB B), and foam tipped DNA free swabs (SWAB C) from Puritan (Guilford, ME) were compared for recovery. To determine whether DNA contamination was present on the swabs and to determine the effectiveness of our cleaning process, control samples were assessed by qPCR before and after cleaning. Replicate aliquots of saliva were deposited on the metals and then collected using the different swabs. DNA was extracted using the organic extraction process, quantified with qPCR, typed by PCR STR multiplex amplification, and capillary electrophoresis. GeneMapper ID from Applied Biosystems (Foster City, CA) was used to evaluate the data.

DNA free foam swabs (SWAB C) did not work well for either metal resulting in the lowest yields from replicate samples. Highest recovery was observed for the conventional DNA sterile cotton swabs (SWAB A) from stainless steel whereas, the DNA free cotton swabs (SWAB B) resulted in the highest average recovery from brass. Additional experiments are underway to corroborate the results due to high variability in replicates. It is worth noting that low levels of contamination were detected from the

Puritan“sterile” cotton swabs and this is not unexpected as the Puritan sterile cotton swabs certificate of analysis indicates they may contain up to 23pg of human DNA.

Part II. Comparing Wearer DNA Sample Collection Methods for Determining the Best Method for the Recovery of Single Source Profiles

The most commonly used collection methods for wearer DNA include swabbing and scraping. These often result in mixture profiles. The detection of a single individual who last wore or came in contact with an item is desirable. Recently, adhesives have been introduced as a possible reliable method for the collection of biological evidence. Adhesives have a tendency to recover less, but more recently deposited particulate than the current methods because they are less invasive. The ability to observe the collected cells with the aid of a microscope is another advantage of using adhesives.

The goal of the research was to compare the current collection methods of swabbing and scraping with a gel film called Gel-Pak ‘0’ which shares similar properties with adhesives. Gel-Pak ‘0’ has been previously studied in comparison to other adhesives for the collection of epithelial cells, and was shown to recover the top layer of loose particulate. The particulate was deposited by the individual who last came in contact with an item. Therefore, in comparison to the other two collection methods, Gel-Pak ‘0’ was hypothesized to recover single source profiles on clothing items from the most recent wearer.

DNA analysis was performed on samples collected by the three methods from various clothing items including baseball hats, t-shirts, sweatpants, socks, and other items commonly submitted to crime labs for DNA analysis. The habitual wearer and second/last wearer wore each item for a predetermined amount of time.

Research findings revealed that Gel-Pak ‘0’ collected less DNA compared to the other two methods for the majority of items sampled but, did not recover single source profiles from the last wearer. Instead, all three methods resulted in DNA mixtures. Low levels of DNA associated with wearer DNA often resulted in peak height imbalance and stochastic effects. This prevented the determination of major and minor contributors for the majority of items sampled. Even with mixed profiles, the last wearers’ profiles were more discernable with Gel-Pak ‘0’ and swabbing, while scraping had a tendency to recover more DNA from the habitual wearers. There was no significant difference in which swabbing or Gel-Pak ‘0’ most frequently collected more of the last wearer’s DNA. However, swabbing resulted in slightly more interpretable profiles from the last wearer, and an increase in overall CODIS eligible profiles compared to Gel-Pak ‘0’.

This research may reveal how best to collect wearer DNA. Swabbing and the use of a gel film or adhesive preliminarily shows to be more effective in detecting who last wore a piece of clothing while scraping best determines the habitual wearer. Revealing individuals who last wore an item can be of great importance in forensic science, and

therefore, further research with various adhesives and gel films could be vital for solving forensic investigations.

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